TECHNICAL MANUAL



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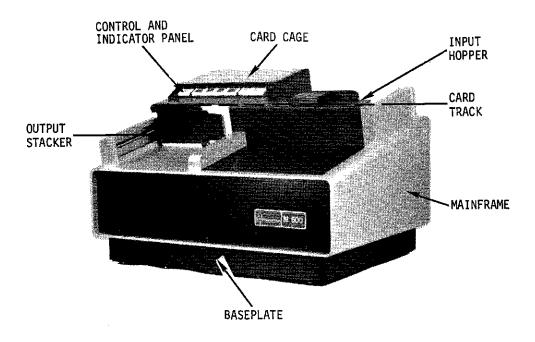


Figure 1-1. Card Reader, Three-Quarter Front View (Typical)

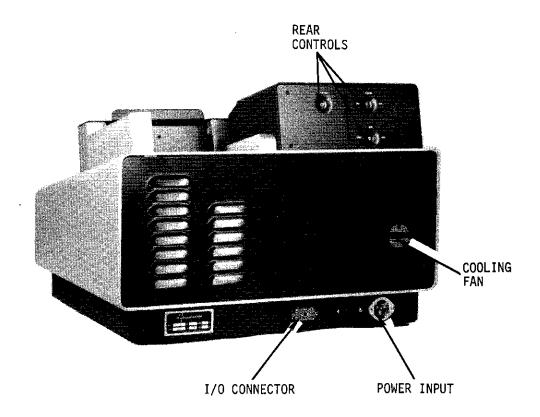


Figure 1-2. Card Reader, Three-Quarter Rear View (Typical)

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 1000L Card Reader. An Illustrated Parts Breakdown is included in Section 12 to aid in locating and identifying parts if replacement becomes necessary.

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

1.2 DESCRIPTION

The entire reader is constructed around a mainframe, figure 1-1. Mounted on top of the mainframe are the input hopper and output stacker, card track mechanism and control and indicator panel and printed circuit card cage. All logic circuitry is contained on printed circuit boards within the card cage. Located on the underside of the mainframe are the drive motor, drive train, and a portion of the card pick mechanism. The bottom of the mainframe contains a baseplate which mounts the vacuum pump motor assembly and the remainder of the electronics.

Located on the rear of the reader, figure 1-2, are three controls, a circuit breaker, the power input, the I/O connector, and a cooling fan.

1.3 SPECIFICATIONS

READING SPEED:

1000 cards per minute maximum in continuous run.

Single Card Cycle: 60 milliseconds.

CARD TYPE:

Standard 80 column cards.

CONTROL:

Demand feed, one card-at-a-time under external program control. Reader will continuously run as

long as the Pick Command remains TRUE.

INPUT:

Pick Command (PC)

Logic True for 1µsec -15 MaDC @ 0.8 VDC Max.

OUTPUT:

Data Lines and

Interface Signals

TTL Type 7404 or Equivalent.

I Source 2,2 MaDC

I Sink -15 MaDC @ 0.4 VDC Max.

HOPPER SIZE:

7.25 inches (Approx. 1000 cards of 7 mil thickness)

STACKER SIZE:

7.25 inches (Approx. 1000 cards of 7 mil thickness)

POWER REQUIREMENTS:

Voltage:

115VAC+10%, single phase, 60 Hz (Standard model)

230VAC ±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

Relative Humidity

50 to 100° F. 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

CARD STOCK:

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

PUNCH DATA:

Punch data must meet American National Standard ANSI X3.21-1967 specifications.

SECTION 2 UNPACKING AND INITIAL CHECKOUT

2.1 UNPACKING

The M Series Card Readers are packed in a cardboard container, figure 2-1, with cushioning and padding to protect the equipment from damage during shipment. Inspect the outside of the container and report any physical damage to the carrier immediately.

Included in the container are the power cord and technical manual. After removing these items, lift the card reader straight up and place on a flat, sturdy, support area. Inspect the reader for any physical damage and report any damage to Documation Incorporated. Locate a Phillips screwdriver and with the reader tilted in an upright position, remove the two red 8 x 32 screws in the bottom plate. These screws lock the blower motor plate in a solid position to prevent damage to the motor plate vibration isolators during shipment. If the reader is reshipped, these screws must be installed.

2.2 INITIAL CHECKOUT

Use the following instructions to test reader readiness.

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

- j. Pull the stacker plate toward the front of the reader with one hand and remove the cards.
- k. This completes the initial off-line test.

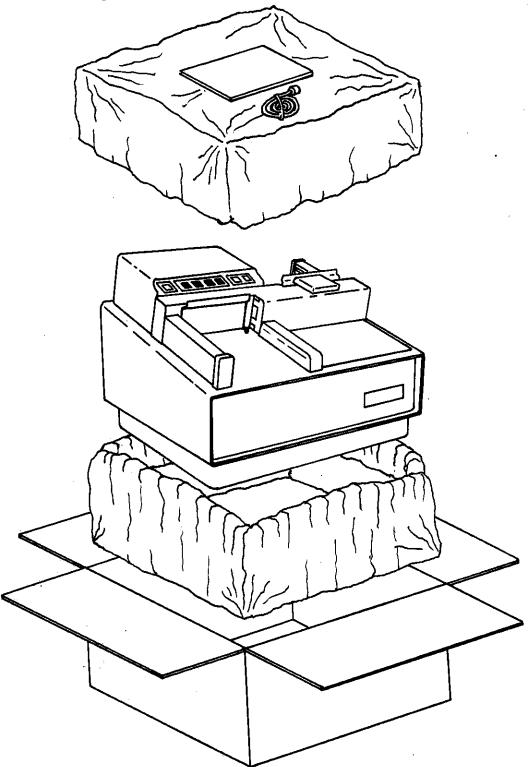


Figure 2-1. Unpacking

SECTION 3 OPERATION

3.1 LOADING THE INPUT HOPPER

Load the input hopper with punched cards to be read as follows:

a. Pull the hopper follower back with one hand and load the card deck into the hopper area; the first card to be read must be placed 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 INPUT HOPPER SO FULL THAT THE RIFFLE ACTION AT THE AIR RIFFLE CAP IS INHIBITED

- b. The hopper may be loaded while cards are being read if the operator is careful to keep tension on the front portion of the deck while loading additional cards at the rear. This is accomplished with the input hopper approximately one-half to one-third full. Use just enough pressure to maintain the riffle action.
- c. Unloading the input hopper is the reverse of the loading procedure. Normally all cards are processed through the reader; however, if it is necessary to unload the hopper, pull the follower back and remove the card deck. If the cards are arranged in a particular order, exercise care in repacking them in their storage container so that the order is maintained.

3.2 UNLOADING STACKER

To unload the stacker, perform the following steps:

- a. Pull stacker follower back with one hand and remove the front or rear portion of the card deck from the stacker area, being careful that deck order is maintained.
- b. To unload stacker during operation, pull stacker back and remove portion of deck taking care to allow stacker plate to return to its normal position gradually.

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:

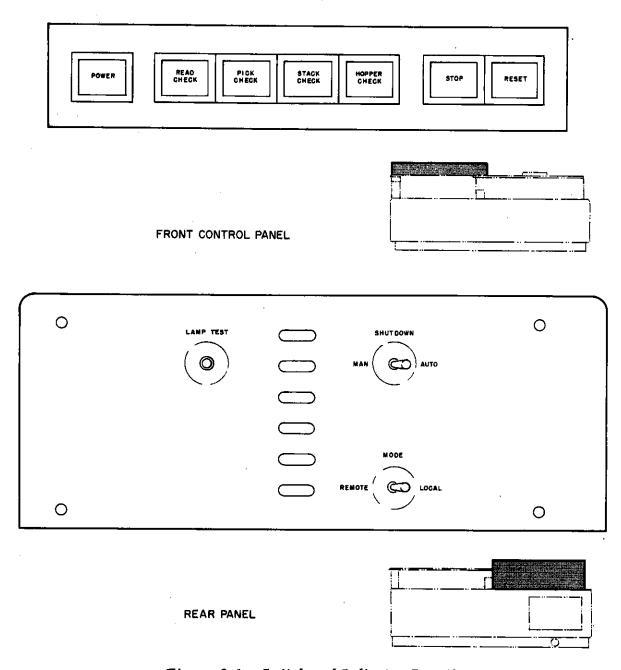


Figure 3-1. Switch and Indicator Location

3.3.1 FRONT PANEL CONTROLS AND INDICATORS

Located on the front panel are three pushbutton type switches.

POWER STOP RESET Located within these switches are lighted indicators showing reader status; they are POWER ON (white), RESET (green), and STOP (red).

Four other "error" indicators are located on the front panel.

READ CHECK PICK CHECK STACK CHECK HOPPER CHECK

3.3.2 REAR READER CONTROLS

Located on the rear of the reader are two mode switches, a LAMP TEST switch and the main AC power circuit breaker. The two mode switches are:

SHUTDOWN - MAN/AUTO MODE - REMOTE/LOCAL

3.4 OPERATIONAL PROCEDURES

The following procedures explain both the operational sequence and some of the theory associated with the controls and indicators.

- a. Place the AC power circuit breaker in the ON position to allow power ON/OFF control from the front panel.
- b. Select the mode of operation, MANUAL or AUTO. When the MANUAL mode is selected, the drive motor and vacuum/blower will run continuously when AC power is applied. When the AUTO mode of operation 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 operation is selected, card reader operations are controlled from the operator's control panel. In normal operation the card reader is connected to the appropriate interface logic and the switches should be in AUTO and REMOTE positions.
- d. With the LOCAL mode of operation established, depress the POWER switch on the front panel to apply primary power to the reader. The drive motor and vacuum/blower will not come on at this time due to the input hopper being empty and AUTO shutdown selection.
- e. Depress the LAMP TEST switch and check that all front panel indicators are lighted.

- f. Load the input hopper and depress the RESET switch. The RESET switch is a momentary action pushbutton indicator used to clear any error conditions and establish the card reader "ready" condition. When the "ready" condition is established, the RESET indicator will light green. All motors will start and riffling action begins on the first half inch of cards.
- As the cards are being read, the PICK CHECK indicator will light if a card has failed to reach the read head after a pick command has been given. 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 light 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. Control logic failure.
- i. The STACK CHECK will light 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 light when the input hopper is empty or when the output stacker is full. This is normal operation.
- k. The STOP switch is a momentary action pushbutton switch indicator used to terminate card reader operation at the end of a read cycle. The STOP indicator will light red when the "stop" condition is established.

3.5 OPERATIONAL FLOW CHART

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

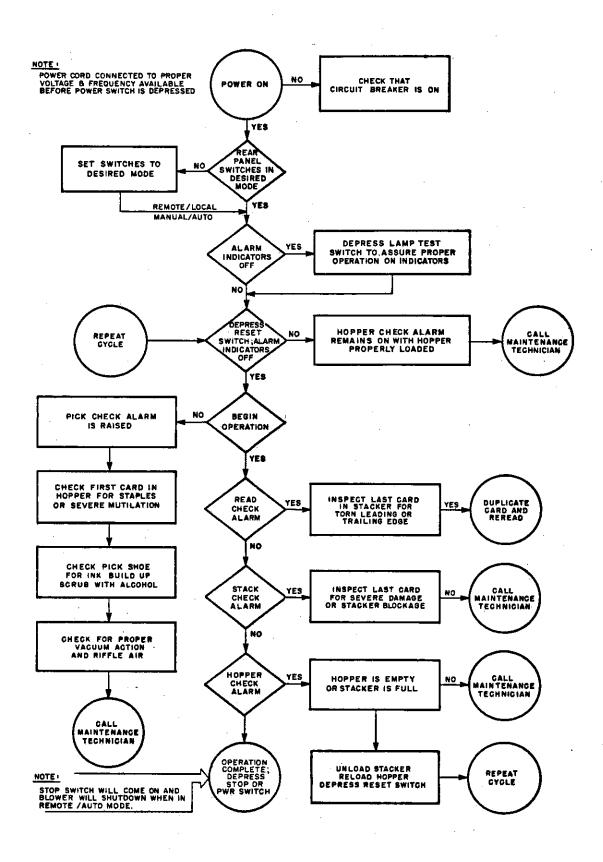


Figure 3-2 - Operational Flow Chart

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 riffles 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, the reader's electronics drives a rotary solenoid coupled to the picker sector causing it to rotate. As the solenoid moves the picker sector, the card is accelerated due to the friction forces caused by the vacuum between the picker's rubber surface and the card. The picker sector rotates pulling the card toward and into the drive rollers. When the leading edge of the card reaches the drive rollers, the rollers pull the card into the card track. The picker is now returned to its rest position by spring tension. As the card in the track clears the picker's surface, the next card is sucked down ready for the next pick command.

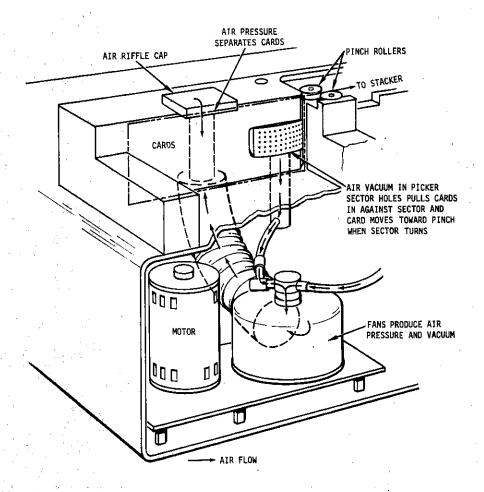


Figure 4-1. Card Feeding Air Flow

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 provides 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 Crystal Oscillator and the Four-Phase Generator. These are used to shift, store and control other logic operations.

When a PICK COMMAND is received from the controlling device, card processing will begin provided no alarm conditions exist. The Pick Logic produces a PICK signal to the Solenoid Driver, a PCLK signal, and a pick-command reset (PCR) to the Control Logic. 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 card's hole pattern and to monitor the card's movement. When a card is picked and moved into the card track, the leading edge interrupts the 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 the card's 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 at Column 0 and 81 and a Light Check at Column 84. Figure 4-3, Timing Relationship for Standard Card, shows these check positions. These checks provide a quality check on both the Read Station and the 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's phototransistors. The light (punched hole) and dark conditions are converted to electronic signals at the Phototransistor's

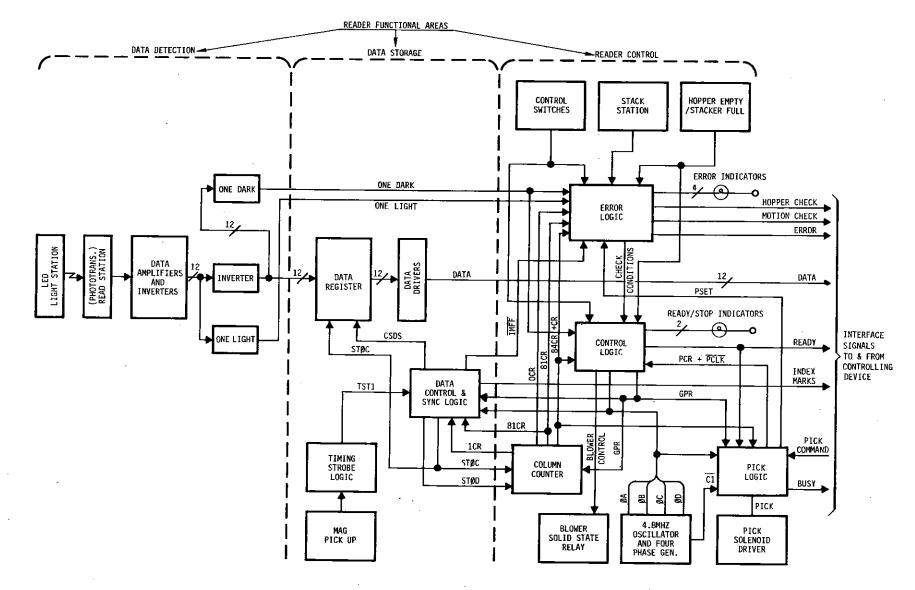


Figure 4-2. Block Diagram, M Series Card Reader

emitters and used to drive the Data 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 Synchronized Data Strobes (CSDS) to the Data Register at predetermined punched column positions. Synchronization is accomplished by a notched ferrous timing disc attached to one of the drive roller shafts. As the timing disc rotates, a reluctance pickup senses the movement of the disc's notches past the pickup producing timing signals. These signals are used by the Data Control and Sync Logic to generate Data Strobes (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 DETAIL OPERATIONAL DESCRIPTION

The following gives a detailed description of each block shown in Figure 4-2, Block Diagram - M Series Card Reader. The description is designed to give the reader an indepth understanding of how the card reader works without the usual logic gate-by-gate description.

The reader should familiarize himself with the signal mnemonics used in the text description and contained in Section 11 since it will aid in interpreting both the description that follows and the logic schematics in Section 10.

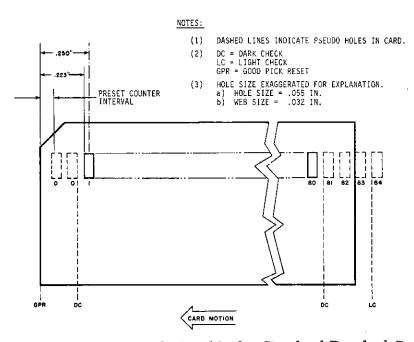


Figure 4-3 - Timing Relationship for Standard Punched Card

4.3.1 READER CONTROL

The following is a detailed description of each block 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 squarewave as an output. The 4.8 MHz output is divided by ten in a decade counter and the counter's 480 KHz output used to drive the Four-Phase Generator. The Generator then divides the 480 KHz by four, generating signals ØA, ØB, ØC, ØD and C1 as shown by the timing diagram of Figure 4-4.

 $\emptyset A$, $\emptyset B$, $\emptyset C$, $\emptyset D$ and $\overline{C1}$ are used throughout the reader as a timing source.

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. At reader power turn on, 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 a reader

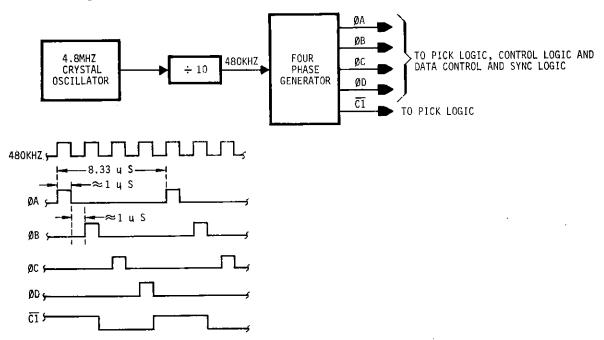


Figure 4-4 - Block and Timing Diagram, 4.8 MHz Oscillator and Four-Phase Generator

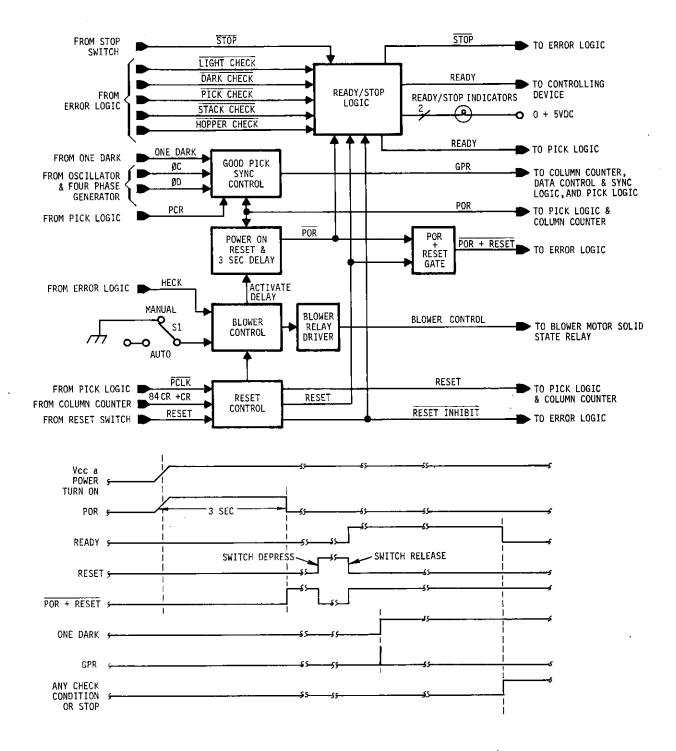


Figure 4-5 - Block and Timing Diagram, Control Logic

operation. POR is also used to initialize the Pick Logic and Column Counter. POR OR'ed with RESET to form POR + RESET resets the Error Logic. The reader is now brought to the ready state by the operator depressing and releasing the RESET switch. Note that while the RESET Switch is depressed, RESET is routed to initialize the Pick Logic and Column Counter and RESET activates the POR + RESET signal to the Error Logic. The Reset Control is designed to ignore all RESET switch signals while a read cycle is in progress. Signals PCLK and 84CR or CR identify the beginning and end of a read cycle.

Reader READY is signalled to the controlling device by the Ready/Stop Logic when the RESET Switch is released provided HOPPER CHECK is not being presented by the Error Logic. (All other Error Logic Check signals will be reset by POR or RESET.) Reader READY is indicated to the operator by the RESET Switch lighting green. The controlling device can now begin a read cycle by transmitting a PICK COMMAND to the reader. READY will be reset upon receipt of any CHECK signal from the Error Logic or if the STOP Switch is depressed by the operator and RESET INHIBIT is not present. The Ready/Stop Logic gates the STOP signal with RESET INHIBIT, preventing READY from being reset due to STOP during a card read cycle. 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 lighting 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 phase \emptyset C and \emptyset 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 reader blower motor and drive motor. These motors automatically shut down when a HECK (Hopper Empty Check) condition exists and switch S1 is in the AUTO position. After the HECK condition is corrected by reloading the input hopper, depressing of the RESET switch will cause the Blower Control Logic to activate the 3-second (nominal) POR. When the SHUTDOWN switch is in the MAN position, all motors remain on as long as reader power is applied.

4.3.1.3 Pick Logic

Once the reader is brought to ready condition, a PICK CMD from the

controlling device can be accepted by the Pick Control. (Figure 4-6, see diagram and timing.)

The Pick Logic will then:

- 1. Generate PCLK
- 2. Initiate a PICK pulse that drives the picker solenoid.
- 3. Control the PICK pulse length.
- 4. Wait out the interval while the card leading edge is accelerated to the read station (14 to 27 ms).
- 5. If the leading edge has not arrived in 50 ms, generate another pick pulse.
- 6. Repeat the pick attempt six times and if the leading edge has not appeared, generate a pick fail alarm (PSET).

The Pick Control generates PCLK (Figure 4-6 timing) until a GPR is received or READY goes false due to the pick fail signal (PSET). 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

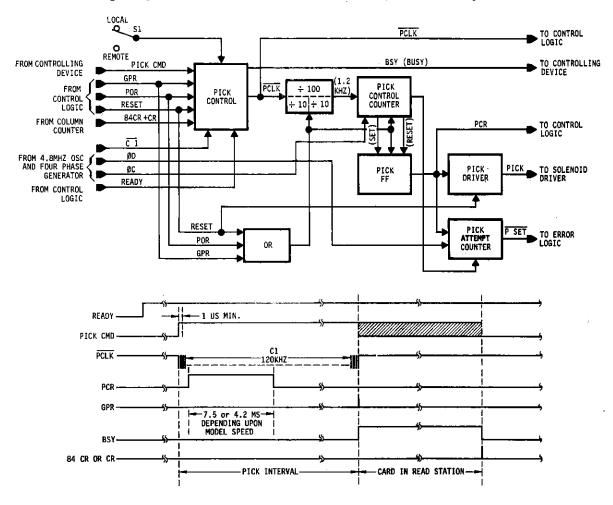


Figure 4-6 - Block and Timing Diagram, Pick Logic

Counter. At the count of one the Pick Control Counter sets the Pick Flip-Flop (FF). This begins the PICK pulse interval. The Pick Control Counter continues to count the 1.2 KHz until count 10 (for M200, 300 and 600) or 6 (for M1000, M1200) is decoded generating a reset to the Pick FF ending the PICK pulse. PCR, generated by the Pick FF, 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 a 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 pulse. PICK and PCR pulses will continue to be generated until a 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 Busy (BSY) to the controlling device to indicate a card has entered the read station. BSY remains true until 84CR or CR indicating the card has left the read station and another PICK CMD can be accepted.

The position of Switch S1 determines the source of the PICK CMD. In LOCAL, the PICK CMD signal is held true so that whenever the reader is READY, PICK CMDs are generated internally each time 84CR or CR is reached. When in REMOTE, only a PICK CMD from the controlling device can initiate a read cycle.

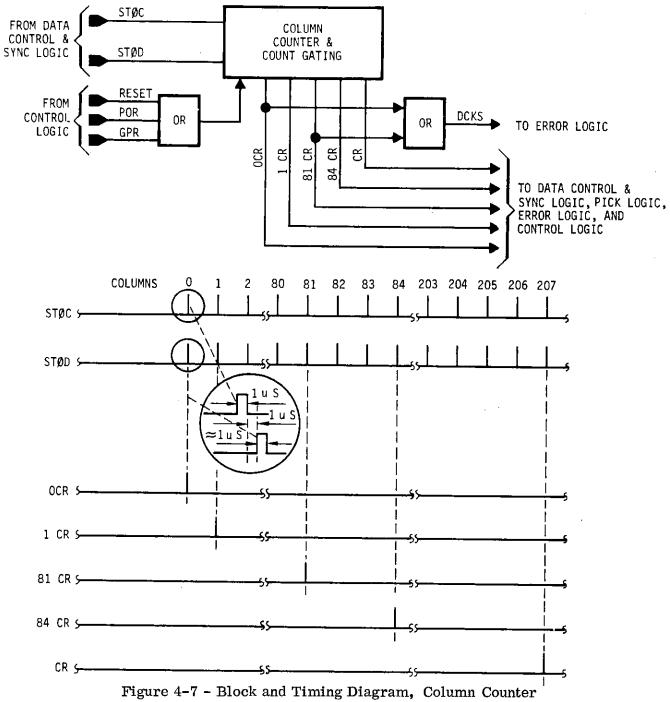
4.3.1.4 Column Counter

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, a 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, 84CR and CR. These signals are used by the Control Logic, Data Control and Sync Logic, Pick Logic and Error Logic as follows:

COUNT USED BY

OCR 1. Error Logic for a Dark Check

1. Data Control and Sync Logic to set the Index Mark Control Flip Flop (IMFF).



COUNT		USED BY
81CR	1. 2. 3.	Data Control and Sync Logic to Reset the IMFF. Error Logic for a Dark Check. Error Logic for a Stack Check.
84CR	1.	Control Logic to reset the RESET INHIBIT Flip Flop.

- 2. Pick Logic to enable the Pick Control for the next PICK CMD and reset BUSY.
- 3. Error Logic for a Light Check.
- 4. Data Control and Sync Logic to reset the Sync Control Logic.

CR (M300 Only)

- 1. Control Logic to reset the RESET INHIBIT Flip Flop.
- 2. Pick Logic to enable the Pick Control for the next PICK CMD and reset BUSY.
- 3. Data Control and Sync Logic to reset the Sync Control Logic.

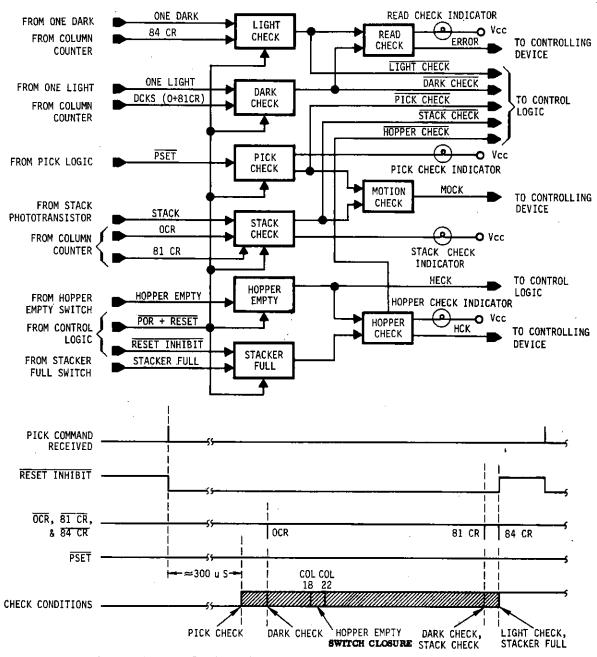


Figure 4-8. Block and Timing Diagram, Error Logic

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.

Once a PICK CMD is accepted by the reader, the Error Logic is sampled at intervals of card processing for error and reader conditions. These error/reader conditions are referred to as CHECK CONDITIONS and shown in the timing diagram of Figure 4-8. Should a CHECK CONDITION occur the reader READY will be reset. The first test is Pick Check. If a PSET is signalled to Pick Check, a Motion Check (MOCK) will be sent to the controlling device. PSET will occur approximately 300 ms after PICK CMD was received and reader READY will be reset. Pick Check will be signalled to the operator by the PICK CHECK control panel indicator. If PICK CHECK does not occur, a read cycle will be in process and OCR will sample the Dark Check circuits. Should ONE LIGHT be 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 reader control panel will indicate READ CHECK.

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. As shown in the timing for CHECK CONDITIONS the hopper empty switch will close between columns 18 and 22 of the last card. Hopper Empty is signaled to the controlling device and READY is reset. Hopper Empty is signalled to the operator by the HOPPER CHECK indicator.

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 is clear of the card track (fully seated in the output stacker). The Stack Check logic is designed to test the stack sensor light-to-dark transition (i.e., track clear) between the time an OCR signal occurs (card entering the read station) and the 81CR signal occurs. Should this transition not have taken place, a STACK CHECK alarm is generated. This signal generates a MOTION CHECK to the controlling device, resets the READY line and lights the STACK CHECK indicator on the control panel.

84CR occurs next in the read cycle and samples the Light Check circuitry. A ONE DARK present at 84CR indicates a failed LED phototransistor or

excessive card slip in the read track. This error is signalled to the controlling device as an ERROR and the READY line is reset. The reader control panel will indicate READ CHECK.

Since 84CR or CR 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 HOPPER CHECK to the controlling device, Reset READY, and light the HOPPER CHECK Indicator.

All error conditions are cleared by the Reset Switch.

4.3.2 DATA DETECTION

The following is a detailed description of each block 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 the LEDs is allowed to pass to the Phototransistors by the presence of punched holes in the tab card. Figure 4-9 presents a block diagram and typical waveform for the Data Amplifiers and Inverters. Light reaching the Phototransistor (PT) is amplified by the PT and converted into an electrical signal at its' emitter. A typical PT's emitter waveform is ROW 12 (A). As the leading edge of the card passes over the PT lens, the received light is reduced causing a reduction in the PT's output voltage. The emitter of the PT is coupled to pull down resistor R and the input of a high impedance TTL inverter. When the PT's emitter voltage drops through the switching threshold of the inverter (nominally) 1.4 volts) the inverter changes states. The High Impedance Inverters output is amplified by the Inverter and then used to drive the One Light and One Dark Logic. As can be seen from the waveforms each time the High Impedance Inverters threshold is crossed the device switches states driving the inverter to produce waveform ROW 12(B).

4.3.2.2 One Dark and One Light

In order to provide the Dark Check at OCR 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 consist of 12 each 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.

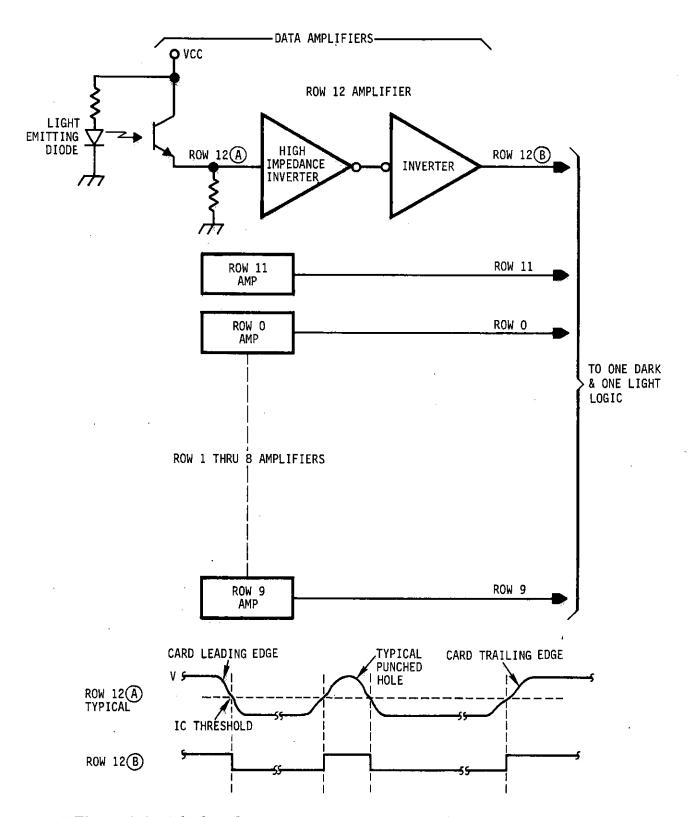


Figure 4-9. Block and Timing Diagram, Data Amplifiers and Inverters

The timing of Figure 4-10 shows the normal waveforms for ONE DARK and ONE LIGHT. When OCR occurs, ONE LIGHT should be low indicating all PTs are dark. The same is true for 81CR. At 84CR, ONE DARK should be low indicating light is being received by all PTs. If the foregoing conditions are not met, a READ CHECK will result and the reader READY will be reset.

4.3.3 DATA STORAGE

The following describes the 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. Figure 4-11 is the block diagram, timing and illustration that should be referenced to fully understand 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 should begin. As shown on the card illustration,

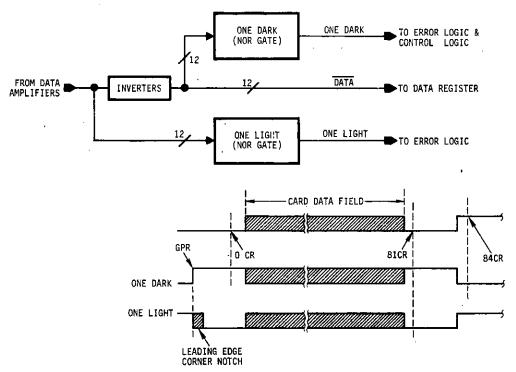


Figure 4-10. Block and Timing Diagram, One Dark and One Light

the first measurement is the PRESET DISTANCE. PRESET is the distance from the card's leading edge (GPR) to the point in column 0¹ where the Column Storage Data Strobe (CSDS) should begin. This distance is equal to .063 inch. The PRESET DISTANCE is predetermined and a PRESET count calculated by knowing the PRESET distance, card velocity and the Preset Counter's input clock rate. 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 where the CSDS should begin. Since there are precisely two timing disc teeth for each Column on the card, the reader logic can now count the next two teeth's trailing edges, add the Offset Count and again be positioned to provide CSDS.

Because the Timing Disc's teeth rotate past the magnetic pickup asynchronously with respect to the arrival of the card's leading edge in the Read Station, the OFFSET DISTANCE is a variable and subsequently 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 PRCLK (see timing of Figure 4-11). A zero crossing amplifier (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 OSCLK (Offset Clock). OSCLK at 120 KHz drives the eight stage Offset Storage Counter, counting it upwards, while and until the Preset Counter reaches all ones. ZERO is now generated by the Preset Counter terminating both PRCLK and 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 (OSUCLK). 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's STØB resets the Sync Control Logic, STØC resets the Data Register and STØC and STØD 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, STØB, STØC and STØD each time.

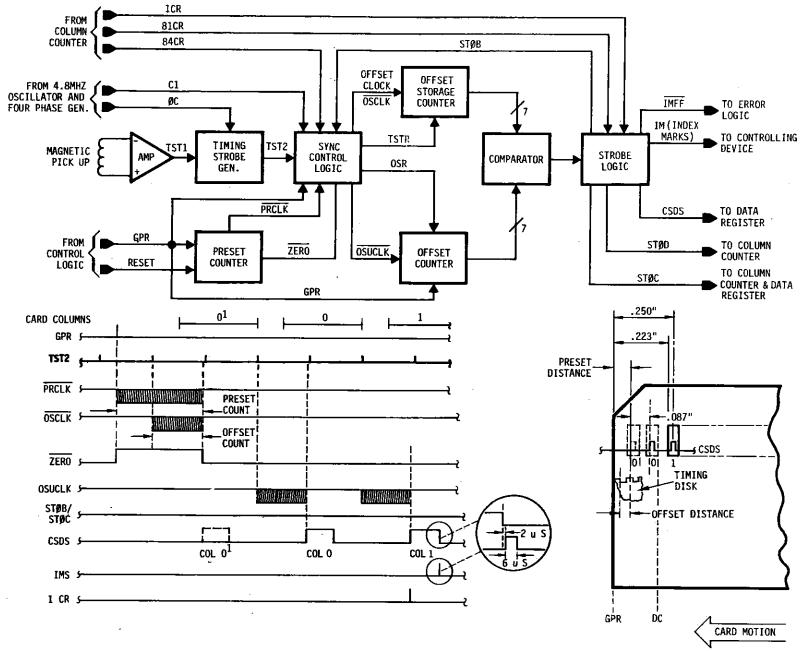


Figure 4-11. Block and Timing Diagram, Data Control and Sync Logic Drivers

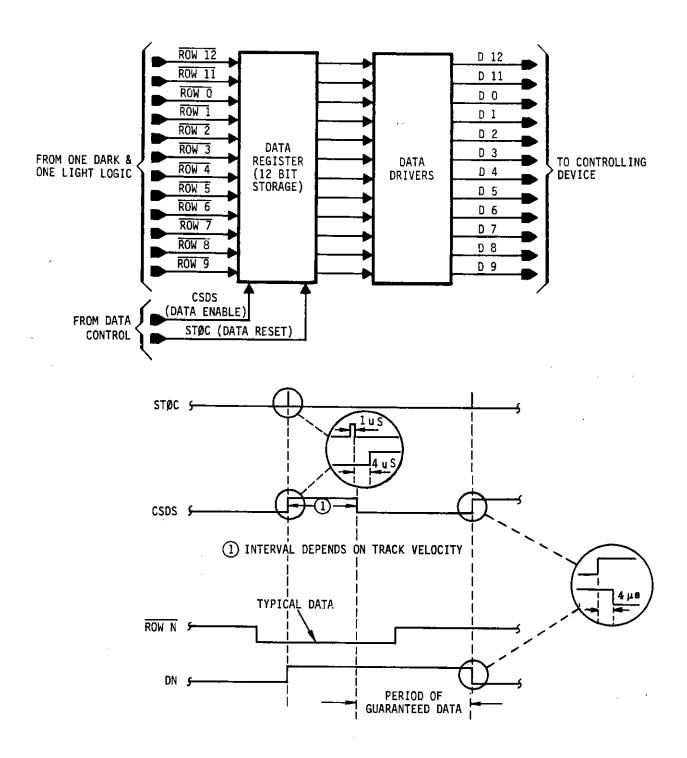


Figure 4-12. Block and Timing Diagram, Data Register and Data Drivers

1CR from the Column Counter sets the Index Mark Control Flip Flop (IMFF) in the Strobe Logic. The Strobe Logic generates 6µs Index Marks (IM) for each Column. The IM indicates to the controlling device the beginning of the guaranteed data period. When the 81CR is received by the Strobe Logic, the IMFF resets preventing any further IM's 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, Data Registers and Data Drivers diagram and timing details this sequence.

The 12 bit Data Register is reset each time STØC is generated by the Data Control and Sync Logic. The 1 us STØC is followed in approximately 4 us by the Column Storage Data Strobe, CSDS. CSDS is synchronized with the card movement by the Data Control and Sync Logic so that they occur in the center of the card's data columns. Any ROW's 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.

SECTION 5 INTERFACE

5.1 GENERAL

This section covers the interface between the M Series punched card readers and the equipment into which it transfers data.

5.2 TIMING

In interfacing the M Series card readers to an external system or card reader controller, three separate categories of interface signals must be considered. The first are the signals which control and report the status of card processing, the second are the data signals themselves with their associated index marks, and the third are the various alarm signals provided. In the description following, refer to the timing diagram shown in figure 5-1.

5.2.1 PICK CONTROL

The PICK COMMAND initiates the card read cycle, and depending upon its duration, the card reader will either continuously run or operate in a card-at-atime 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 COMMAND from the external program control. A visual indication of the READY line is the green RESET indicator on the front control panel.

The conditions which must be present for the READY line to be TRUE are:

- 1. Power applied and the 3-second run-up completed.
- 2. The input hopper has been loaded.
- 3. Depress and release of the RESET pushbutton.

Should all of the above conditions be satisfied, and the unit is in the remote mode of operation the presence of a PICK COMMAND signal will generate the PICK pulse to the picker solenoid. The first card is introduced into the card track, and after a delay (see A, figure 5-1), the leading edge will arrive at the read station. The BUSY signal will go TRUE as soon as the leading edge of the card enters the read station.

To initiate the card pick cycle, the PICK COMMAND must be present for at least 1 microsecond (μ s) concurrently with the READY signal. Once the pick cycle is initiated, the PICK COMMAND line is ignored until the BUSY signal goes FALSE, indicating the end of the card read cycle. In card-at-a-time operation, it is suggested that the PICK COMMAND be retained TRUE until receipt of the column 1 index mark. In the continuous run mode, the PICK COMMAND may be left in the TRUE condition and a new PICK signal will be automatically generated within 1 μ s of the BUSY signal going FALSE.

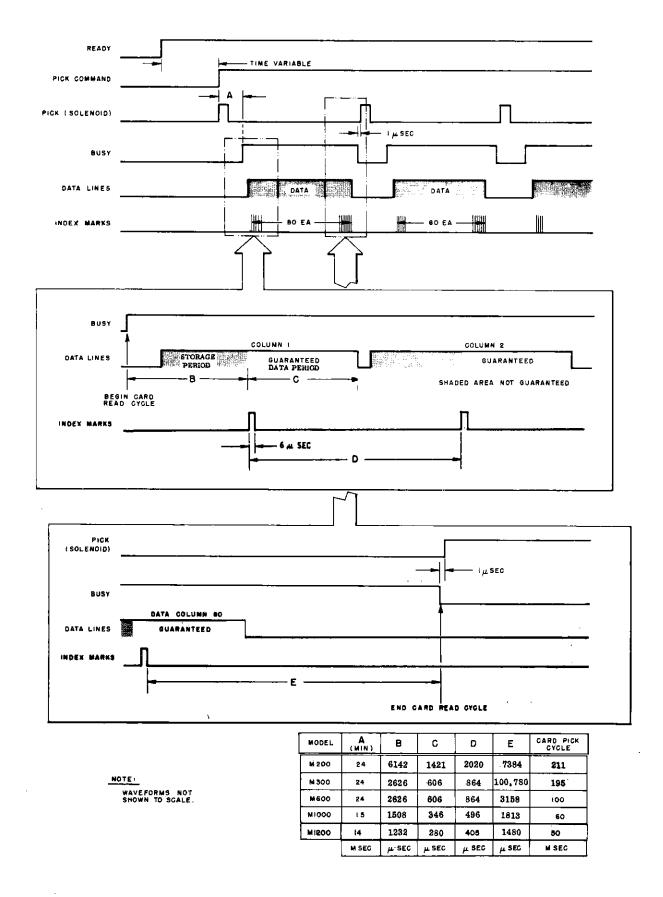


Figure 5-1. Interface Timing Diagram

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 6 attempts have been made. After 6 attempts have been unsuccessful (300 ms), a PICK CHECK alarm will be generated, disabling 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 us duration are generated while the BUSY signal is present. The time spacing of the Index Marks and the BUSY signal are shown by intervals, B, D, and E on figure 5-1.

It can be seen from the timing diagram that 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, all Documation 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 is stored into the Character Buffer. Since the contents of the Character Buffer are subject to change throughout this interval, the data is not guaranteed until the end of the acceptance interval. This period is terminated and the Index Mark generated.

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

5.2.3 ALARMS

A description of the standard alarm signals provided in the M Series reader follows:

5.2.3.1 Hopper Check

The HOPPER CHECK 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 position, the motors are also automatically switched off; when the input is reloaded and RESET depressed, the motors will automatically turn on.

When the last card leaves the input hopper, the switch which senses the empty condition immediately signals a HOPPER CHECK and disables the READY signal. 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, the HOPPER CHECK signal only appears at the end of the read cycle during which it occurred.

5.2.3.2 Error

The ERROR signal is produced by failure of the LIGHT or DARK check. This usually indicates that a card has a tear at the leading or trailing edge (DARK CHECK). If the read station should experience an emitter/sensor failure while reading a card, the LIGHT CHECK will pick it up. Either type of failure will be signalled by the ERROR line going TRUE and a READ CHECK indication on the front panel.

5.2.3.3 Motion Check

The MOTION CHECK signal is a composite of the PICK CHECK and STACK CHECK alarm. Both alarms are conditions requiring operator intervention and are furnished to the interface as a single alarm line. The condition is displayed on the front panel indicator lights as either a PICK CHECK or a STACK CHECK. The MOTION CHECK signal 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 is not completely clear of the card track.

5.3 CONNECTORS

The 38-pin output connector provides access for all control, data and 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 (#60-8017-0513). This mating connector assembly is available from Documation and is shipped unassembled as a kit (P/N 10139401).

The power connector is Hubbell part no. 7486. The mating connector is Hubbell part no. 7484. The mating AC power connector is supplied on the standard accessory power cord; however, it is identified if it is desired to fabricate a special power interface.

The standard M Series pin assignment configuration is listed as follows: *

J2 I/O SIGNAL CONNECTOR PIN LIST

PIN	SIGNAL	DESCRIPTION	PIN	SIGNAL	DESCRIPTION
Α	D12	Row 12 Data	X	D7 (RET)	
${f B}$	D11	Row 11 Data	Y	$\mathbf{D}8$	Row 8 Data
· C	$\mathbf{D}0$	Row 0 Data	${f z}$	D9	Row 9 Data
D	D1	Row 1 Data	AA	IM	Index Mark
${f E}$	D12 (RET)		${f BB}$	RDY	Ready
\mathbf{F}^{\cdot}	D11 (RET)		· CC	D8 (RET)	
H	D0 (RET)	•	$\mathbf{D}\mathbf{D}$	D9 (RET)	
J	D1 (RET)		$\mathbf{E}\mathbf{E}$	IM (RET)/GRD	Signal Ground
K	$\mathbf{D2}$	Row 2 Data	$\mathbf{F}\mathbf{F}$	RDY (RET)	
L	D3	Row 3 Data	HH	ERROR	Error
\mathbf{M}	$\mathbf{D}4$	Row 4 Data	JJ	HCK	Hopper Check
N	D5	Row 5 Data	KK	MOCK	Motion Check
P	D2 (RET)		${f L}{f L}$	PC	Pick Command
${f R}$	D3 (RET)		${f MM}$	BSY	Busy
S	D4 (RET)		NN	Error (RET)	
${f T}$	D5 (RET)		${f PP}$	HCK (RET)	
U	D6 `	Row 6 Data	RR	MOCK (RET)	
\mathbf{v}	D7	Row 7 Data	SS	PC (RET)	
W	D6 (RET)		TT	BSY (RET)	

POWER CONNECTOR PIN LIST

PIN	SIGNAL	
W	Safety Ground	(green)
\mathbf{x}	Neutral	(white)
Y	115 Volts	(black)

^{*} For Non-Standard Units, see Wiring Diagram, figure 10-3.

5.4 SIGNAL CHARACTERISTICS

The standard interface is supplied as the output of TTL type 7404. Signal sense is specified as a Logical TRUE and is a positive level; logical FALSE is a ground level. Circuit characteristics are shown in figure 5-2. Other output drive configurations are available.

5.5 GROUNDING

Grounding within the 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 readers 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.

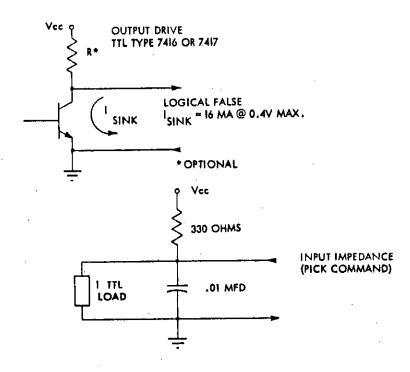


Figure 5-2. Circuit Characteristics

SECTION 6 ADJUSTMENT PROCEDURES

6.1 GENERAL

The adjustment procedures necessary for proper reader operation are listed separately in this section for ease in reference. These adjustments should be checked when minor malfunctions occur and before major repair is attempted. They will also be used after major repair and replacement.

To perform any of the adjustments in this section, it will be necessary to remove the front, top and rear panels. Remove all three panels using a 5/64 Allen wrench.

- a. Remove six screws \bigcirc which hold front panel and remove panel, figure 6-1.
- b. Remove four screws 3 which hold top cover and remove cover
- c. Remove six screws 2 which hold rear panel, figure 6-2.
- d. Move rear panel out slightly and disconnect fan, then remove panel.

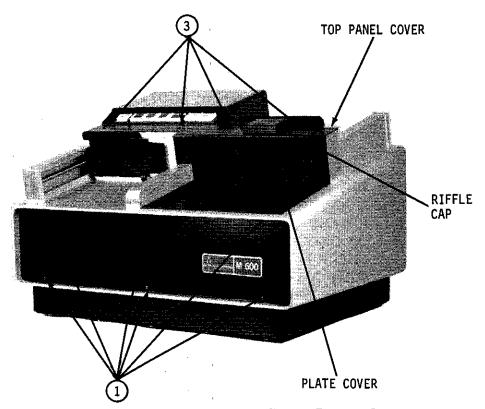


Figure 6-1, Front Panel and Top Cover Removal

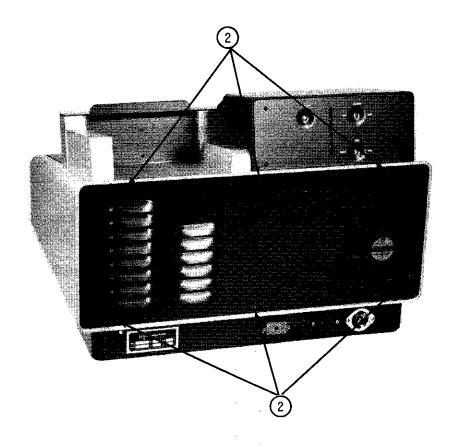


Figure 6-2. Rear Panel Removal

6.2 TENSION ON THE MAIN DRIVE MOTOR BELT

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

a. Using a 9/64 Allen wrench, LOOSEN four motor mounting plate screws, figure 6-3.

CAUTION

THE DRIVE MOTOR BELT TENSION IS CRITICAL. TOO MUCH TENSION CAN 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.

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. Hold tension at that level and tighten four motor mounting plate screws.

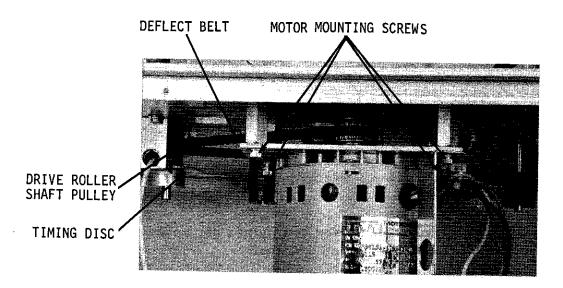


Figure 6-3. Drive Motor Belt Tension Adjustment

6.3 MAGNETIC PICKUP ADJUSTMENT

The magnetic pickup is adjusted to ensure that timing pulses are developed correctly. There are two adjustments: horizontal alignment and air gap. Refer to figure 6-4.

a. Using a 1/16 Allen wrench, LOOSEN set screw that is holding timing disc on drive roller shaft and position timing disc on drive roller shaft so that it is in a horizontal plane with center of magnetic pickup tip.

CAUTION

IF THE TIMING DISC MUST BE REMOVED, EXERCISE EXTREME CAUTION. DAMAGE TO DISC WILL RESULT IN ERRONEOUS MACHINE OPERATION.

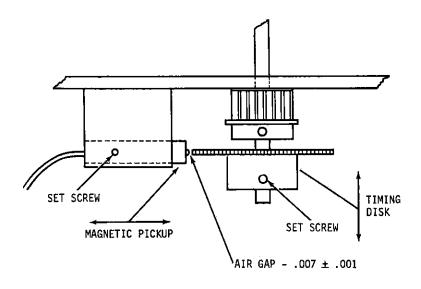


Figure 6-4. Magnetic Pickup Adjustment

- b. Align disc in correct position and tighten set screw making sure that set screw is tightened on flat side of shaft.
- c. To adjust air gap between magnetic pickup and timing disc, LOOSEN set screw holding magnetic pickup in its mounting block and reposition pickup. The air gap should be set to .007" + .001".
- d. Rotate timing disc and check two other positions to make sure that air gap is maintained.

If either of these two adjustments of the magnetic pickup are not correct, card synchronization may be erratic resulting in read checks or incorrect data being read.

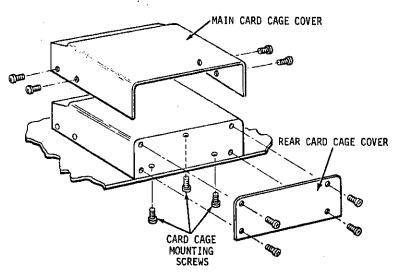


Figure 6-5. Card Cage Repositioning

6.4 ADJUSTMENT OF STACK PHOTOCELL

The stack photocell is adjusted to ensure that it correctly monitors the stacking of cards and so 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. Using a 5/64 Allen screwdriver, remove the 4 button head screws retaining the rear card cage cover, figure 6-5.
- b. Using the same tool, remove the 4 screws retaining the main card cage cover.
- c. Use a 9/64 Allen screwdriver to remove the 3 socket head screws from the underside of the mainframe which is 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 two rear mounting screws.
- e. To gain access to the stack photocell set screw, the drive roller must be removed. Using a 1/16 Allen screwdriver loosen the set screw in the drive roller and remove the roller, figure 6-6.
- f. Using the same tool, loosen the set screw in the stacker casting which retains the stack photocell, figure 6-6.

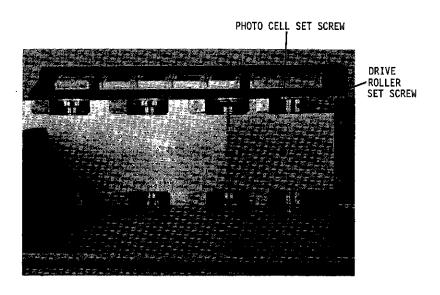


Figure 6-6. Location of Photo Cell Set Screw

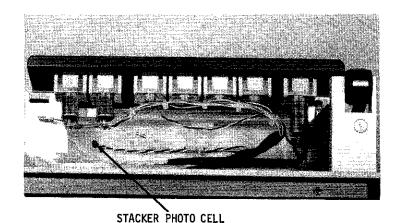


Figure 6-7. Stacker Photo Cell

- 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 mounting 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 not detectable end play in shafts. If there is any detectable end play, excessive wear of the support bearings will result.

- a. Preloading bearings can be accomplished by rotating roller of shaft to be adjusted to conveniently expose the set screw. Using a 1/16" Allen screwdrive, LOOSEN set screw in top roller, figure 6-8.
- b. From bottom side of mainframe push shaft upwards as far as possible.

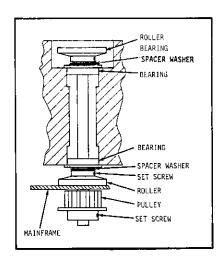


Figure 6-8. Roller Shaft Bearing Preload Adjustment

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 (5 to 25 mils).

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

6.6 HOPPER EMPTY SWITCH ADJUSTMENT

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

- a. Using a 3/32 Allen wrench, 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.

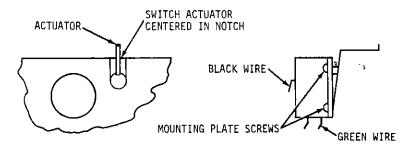


Figure 6-9. Hopper Empty Switch Adjustment

- c. Using a 1/16 Allen screwdriver, 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 riffle air cap.

If hopper empty switch is faulty or misadjusted, an eroneous status condition will be developed. Refer to paragraph 9.21, Hopper Empty Switch.

6.7 STACKER FULL SWITCH ADJUSTMENT

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

a. Place approximately one inch of cards in hopper. Depress POWER switch placing the machine in operation.

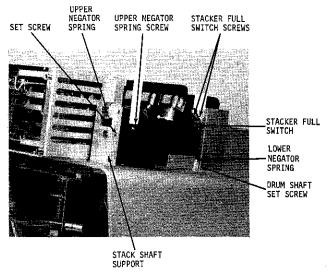


Figure 6-10. Stacker Full Switch Adjustment

- 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 light should illuminate. If this condition is not met, stacker full switch must be repositioned.
- c. Using a small Phillips screwdriver, LOOSEN two screws retaining stacker full switch bracket, figure 6-10.
- d. Adjust switch bracket horizontally until HOPPER CHECK indicator illuminates when stacker follow is approximately 1/8" before end of travel. Secure bracket mounting screws.

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.

CAUTION

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

a. Check picker sector height adjustment. Using a 6" steel rule, measure distance from top of mainframe to center of middle row of holes in picker sector. This should be exactly 1-5/8", figure 6-11.

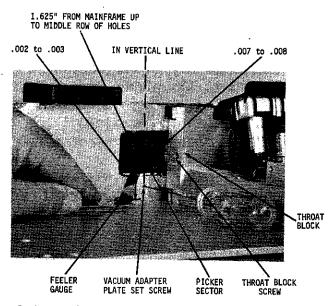


Figure 6-11. Picker Sector Adjustment, Rear View

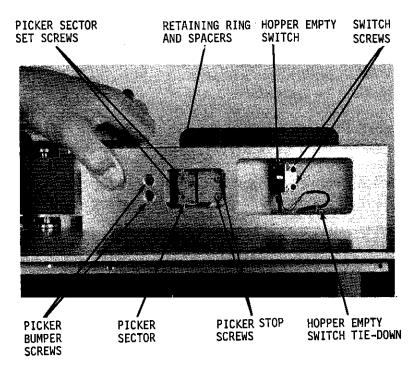


Figure 6-12. Picker Sector Adjustment, Front View

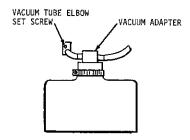


Figure 6-13. Removal of Vacuum Tube Adapter

- b. If height of picker sector requires adjustment, use a 5/64 Allen wrench and LOOSEN set screws in back of picker sector, figure 6-12.
- c. Adjust picker sector until there is exactly 1-5/8" between mainframe and center of middle rows of holes on picker sector.
- d. The second adjustment is air gap between picker sector and vacuum adapter plate. The tolerance between sector and plate is .002"to allow for maximum vacuum with free sector travel.
- e. Using a .050 Allen wrench, LOOSEN set screw in vacuum tube adapter elbow located on underside of mainframe, figure 6-13. Remove elbow from sleeve. Prop open hopper using about one inch of cards inserted at a right angle.

- f. Using a .050 Allen wrench, 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.
- Check picker sector rest position. The back edge of 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. Using a 5/64 Allen wrench, 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.
- Check gap between throat block and picker sector. The gap should be .008 inches to ensure that only one card is picked at a time.
- m. Using a small Phillips screwdriver 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. Using a 1/16 Allen screwdriver, LOOSEN two set screws in the top of the solenoid coupling, figure 6-14.
- r. Depress coupling slightly with fingers 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 on its stop position. Too much tension could cause solenoid to not provide enough drive action to load shaft.
- 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 .020 inches beyond point where card is delivered to pinch rollers.
- u. Place about 2" of cards in the input hopper. Depress POWER switch. With reader in LOCAL, depress RESET switch and run a few cards into stacker. Depress STOP switch.
- v. Manually operate picker sector. Note point at which card reaches pinch rollers. After card is picked, there should be approximately .020" of overtravel of sector before it reaches bumper.
- w. Using a 9/64 Allen wrench, LOOSEN two picker bumper socket head screws, figure 6-12.
- x. Adjust picker bumper to proper position and tighten screws.

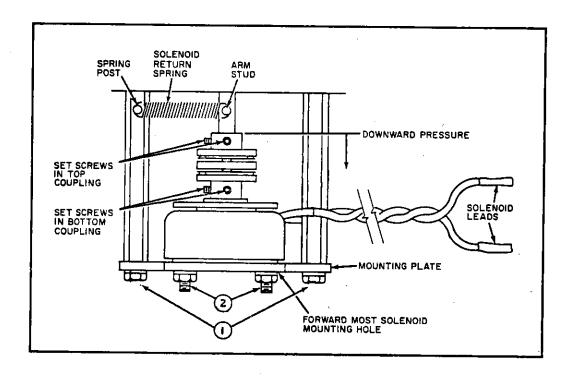


Figure 6-14. Solenoid Preload Adjustment

6.9 VACUUM PUMP BELT TENSION ADJUSTMENT

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

- a. Using a Phillips screwdriver, remove four screws from rear subframe panel, (1), figure 6-15.
- b. Remove five screws (2) from bottom of baseplate retaining rear subframe panel.
- c. Cut the cable tie holding main connector cable to baseplate. Move subframe panel backward and bend outward.

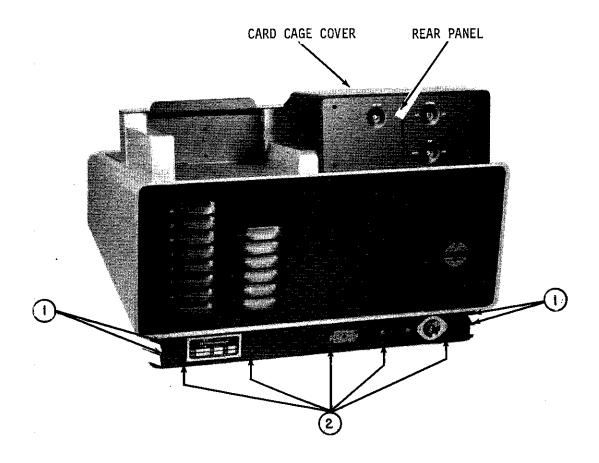


Figure 6-15. Removal of Rear Subframe Panel

NOTE

Be sure to tag the wires to be 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.

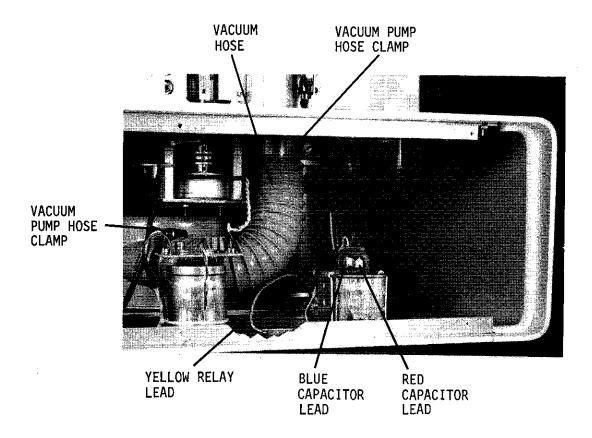


Figure 6-16. Disconnecting Vacuum Blower Motor Assembly

- g. LOOSEN vacuum adapter clamp on top of pump and remove from pump, figure 6-17.
- h. Using a Phillips screwdriver, remove ground strap from pump mounting plate.

CAUTION

USE A ½ INCH OPEN-END WRENCH TO HOLD MOUNTING POSTS TO AVOID TWISTING OFF THE PUMP PLATE RUBBER SHOCK MOUNTS.

- i. Remove four Phillips head mounting screws 1 holding the vacuum pump motor assembly.
- j. The pump assembly can now be removed from reader and belt tension adjusted.

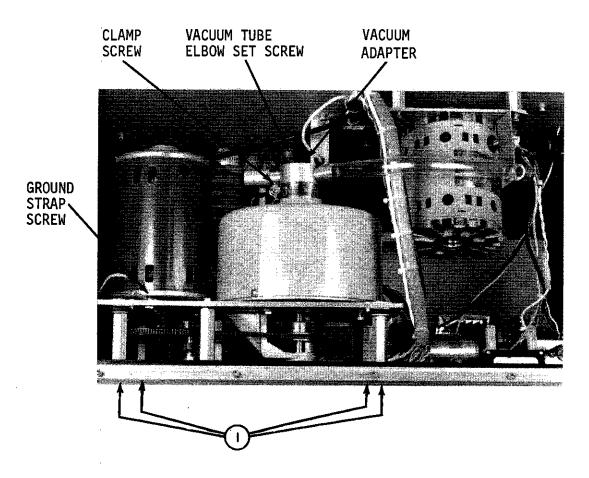


Figure 6-17. Removal of Vacuum Blower Motor Assembly

- k. Using a 7/16 open-end wrench, LOOSEN three hex bolts ① holding pump assembly in place, figure 6-18.
- 1. 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 make sure they are in the same plane. Also check motor pulley set screw to make sure 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.

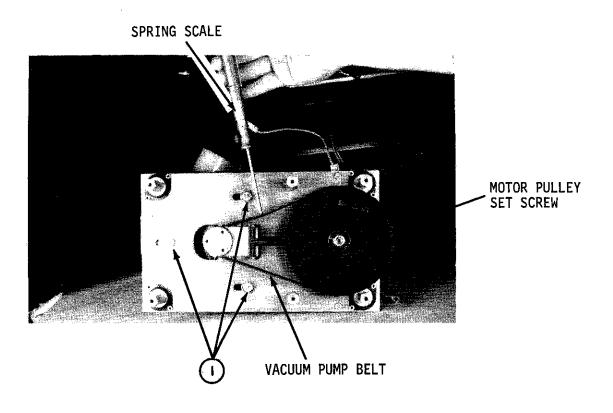


Figure 6-18. Adjustment of Vacuum Blower Motor Belt Tension

6.10 PICKER CASTING ADJUSTMENT

- a. Position picker casting in place, insert mounting screws but do not fully tighten.
- b. Make a gauge using 8 new unpunched cards cut to 2 x 5 inches and staple together.
- c. Insert gauge between picker casting and stacker casting but avoid covering read station window. Apply even pressure to picker casting toward stacker casting and tighten picker casting mounting screws.
- d. Using extender board on control card, connect voltmeter between R17 and card ground. Verify voltage is > 2.3 vdc and < 4.3 vdc. (Nominal 3 to 4 vdc)
- e. Repeat step d. at R18 through R28.
- f. If any reading is outside limits, LOOSEN picker casting mounting screws and reposition for optimum reading. Tighten screws and re-check per paragraph d. and e.
- g. If a dial caliper is available, measure distance from outside face of stacker casting to outside face of picker casting. This measurement should be 2.98 inches ± 1 mil.

SECTION 7 PREVENTIVE MAINTENANCE

7.1 GENERAL

The following paragraphs provide information for preventive maintenance and general care of the M-Series card readers. The card readers are of rugged construction and are designed to provide many hours of reliable operation; as such, preventive maintenance consists primarily of <u>routine</u> cleaning.

7.2 CLEANING

Keeping the card reader clean is very important and can prevent problems which appear to be major malfunctions.

7. 2. 1 PICKER SECTOR

The picker sector is the heart of the card reader; it is the mechanism that must operate properly to remain on-line.

After each 40 hours of operation, the neoprene surface of the picker sector should be wiped with a cloth or paper wiper saturated with a solution of soap and water. This will remove the glaze buildup from the ink which rubs off of the cards. This is especially prevalent where new cards are used exclusively. If this glaze is allowed to remain, it reduces the coefficient of 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. Using a 5/64 Allen wrench, remove four button head screws 3, Figure 9-1, holding top panel cover. Remove this cover 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 air-take screen performs the function of preventing dirt and dust from entering the card reader interior. Depending upon the operational atmosphere, the screen should be cleaned as necessary. Use a flat-blade screwdriver and 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 practical. Cleaning is recommended after each 40-hour operational period. 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 humidity, use, and speed of the machine, but the four month application will maintain a safe level. Sparingly apply light lubricant, (Part No. 124048-001) to each of the three roller grease points (Figure 7-1). This is available from Documation or Ledex, Inc., Dayton, Ohio.

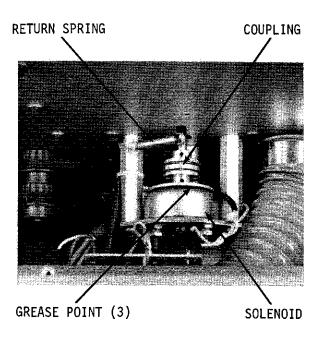


Figure 7-1. Solenoid Lubrication

SECTION 8 TROUBLESHOOTING

8.1 GENERAL

If trouble persists after checking the adjustment procedures in Section 6, use the following fault isolation chart to analyze the problem. If it is determined that a part is defective and needs replacement, use the repair and replacement procedure in Section 9, and the illustrated parts breakdown.

FAULT ISOLATION CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
POWER indicator fails to light.	1. Power cord is not con- nected to reader or power source.	1. Connect power cord to reader and power source.
	2. Circuit breaker CB1 is not on	2. Place circuit breaker CB to ON position.
	3. Fuse F1 is defective.	3. Replace F1.
	4. Lamp is burned out.	4. Replace lamp.
	5. +5 volt power regulator defective.	5. Replace +5 volt power regulator.
A given lamp fails to light when lamp test switch is activated (POWER indicator excluded).	 Lamp is burned out. Defective Error Card. 	 Replace defective lamp. Replace Error Card.
When LAMP TEST switch is activated, none of the lamps on the control panel will light. (POWER indicator excluded).	 Defective lamp test switch. Defective Error Card 	 Replace lamp test switch. Replace Error Card.
HOPPER CHECK indicator does not light when hopper goes empty or stacker goes full. No other error indications.	 Lamp is burned out. Defective Error Card. 	 Replace lamp. Replace Error Card.
HOPPER CHECK indicator does not light when hopper goes empty and PICK CHECK indicator is lit.	 Hopper empty switch not adjusted properly. Defective hopper empty switch. 	 Adjust hopper empty switch per paragraph 6. 6. Replace hopper empty switch.

SYMPTOM	PROBABLE CAUSE	REMEDY
HOPPER CHECK indicator does not light when stacker goes full.	 Stacker full switch is not adjusted properly. Defective stacker full switch. 	 Adjust stacker full switch per paragraph 6.7. Replace stacker full switch.
PICK CHECK indicator fails to light when reader makes six attempts and fails to pick a card.	1. Lamp is burned out. 2. Defective Error Card.	 Replace lamp. Replace Error Card.
STACK CHECK indicator fails to light when there is a stack check condition.	1. Lamp is burned out. 2. Defective Error Card.	 Replace lamp. Replace Error Card.
PICK CHECK indicator lights regularly after making six pick attempts.	 Dirty picker sector. Maladjustment of picker stops, vacuum plate, throat clearance, or solenoid coupling. Defective Sync Card. Defective Error Card. Defective Clock Card. 	 Clean picker sector with denatured alcohol. Readjust picker sector per paragraph 6.8. Replace Sync Card. Replace Error Card. Replace Clock Card.
READ CHECK indicator fails to light when a dark check or light check condition occurs.	 Lamp is burned out. Column "0" output or Column "81" output is missing from the Clock Card. One light or one dark output missing from the Control Card. Defective Error Card. 	 Replace lamp. Replace Clock Card. Replace Control Card. Replace Error Card.
Reader picks three cards, and then stops with a PICK CHECK.	 Good pick reset output is missing from the Clock Card. Clear pick control is missing on the Sync Card. Pick attempt counter is not being cleared out properly. 	 Replace Clock Card. Replace Sync Card. Replace Sync Card.

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 re- set 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 press- ing the STOP switch.	 Column "84CR or CR" output is missing from the Clock Card. Column strobe phase "B" or phase "D" is missing from Syna Card 	 Replace Clock Card Replace Sync Card.
	from Sync Card. 3. Clock phase "C" or phase "D" is missing from Clock Card. 4. Clock phase "B" is missing from Clock Card. Card.	3. Replace Clock Card.4. Replace Clock Card.
Reader reads erroneous data.	 Defective Clock Card. Defective Sync Card. Defective Control Card. 	 Replace Clock Card. Replace Sync Card. Replace Control Card.
Sharp, metallic noise from picker sector while reading cards.	 Picker sector maladjusted. Rubber roller worn. Bearing bad. Belt too tight. 	 Adjust picker sector per procedure in paragraph 6.8. Replace roller. Replace bearing. Readjust belt.

NOTE

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

SECTION 9 REPAIR PROCEDURES

9.1 GENERAL

The following repair procedures detail step by step methods for those parts for which replacement may be required during the life of the reader. It is recommended that these procedures are followed closely and performed by a technician familiar with tools, their use and disassembly/assembly techniques.

9.2 REQUIRED TOOLS

The following tools are required to perform removal and replacement procedures in this section and adjustment procedures in Section 6.

section and adjustment procedures in Section 6.			
	Manufacturer and Part		
Description	Number of Special Tools		
1/16" Allen Screwdriver			
3/32" Allen Wrench (long arm)	•		
5/64" Allen Wrench (long arm)			
7/64" Allen Wrench (long arm)			
1/8" Allen Wrench (long arm)			
9/64" Allen Wrench (long arm)			
.050" Allen Wrench (short arm)			
1/16" Allen Wrench (short arm)			
AMP Extraction Tool	AMP 91022-1		
"AMP Leaf Contact" Extraction Tool	AMP 465195-2 or 465275-1		
"AMP Modified Fork" Contact Extraction Tool	AMP 91037-2		
"AMP Mod IV" Contact Extraction Tool	AMP 91029-1A		
Deutsch Insertion/Extraction Tool (on base plate)	M15570-16		
1C Removal Tool	AMP 91049-1		
Elco Extraction Tool	Elco 061877-04		
Elco Insertion Tool	Elco 061742-04		
Feeler Gauge Set 0.0015" thru 0.025"			
Long Nose Pliers			
IC Test Clip	AP Inc. 923700		
Medium Flat Blade Screwdriver 3" long			
Medium Flat Blade Screwdriver 6" long			
6" Metal Scale, decimal/fraction per inch	,		
1/4" - Open End or Socket Wrench			
1/2" - Open End Wrench			
11/32" - Open End or Socket Wrench			
7/16" - Open End or Socket Wrench			
#1 Phillips Screwdriver 6" long			
#2 Phillips Screwdriver 6" long			
Printed Circuit Card Extender	Documation P/N 103099501		
#2 Retaining Ring Remover			
Side Cutter			
Solder Removal Tool			
60-Watt Soldering Iron			
32-oz. Spring Scale			

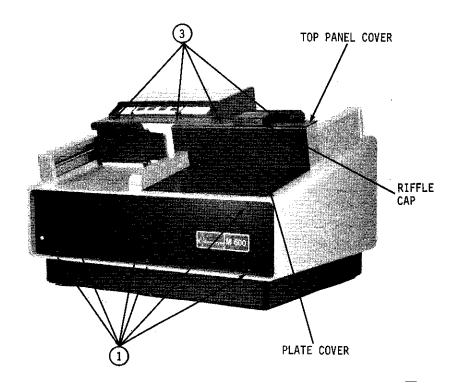


Figure 9-1. Front Panel and Top Cover Removal

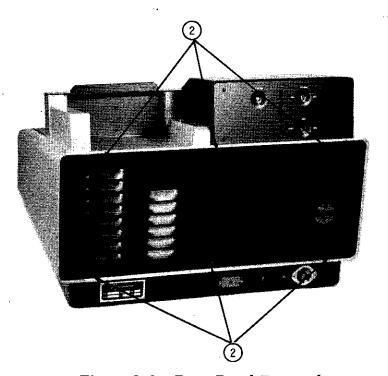


Figure 9-2. Rear Panel Removal

9.3 MAIN DRIVE MOTOR BELT

- a. Using a 5/64 Allen wrench, remove six 6 x 32 button head screws holding front panel and remove front panel, figure 9-1.
- b. Using a 5/64 Allen wrench, remove six 6 x 32 button head screws (2) holding rear panel, move rear panel out slightly, disconnect fan motor connector, and remove rear panel, figures 9-2 and 9-14.
- c. Using a 9/64 Allen wrench, LOOSEN three 8 x 32 socket head motor mounting plate screws (bottom of mainframe). Remove fourth motor mounting plate screw, figure 9-3.
- d. Using a 1/16 Allen wrench, LOOSEN 8 x 32 set screw in timing disc, figure 9-4.

CAUTION

REMOVE TIMING DISC USING EXTREME CARE NOT TO DAMAGE TEETH ON DISC. WRAP DISC IN SOFT TISSUE WHILE NOT IN READER.

- e. Using a 1/16 Allen wrench, LOOSEN set screw in fifth stacker roller pulley, figure 9-5.
- f. Remove fifth stacker roller pulley from stacker-roller shaft.
- g. Using a 3/32 Allen wrench, LOOSEN set screw in bottom fourth stacker roller pulley.
- h. Remove bottom fourth stacker roller pulley.
- i. Remove main drive motor belt figure 9-4.
- j. To replace main drive motor belt:

CAUTION

PULLEY CONFIGURATION MUST BE MAINTAINED.
ALWAYS REPLACE PROPER PULLEY IN ITS
CORRECT POSITION (UPPER OR LOWER) ON ITS
RESPECTIVE SHAFT. FIGURE 9-6 SHOWS THE
CORRECT CONFIGURATION.

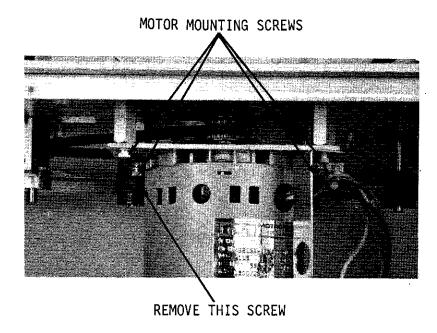


Figure 9-3. Main Drive Motor Mounting

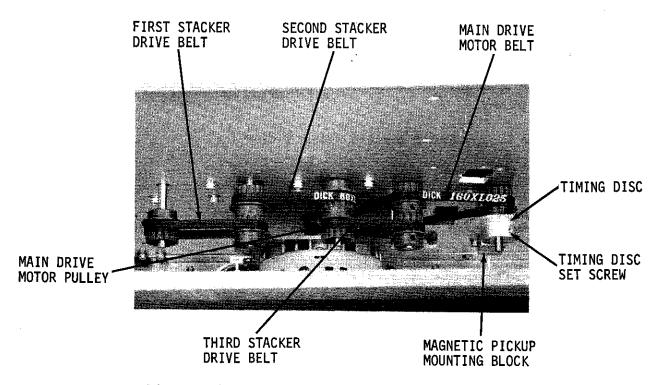


Figure 9-4. Stacker Drive Train Belt Arrangement

- 1. Place belt over main drive motor pulley.
- 2. Slip belt over upper fourth stacker roller pulley, figure 9-5.
- 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. DO NOT OVERTORQUE OR DAMAGE WILL RESULT TO PULLEY.

- 6. Push fifth stacker roller pulley up against mainframe, then pull VERY SLIGHTLY downward making sure 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.
- 1. 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. Using steps a. and b. of paragraph 9.3, remove front and rear panels, figures 9-1 and 9-2.
- b. Using a 3/32 Allen wrench, LOOSEN set screw in bottom fourth stacker roller pulley, figure 9-5.
- c. Pull bottom pulley down to disengage third stacker drive belt. Remove pulley and belt.

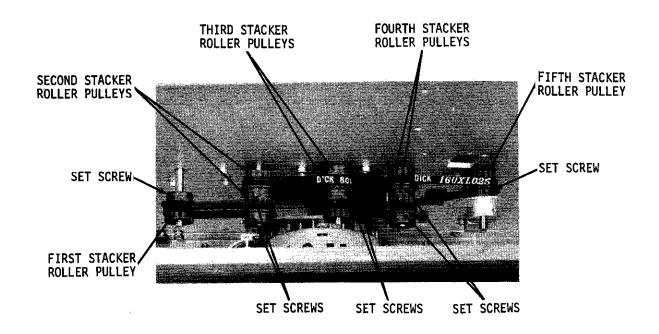


Figure 9-5. Stacker Drive Train Pulley Arrangement

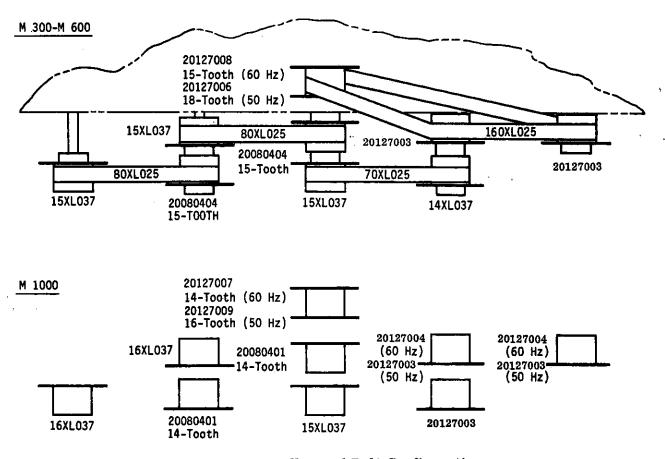


Figure 9-6. Pulley and Belt Configuration

- 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

CAUTION

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. DO NOT OVERTORQUE OR DAMAGE WILL RESULT TO PULLEY.

- a. Using steps a. and b. of paragraph 9.3, remove front and rear panels, figures 9-1 and 9-2.
- b. Using a 3/32 Allen wrench, LOOSEN set screw in bottom second stacker roller pulley, figure 9-5.
- 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

CAUTION

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. DO NOT OVER-TORQUE OR DAMAGE WILL RESULT TO PULLEY.

- a. Using steps a. and b. of paragraph 9.3, remove front and rear panels, figures 9-1 and 9-2.
- b. Using a 3/32 Allen wrench, 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. Using a 3/32 Allen wrench, 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. Using a 3/32 Allen wrench, IOOSEN 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 9-5. 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.
- 1. 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 both bearings and shaft with new matched assembly to assure proper operation.

- a. Using steps a. and b. of paragraph 9.3, remove front and rear panels, figures 9-1 and 9-2. Also remove four screws 3, figure 9-1, holding top panel cover.
- b. Use a 1/2 inch thick group of cards to prop stacker follower in extended position.
- 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 substeps.

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. DO NOT OVER-TORQUE OR DAMAGE WILL RESULT TO PULLEY.

- 1. Using a 3/32 Allen wrench, LOOSEN set screw in bottom second stacker roller pulley, figure 9-5.
- 2. Pull bottom pulley down to disengage first stacker drive belt. Remove pulley and belt.
- 3. Using a 3/32 Allen wrench, LOOSEN set screw in first stacker roller pulley. Remove pulley.
- 4. Perform the following substeps to replace bearing assembly.
 - a. Using a 1/16 Allen wrench, LOOSEN set screw in bottom roller of stacker roller assembly.
 - b. Lift stacker shaft straight up and out of stacker casting. Observe that there is a spacer washer between the top roller and the bearing seat, figure 9-7. Remove top roller from shaft.
 - c. To remove top bearing, use L-shaped tool to lift bearing from assembly.
 - 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 (5 to 25 mils) to force roller against bearing.
 - g. Insert 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.

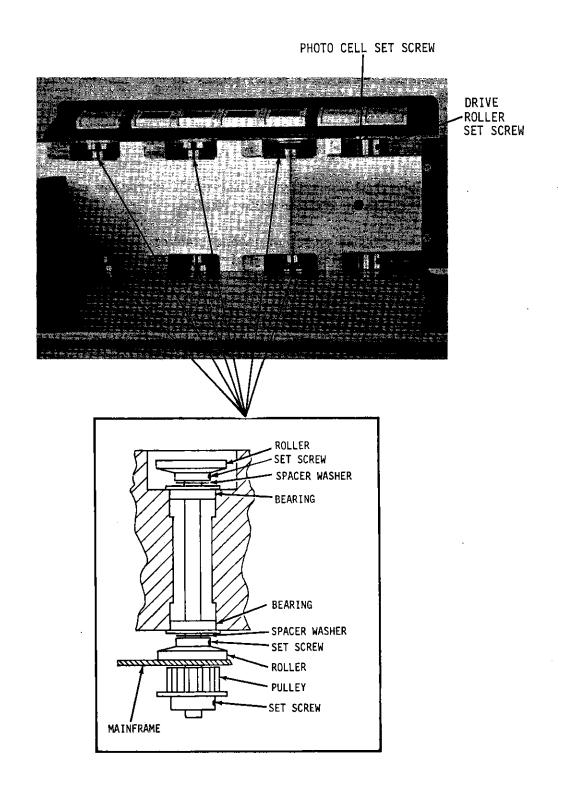


Figure 9-7. Pictorial, Stacker Roller Bearing Assembly

- 5. Replace first stacker roller pulley on first stacker roller shaft in position shown in figure 9-5.
- 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 substeps.

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. DO NOT OVER-TORQUE OR DAMAGE WILL RESULT TO PULLEY.

- 1. Using a 3/32 Allen wrench, 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. Using a 3/32 Allen wrench, LOOSEN set screw in top second stacker roller pulley.
- 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 substeps.

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. DO NOT OVERTORQUE OR DAMAGE WILL RESULT TO PULLEY.

- 1. Using a 3/32 Allen wrench, 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. Using a 3/32 Allen wrench, 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. Using a 3/32 Allen wrench, LOOSEN set screw in bottom third stacker roller pulley. Remove pulley.

- 6. Using a 3/32 Allen wrench, 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. Using a 3/32 Allen wrench, 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 stacker in extended position.
- h. Replace front and rear panels and top panel cover.

9.8 SOLENOID

a. Using steps a. and b. of paragraph 9.3, remove front and rear panels, figures 9-1, and 9-2.

NOTE

Hold lugs on board with long nose pliers while unsoldering or soldering leads in the following procedure. 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 drive circuit board.
- c. Remove solenoid return spring from spring post and arm stud, figure 9-8.
- d. Using a 1/16 Allen wrench, LOOSEN two set screws in top solenoid coupling.
- e. Using a 9/64 Allen wrench, remove two screws 1 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, make sure the wires are extending from the right side (viewed from the front of the reader) and that the forward-most solenoid mounting hole is on the right side.

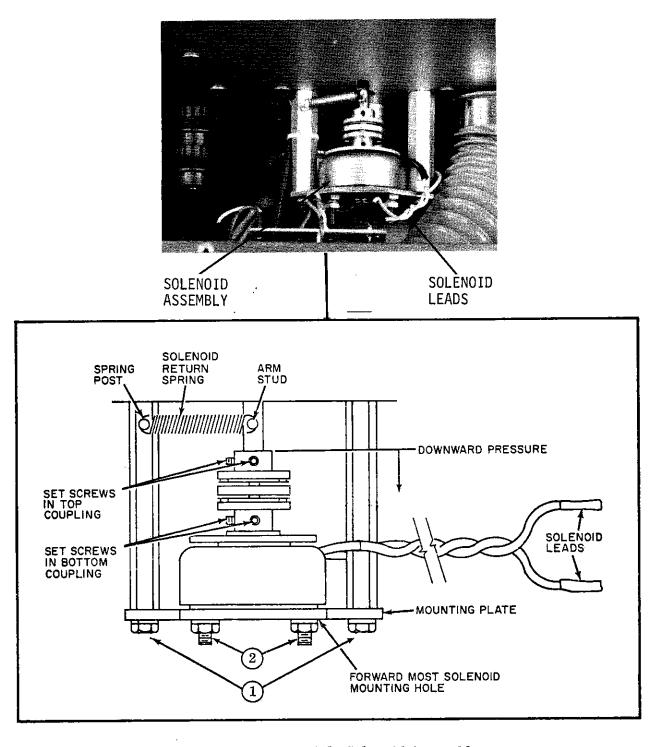


Figure 9-8. Pictorial, Solenoid Assembly

- f. Using an 11/32 wrench, remove two mounting nuts ② .
- g. Using a 1/16 Allen wrench, 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 operational and mounting
type hardware, with the exception of panel
screws.

- h. 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 sure holes are in proper position, with wires extending from right side.
- i. Replace solenoid on mounting post, sliding top coupling onto picker shaft.
- k. Replace solenoid return spring between spring post and arm stud.
- 1. 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 preloading the solenoid, perform the Picker Sector Adjustment, paragraph 6.8.

n. Replace front and rear panels.

9.9 VACUUM PUMP MOTOR ASSEMBLY BELT

- a. Remove front and rear panels. Refer to steps a. and b. of paragraph 9.3, figures 9-1 and 9-2.
- b. Remove four Phillips head screws 1 at rear of subframe panel, figure 9-9.

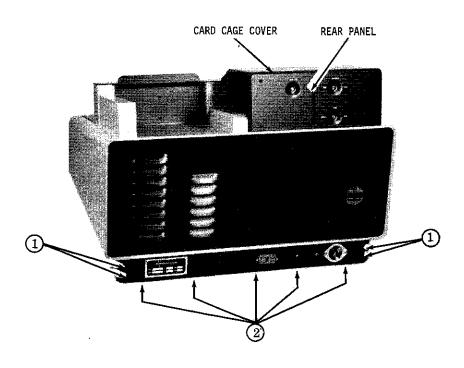


Figure 9-9. Removal of Rear Subframe Panel, Main Card Cage Cover and Panel

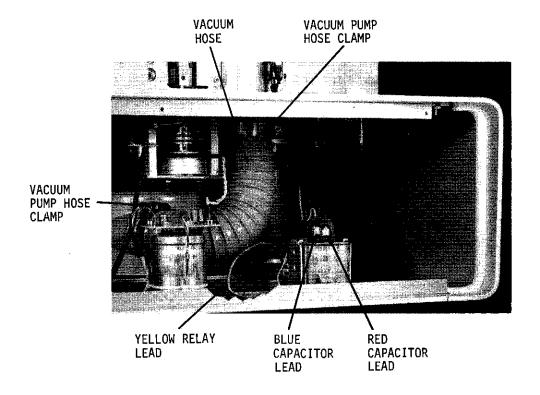


Figure 9-10. Vacuum Pump Motor Assembly Connections

c. Remove five Phillips head screws ② on bottom, rear edge of card reader, holding subframe panel.

NOTE

Tag the 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 9-10.
- e. Loosen vacuum hose clamp on vacuum pump and remove hose from pump.
- f. Using a .050 Allen wrench, LOOSEN set screw in vacuum tube elbow and pull elbow downward, figure 9-11.
- 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.

CAUTION

USE A ½ INCH OPEN-END WRENCH TO HOLD MOUNTING POSTS TO AVOID TWISTING OFF THE PUMP PLATE RUBBER SHOCK MOUNTS.

- i. Remove four Phillips head mounting screws holding vacuum pump motor assembly, figure 9-11.
- The vacuum pump assembly may now be removed from card reader.
- k. LOOSEN three hex vacuum pump mounting bolts (1) figure 9-12.
- 1. Replace vacuum pump belt.
- m. Using a spring scale, adjust vacuum pump for a belt tension of 4-6 ounces. This is about 3/64" belt deflection.
- n. With appropriate belt tension applied, tighten three hex vacuum pump mounting bolts.
- o. Check pulleys to make sure they are in the same plane. Also check each pulley set screw to make sure it is secure.

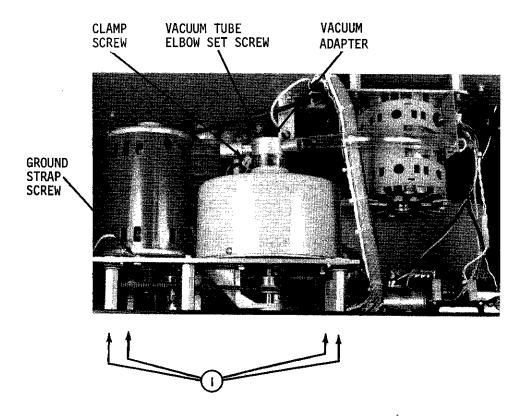


Figure 9-11. Removal of Vacuum Pump Motor Assembly

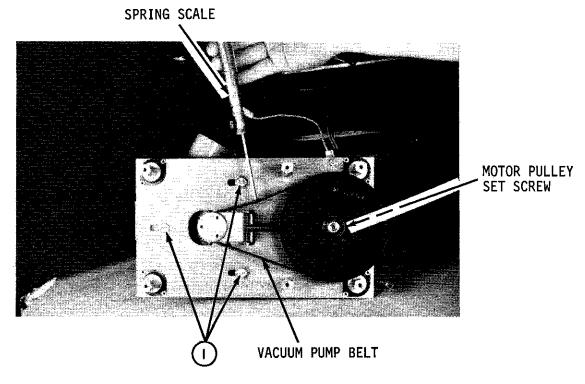


Figure 9-12. Vacuum Pump Belt Replacement

- p. Reinstall vacuum pump assembly into card reader in reverse order of disassembly.
- q. Replace panels removed.

9.10 MAGNETIC PICKUP

- a. Using step b. of paragraph 9.3, remove rear panel, figures 9-2 and 9-14.
- b. Using a 1/16 Allen wrench, LOOSEN set screw in magnetic pickup mounting block, figure 9-13.
- 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 9-9.
- 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 ① holding card cage in place. Move card cage to rear and remount using two rear screws, figures 9-14 and 9-15.
- g. Remove all cards from card cage using card extractor levers, figures 9-15.

NOTE

Tag magnetic pickup wires so that they can be identified with their proper position in the card cage connector, figure 9-15.

- 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 9-13.
- k. Refer to paragraph 6.3 for adjustment of magnetic pickup.
- 1. Reassemble reader in reverse order of disassembly.

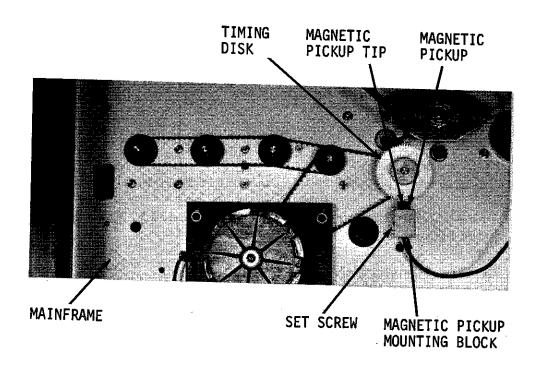


Figure 9-13. Magnetic Pickup Replacement

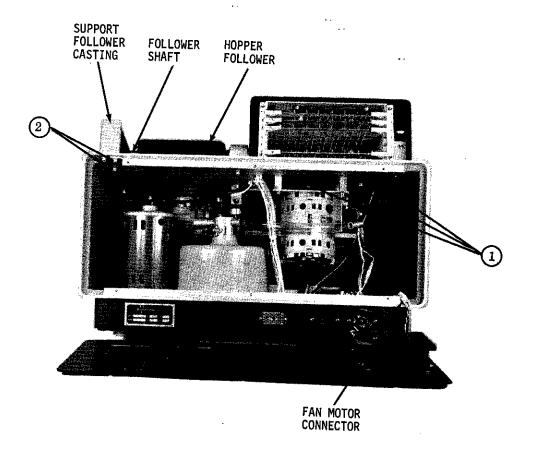


Figure 9-14. Card Cage Repositioning

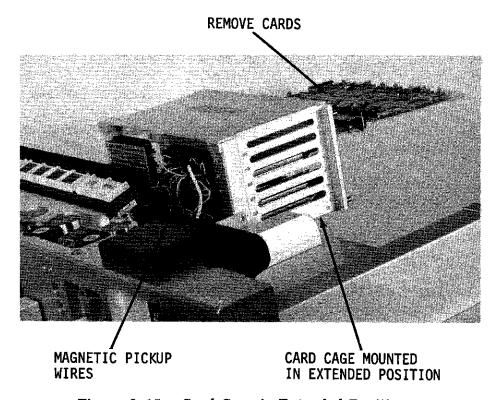


Figure 9-15. Card Cage in Extended Position

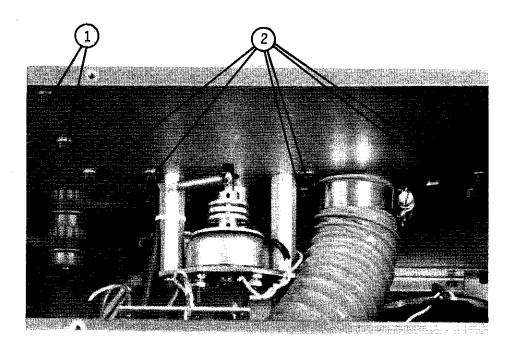


Figure 9-16. Picker Casting Removal

9.11 PICKER SUPPORT ASSEMBLY

The Picker Support Assembly must be removed to replace any of the following assemblies and installed after the replacement of the assembly. These assemblies are:

Read Array Fourth and Fifth Stacker Roller Bearing Assemblies
Light Station First and Second Picker Roller Bearing Assemblies

- a. To remove the Picker Support Assembly proceed as follows:
 - 1. Using steps a. and b. of paragraph 9.3, remove front and rear panels, figures 9-1 and 9-2.
 - 2. Using a 5/64 Allen wrench, remove four button head screws ③, holding top panel cover, figure 9-1.
 - 3. Using a 9/64 Allen wrench, remove two socket head screws ① holding stacker follower casting, figure 9-16, front of reader.
 - 4. Using a 9/64 Allen wrench, remove two socket head screws holding hopper support follower casting, figure 9-17.
 - 5. Remove hopper follower shaft.
 - 6. Pull hopper support follower beyond rear of mainframe sufficiently to expose negator spring screw.
 - 7. Using a Phillips screwdriver, remove negator spring screw and allow spring to slowly return to its roller. Remove hopper follower.
 - 8. Using a .050 Allen wrench, LOOSEN vacuum tube elbow set screw. figure 9-11. Slide elbow off vacuum tube and move to left.
 - 9. LOOSEN adapter clamp screw at top of vacuum pump assembly and with a slight upward pressure remove this adapter from card reader.
 - 10. LOOSEN screw on two large hose clamps; remove blower hose, figure 9-10.
 - 11. Remove solenoid return spring, figure 9-8.
 - 12. Using a 1/16 Allen wrench, LOOSEN two top solenoid coupling set screws.
 - 13. Using a 9/64 Allen wrench, remove two socket head screws (1) holding solenoid assembly. Lay solenoid assembly on baseplate.

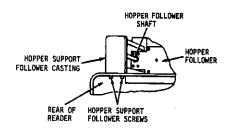


Figure 9-17. Hopper Follower Assembly Removal

- 14. Using a 9/64 Allen wrench, remove six socket head screws ② holding picker casting.
- 15. Remove plastic tie-down holding light station cable on solenoid mounting post.
- 16. Remove plastic tie-down holding hopper empty switch cable, figure 9-19.
- 17. Lift picker casting straight up and lay on chassis, figure 9-18.
- b. To replace the Picker Support Assembly proceed as follows:
 - 1. Set picker casting in place, figure 9-19.
 - 2. Using LOCTITE GRADE C, set all six socket head screws ② , figure 9-16, BUT DO NOT TIGHTEN.
 - 3. Adjust position of picker casting per paragraph 6.10.
 - 4. The remainder of the reader may now be assembled in reverse order of disassembly.
 - 5. Readjust the picker sector per paragraph 6.8.

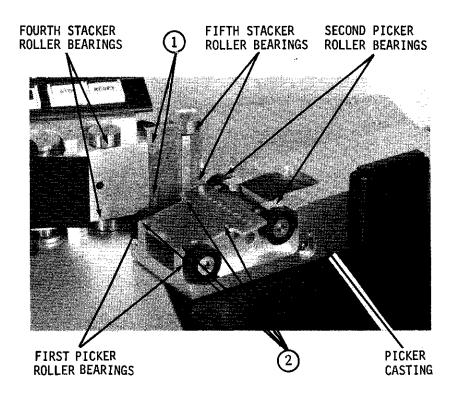


Figure 9-18. Picker Casting Removed From Reader

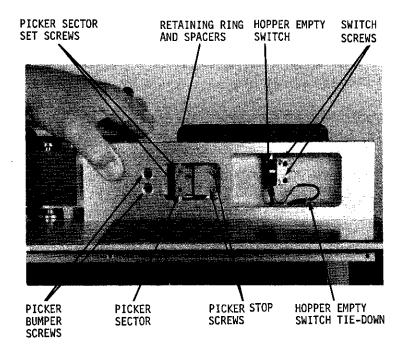
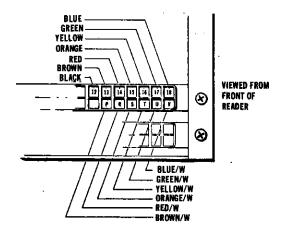


Figure 9-19. Replacement of Picker Casting And Picker Sector, Front View

9.12 READ HEAD

- a. Remove picker support assembly per paragraph 9.11 a.
- b. Remove two button head screws each side of card cage cover and remove main card cage cover sliding back slightly and lifting upward, figure 9-9.
- c. Remove four button head screws and remove rear card cage panel.
- d. Using a 9/64 Allen wrench, remove three socket head screws ① holding card cage in place. Move card cage to rear and remount using two rear screws. figures 9-14 and 9-15.
- e. Remove all cards from card cage using extractor levers, figure 9-15.
- f. Using AMP tool 465195-2, remove read head wires from connector per the following diagram.



- g. Remove two flat head Phillips screws 1 to remove read head, figure 9-18.
- h. Replace read head and connectors in card cage making sure wires are installed in proper color coded positions.
- i. Replace picker support assembly per paragraph 9.11 b.

9.13 LIGHT STATION

- a. Remove picker support assembly per paragraph 9.11. a.
- b. Remove four flat head Phillips screws ② to remove light station, figure 9-18.
- c. Slide off plastic tie-down 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 tie down.
- f. Replace picker support assembly per paragraph 9.11. b.

9.14 FOURTH AND FIFTH STACKER ROLLER BEARING ASSEMBLIES

NOTE

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

- a. Remove picker support assembly per paragraph 9.11. a.
- 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 9-14, perform the following substeps.
 - 1. Using a 3/32 Allen wrench, LOOSEN set screw in bottom pulley of fourth stacker roller, figures 9-5 and 9-6.
 - 2. Pull bottom pulley down to disengage third stacker drive belt. Remove belt and pulley.
 - 3. Using a 1/16 Allen wrench, 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. Using a 1/16 Allen wrench to LOOSEN set screw in bottom roller of fourth stacker roller assembly, figure 9-7.
- 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 (5 to 25 mils) to force roller against bearing.
- 12. Insert 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 is engages with main drive motor belt, figures 9-5 and 9-6.
- 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.

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. Tighten set screw.
- 22. Replace picker support assembly per paragraph 9.16.
- d. To replace fifth stacker roller bearings, figure 9-14, perform the following substeps.

CAUTION

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

- 1. Using a 1/16 Allen wrench, LOOSEN set screw in timing disc, figure 9-4. Carefully remove disc and wrap it in soft tissue.
- 2. Use a 1/16 Allen wrench to LOOSEN set screw in fifth stacker roller pulley.

- 3. Pull pulley downward to disengage it from main drive motor belt. Remove pulley.
- 4. Use a 1/16 Allen wrench to LOOSEN set screw in bottom roller of fifth stacker roller assembly, figure 9-7.
- 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 (5 to 25 mils) to force roller against bearing.
- 11. Insert 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 9-5 and 9-6.
- 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.

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 9-4. 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 picker support assembly per paragraph 9.11. b.

9.15 FIRST AND SECOND PICKER ROLLER BEARINGS

- a. Remove picker support assembly per paragraph 9.11.a.
- 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 substeps.
 - 1. Using a 1/16 Allen wrench, LOOSEN set screw in bottom roller of first picker roller, figure 9-14.
 - 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.

- 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 substeps.
 - 1. Using a 1/16 Allen wrench, 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 picker support assembly per paragraph 9.11.b.

9.16 PICKER SECTOR

- a. Using a 5/64 Allen wrench, remove four button head screws 3 holding top panel cover, figure 9-1.
- b. Perform steps a. and c. through f. of paragraph 9.8. Prop open input hopper follower by taping together 3/4 inch of cards and placing in hopper at right angles.
- c. Using a #2 retaining ring remover tool, remove the retaining ring from the top of the picker shaft, figure 9-19.
- d. Remove spacers located under the retaining ring, figure 9-19.

CAUTION

ALL OF THE SPACERS MUST BE REPLACED IN REASSEMBLY.

- e. Using a 5/64 Allen wrench, LOOSEN two set screws holding picker sector.
- f. Remove picker shaft from bottom of chassis.

- g. Using a Phillips screwdriver, remove throat block, figure 9-20.
- h. Remove picker sector from rear side of picker casting.
- i. Replace picker sector, shaft, all spacers, and retaining ring.
- j. Adjust shaft to place sector set screws on flat side of shaft.
- k. Using a 6" metal ruler, measure 1.625" from the mainframe up to the center of the row of holes on the picker sector.
- 1. Retaining this measurement, tighten two picker sector set screws, figure 9-19.
- m. Reassemble reader in reverse order of disassembly.
- n. Refer to paragraph 6.8 for adjustment of picker sector.

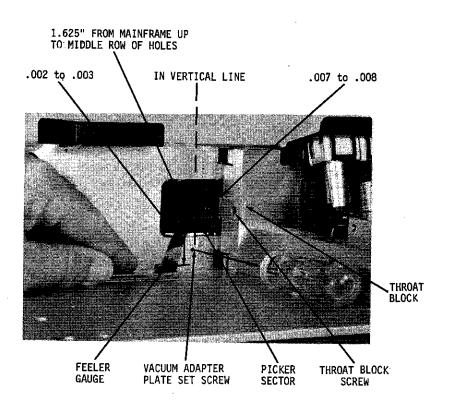


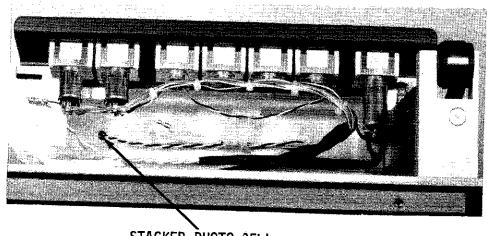
Figure 9-20. Picker Sector, Rear View

9.17 STACKER PHOTOCELL

- a. Using a 5/64 Allen wrench, remove four button head screws 3 holding top panel cover, figure 9-1.
- b. Remove two button head screws each side of card cage cover, slide backward about 2" and lift off, figure 9-9.
- c. Remove four button head screws from rear card cage panel and remove panel.
- d. Using a 5/64 Allen wrench, remove six 6 x 32 button head screws holding rear panel, move rear panel out slightly, disconnect fan motor connector, and remove rear panel, figures 9-2 and 9-14.
- e. Using a 9/64 Allen wrench, remove three socket head screws 8 holding card cage in place. Move card cage to rear and remount using two rear screws, figures 9-14 and 9-15.
- f. Remove all cards from card cage using extractor levers, figure 9-15.
- g. Using a 1/16 Allen wrench, LOOSEN set screw in top fourth stacker roller figure 9-7. Remove stacker roller and preload washer.
- h. Using a 1/16 Allen screwdriver, LOOSEN set screw in stacker casting holding stacker photocell.
- i. Tag black and white wires from photocell. Using AMP tool 465195-2, remove connectors from card cage.
- j. Remove photocell from rear of stacker casting, figure 9-21.
- k. Replace photocell, align flush with stacker casting faceplate, and tighten photocell set screw.

CAUTION

- MAKE SURE PHOTOCELL DOES NOT EXTEND BEYOND SURFACE OF CASTING OR DAMAGE MAY RESULT TO PHOTOCELL OR CARDS.
- Replace connectors in card cage.
- m. Replace stacker roller making sure there is no vertical play in stacker roller shaft. Refer to paragraph 6.5 for preloading bearings.
- n. Reassemble in reverse order of disassembly.



STACKER PHOTO CELL

Figure 9-21. Location of Stacker Photocell

9.18 HOPPER NEGATOR SPRING

- a. Use steps b., c., and e., of paragraph 9.17 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 input hopper follower assembly, figure 9-17.

9.19 LOWER STACKER NEGATOR SPRING

- a. Using a 5/64 Allen wrench, remove six button head screws retaining front panel and remove front panel, figure 9-1.
- b. Remove two button head screws each side of card cage cover, slide cover back slightly and lift off, figure 9-9.

- c. Using a 9/64 Allen wrench, remove two socket head screws 1 holding front stacker shaft support, figure 9-22.
- d. LOOSEN set screw in rear stacker shaft support, figure 9-23.
- e. Remove stacker shaft, figure 9-22.
- f. Move stacker 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.

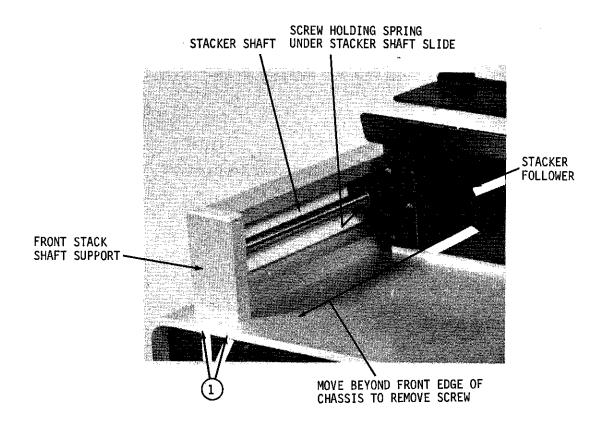


Figure 9-22. Stacker Negator Spring Replacement

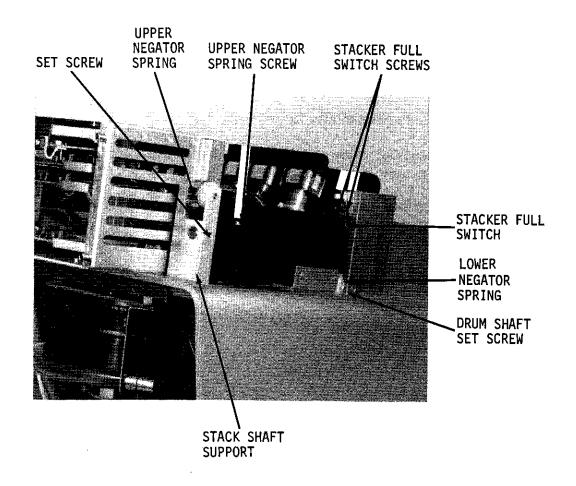


Figure 9-23. Stacker Full Switch Replacement

9.20 UPPER STACKER NEGATOR SPRING

- a. Remove two button head screws each side of card cage cover, slide cover back slightly and lift off.
- b. Remove upper stacker negator spring screw, figure 9-23.
- c. Pull spring from roller and roll new spring onto roller.
- d. Replace spring screw.
- e. Replace card cage cover.

9.21 HOPPER EMPTY SWITCH

- a. Using a 5/64 Allen wrench, remove four button head screws ③, figure 9-1, holding top panel cover.
- b. Using a 3/32 Allen wrench, remove two socket head screws holding riffle cap.
- c. Remove two connectors from hopper empty switch, figure 9-19.
- d. Using a 1/16 Allen wrench, remove two button head screws holding switch.
- e. Replace switch and adjust per paragraph 6.6.
- f. Reassemble in reverse order of disassembly.

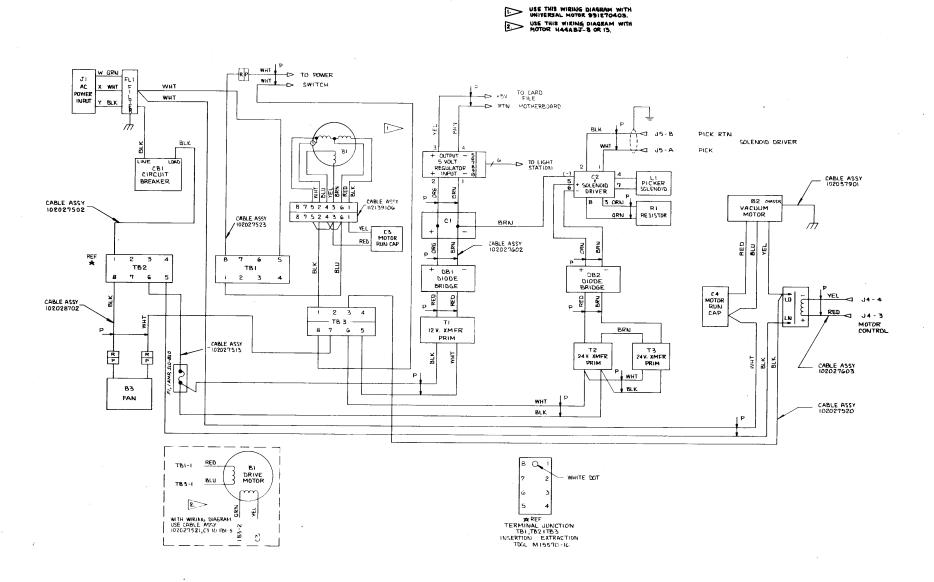
9.22 STACKER FULL SWITCH

- a. Remove two button head screws on each side of card cage cover, slide cover back slightly and lift off.
- b. Remove two Phillips head screws holding stacker full switch, figure 9-23.
- c. Unsolder leads from switch, and solder to new switch.
- d. Mount switch and adjust per paragraph 6.7.
- e. Replace card cage cover.

9.23 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.
- c. Insert new lamp into lens.
- d. Press lens firmly into switch.

SECTION 10 DRAWINGS



NOTES:

Figure 10-1. Wiring Diagram, AC Power Distribution, 115 VAC, 60 Hz (Dwg. No. 1040754)

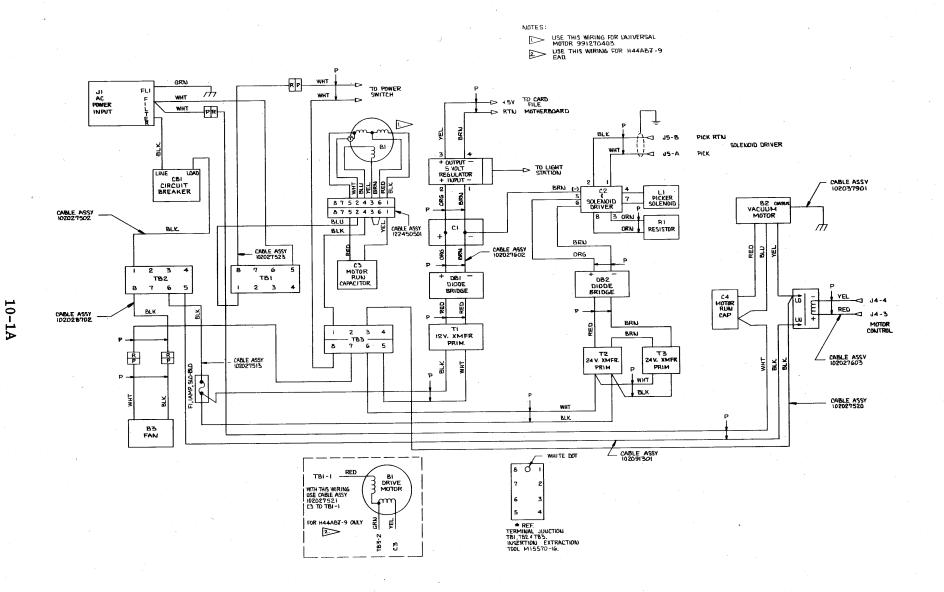


Figure 10-1A. Wiring Diagram, AC Power Distribution, 230 VAC, 50 Hz (Dwg. No. 1040764)

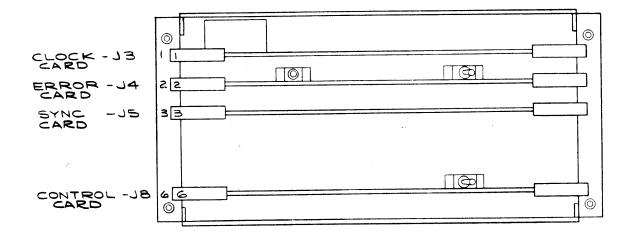


Figure 10-2. Card Cage, P.C. Card Location

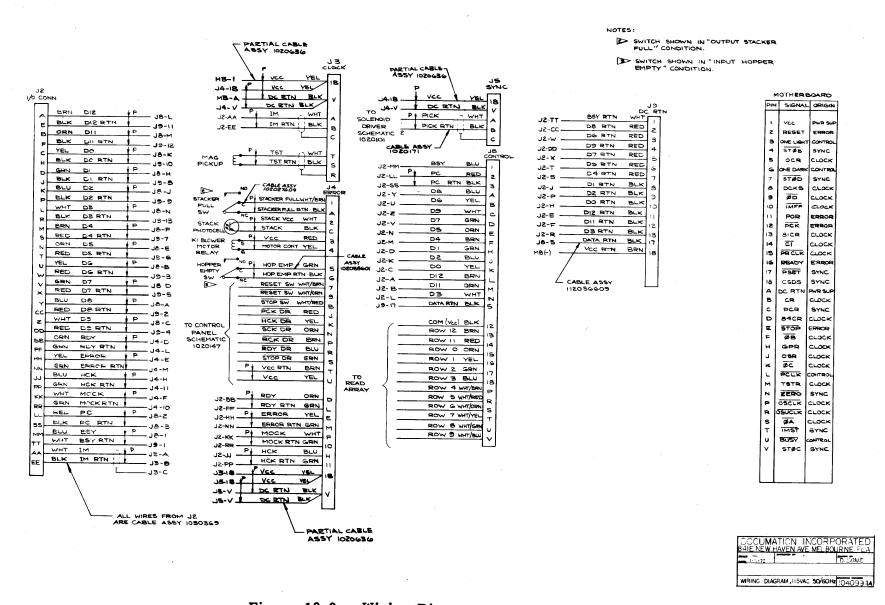


Figure 10-3. Wiring Diagram, Card Cage (Dwg. No. 1040994)

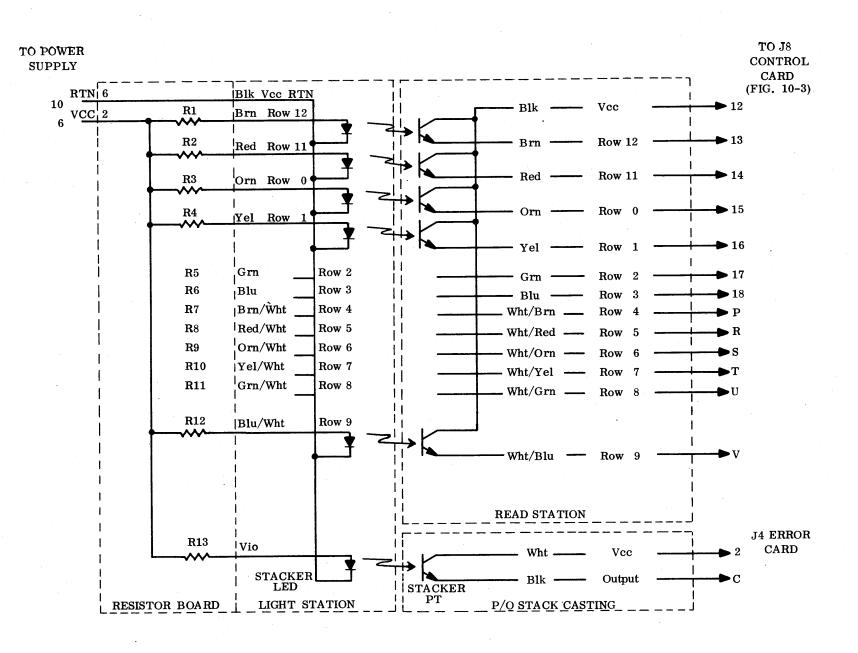


Figure 10-3A. Wiring Diagram, Read/Light Station

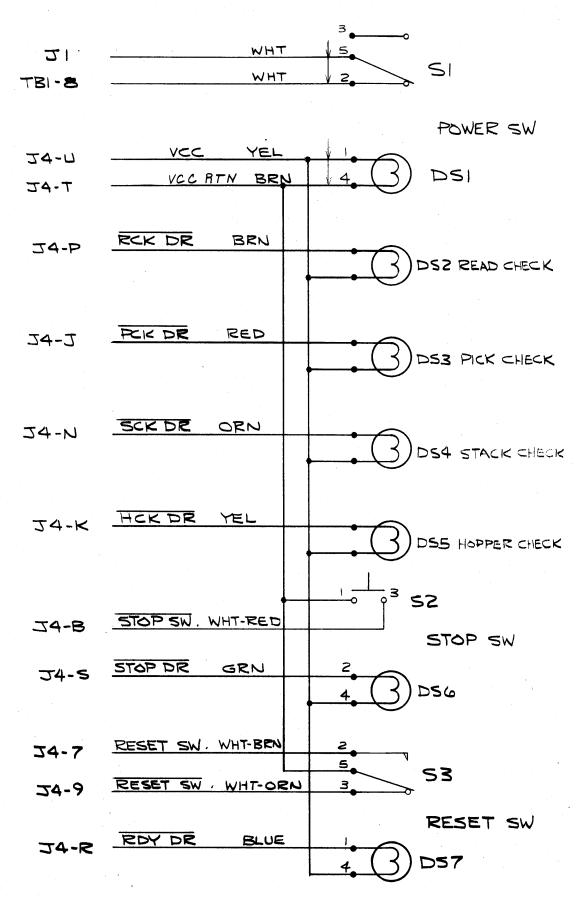


Figure 10-4. Wiring Diagram, Control Panel (Dwg. No. 1020147)

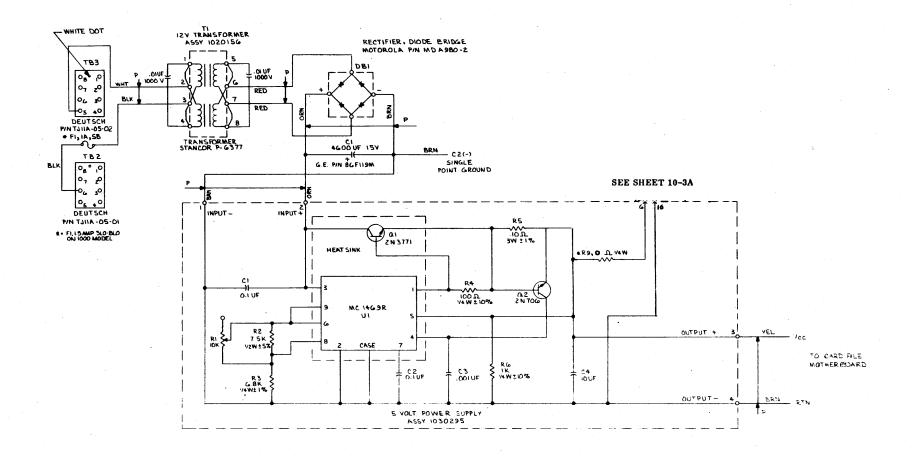


Figure 10-5. Schematic Diagram, 5V Power Supply, 115 VAC, 60 Hz (Dwg. No. 1040506)

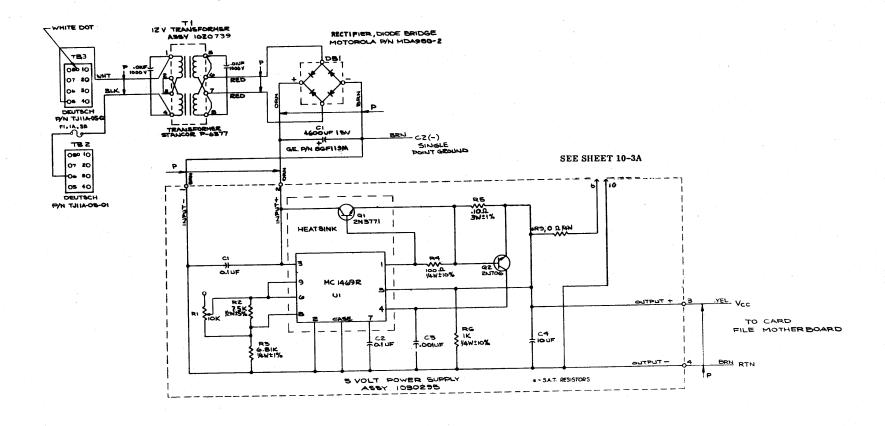


Figure 10-5A. Schematic Diagram, 5V Power Supply, 230 VAC, 50 Hz

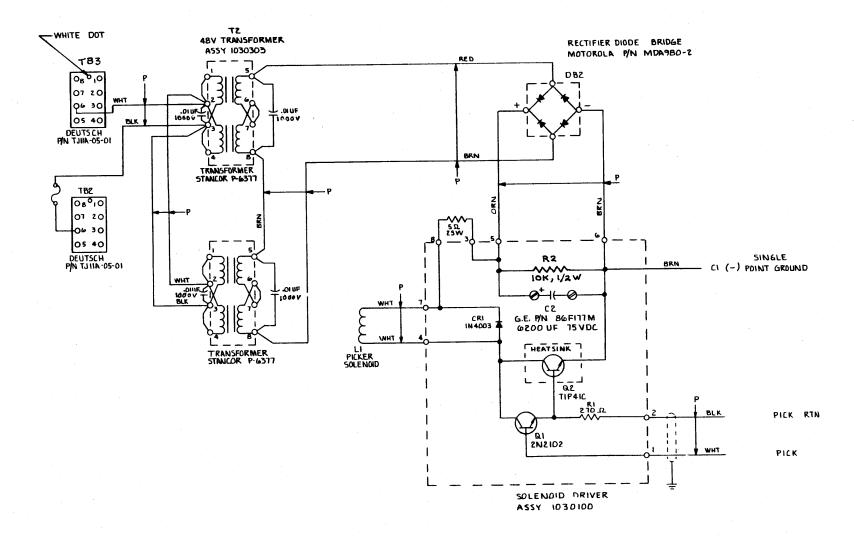


Figure 10-6. Schematic Diagram, Solenoid Driver, 115 VAC, 60 Hz (Dwg. No. 1341226)

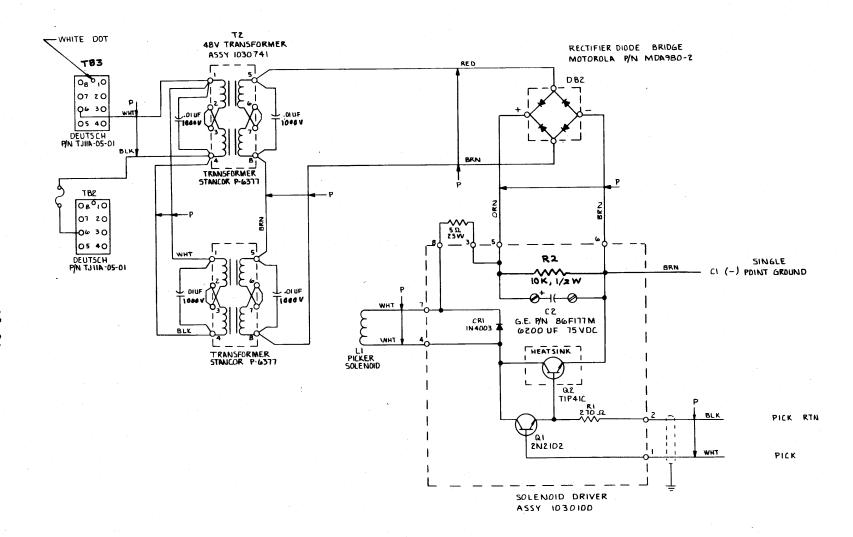


Figure 10-6A. Schematic Diagram, Solenoid Driver, 230 VAC, 50 Hz (Dwg. No. 1341485)

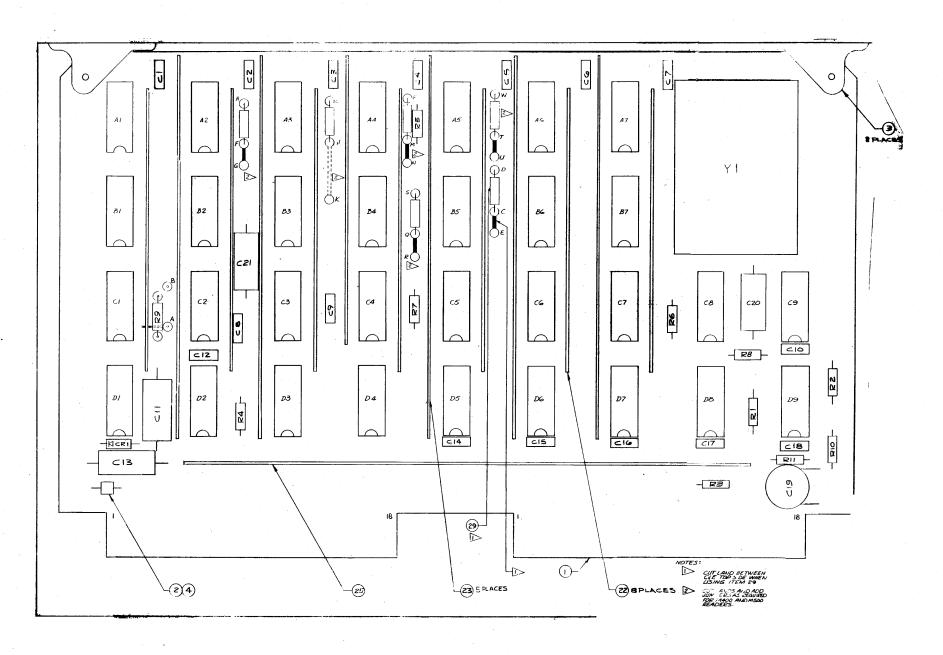


Figure 10-7. Assembly Diagram, Clock Card (Dwg. No. 1040765)

Figure 10-8. Schematic Diagram, Clock Card (Sh. 1 of 3) (Dwg. No. 1040800

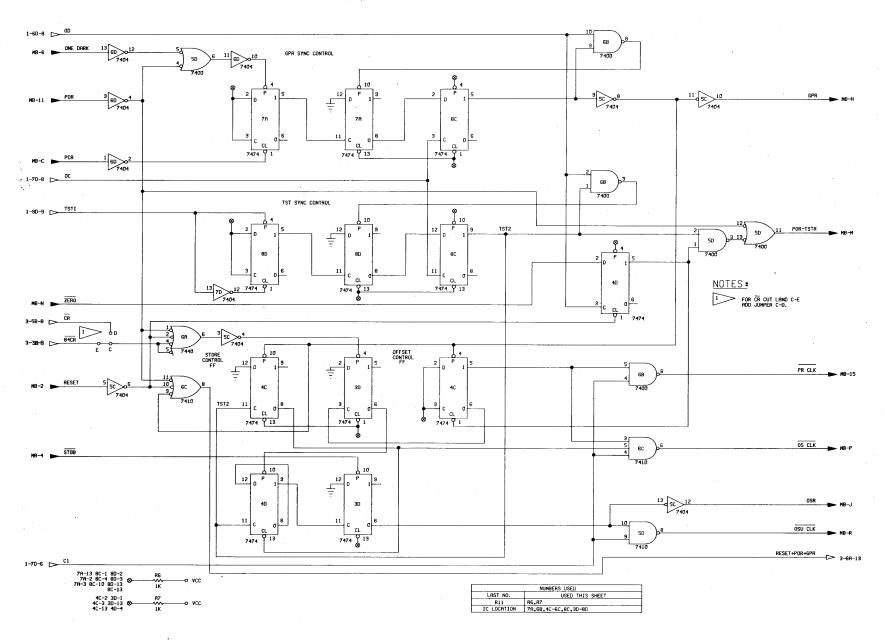


Figure 10-9. Schematic Diagram, Clock Card (Sh. 2 of 3)

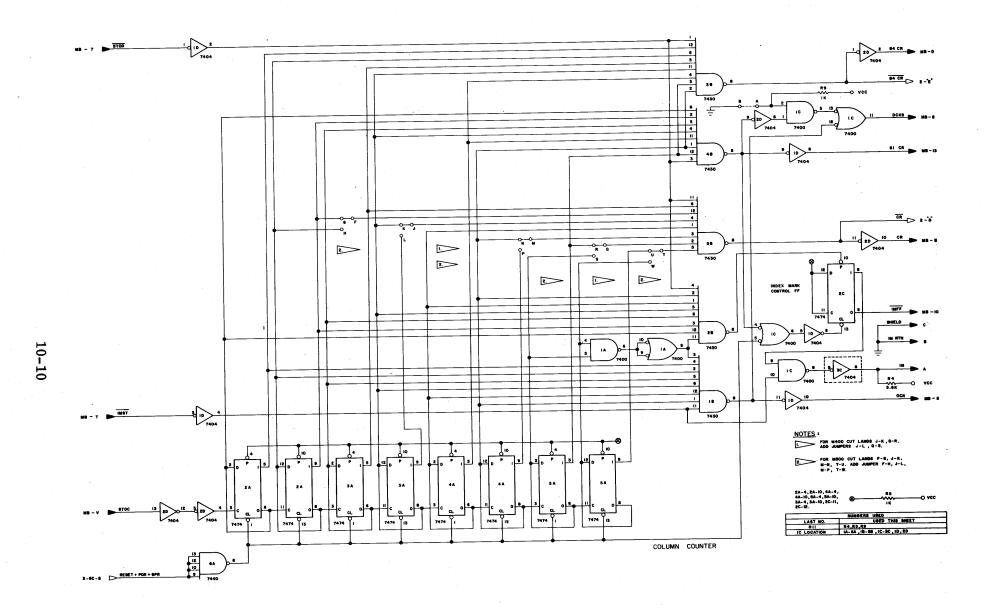


Figure 10-10. Schematic Diagram, Clock Card (Sh. 3 of 3)

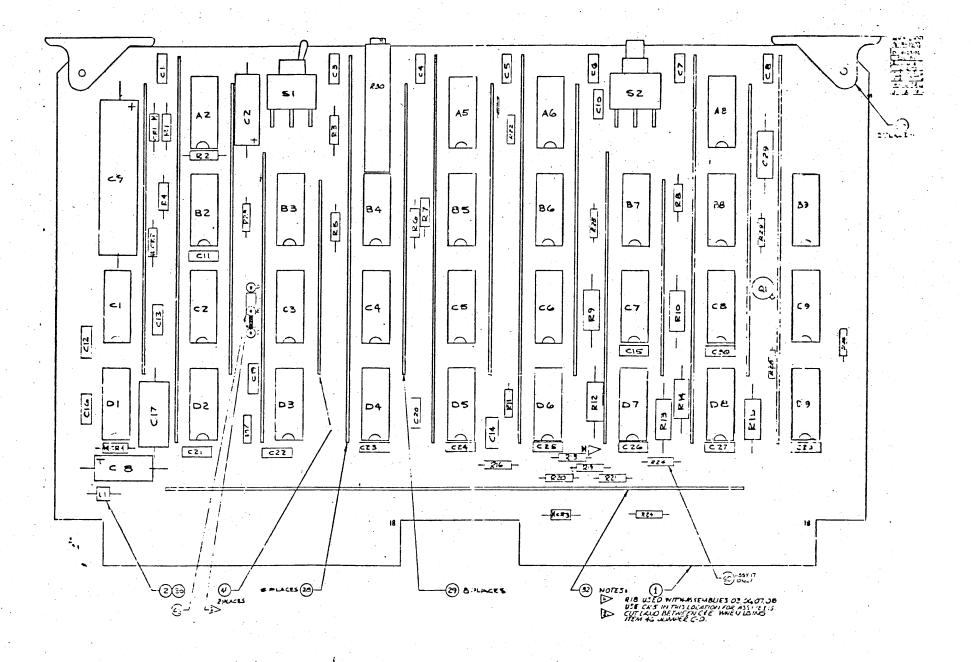


Figure A5. Error Card Assembly (Dwg. No. 1040610)

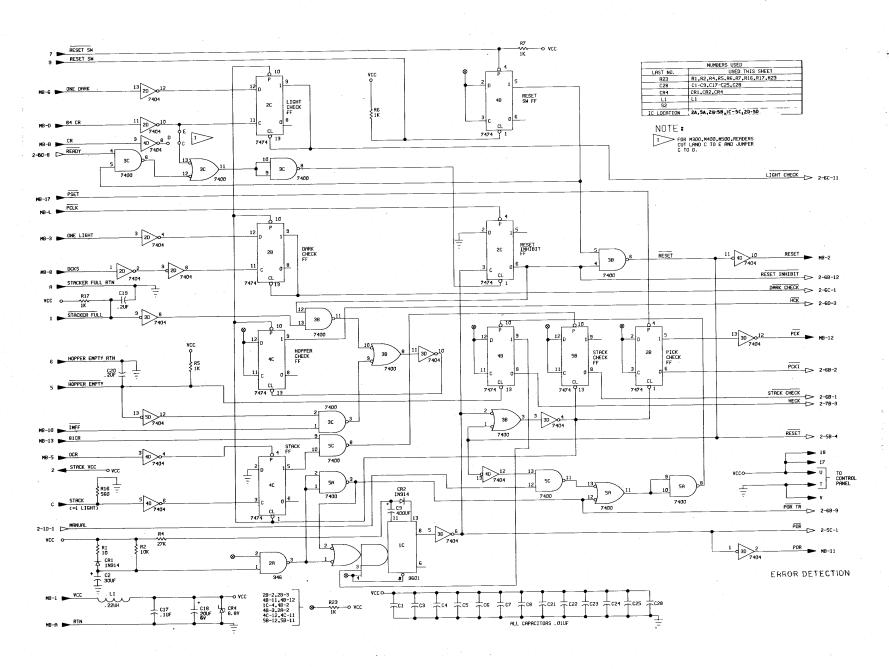


Figure 10-12. Schematic Diagram, Error Card (Sh. 1 of 2) (Dwg. No. 1040814)

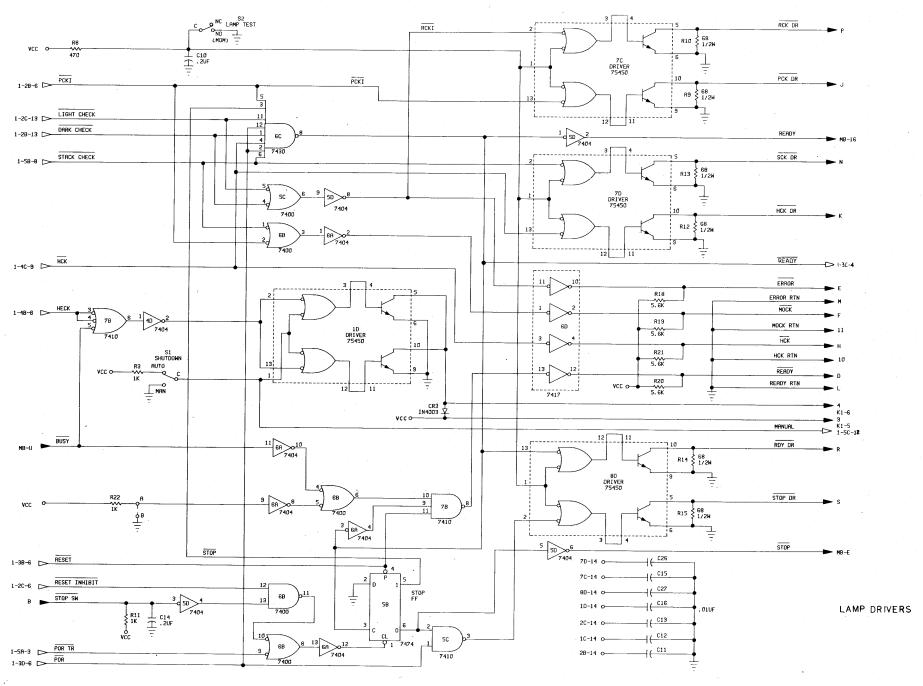


Figure 10-13. Schematic Diagram, Error Card (Sh. 2 of 2)

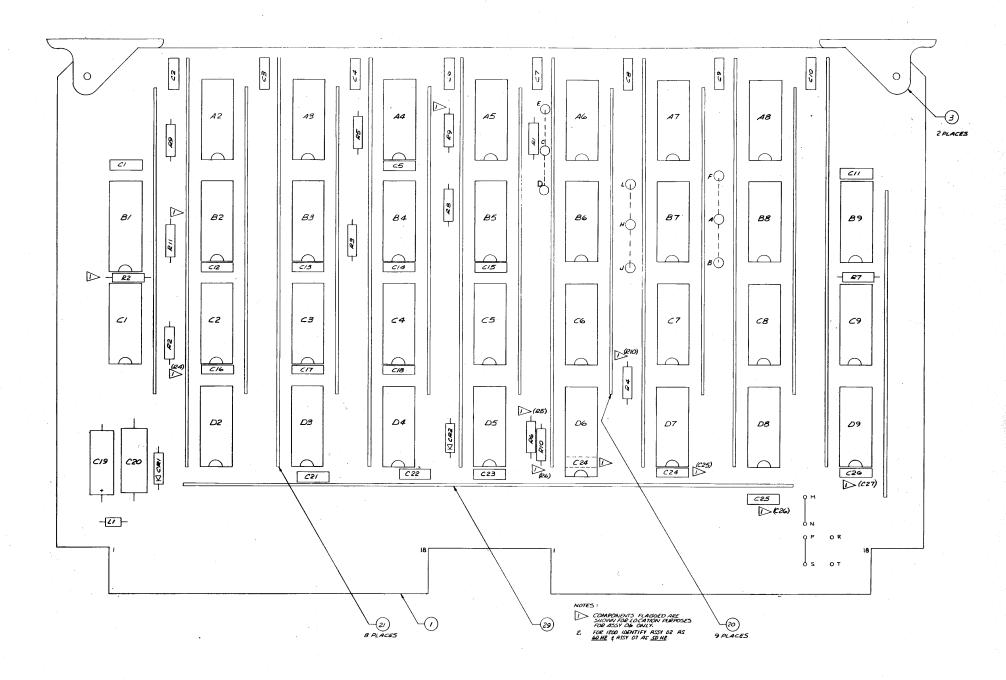


Figure 10-14. Assembly Diagram, Sync Card (Dwg. No. 1040353)

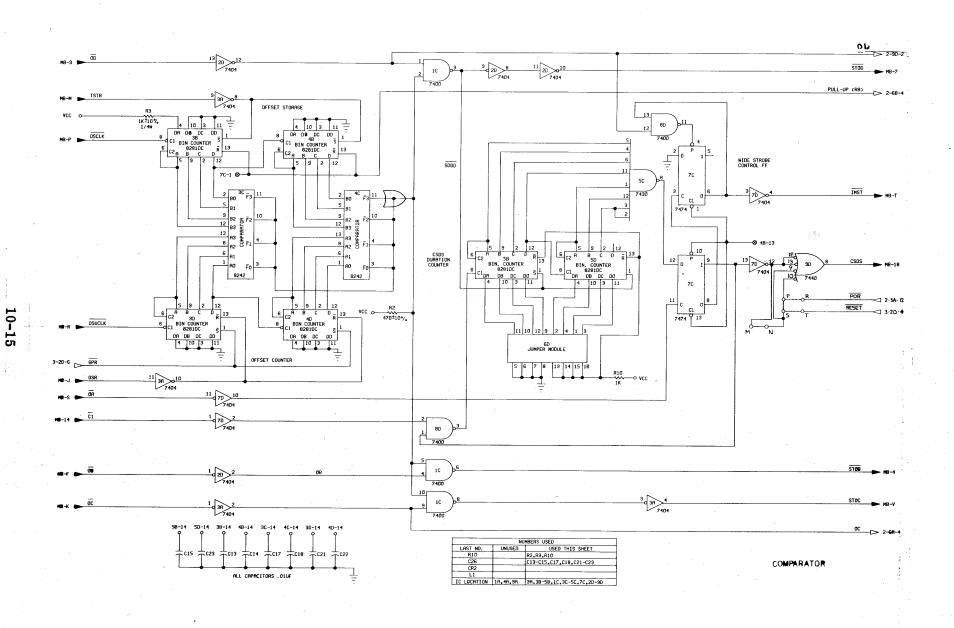


Figure 10-15. Schematic Diagram, Sync Card (Sh. 1 of 3) (Dwg. No. 1640943)

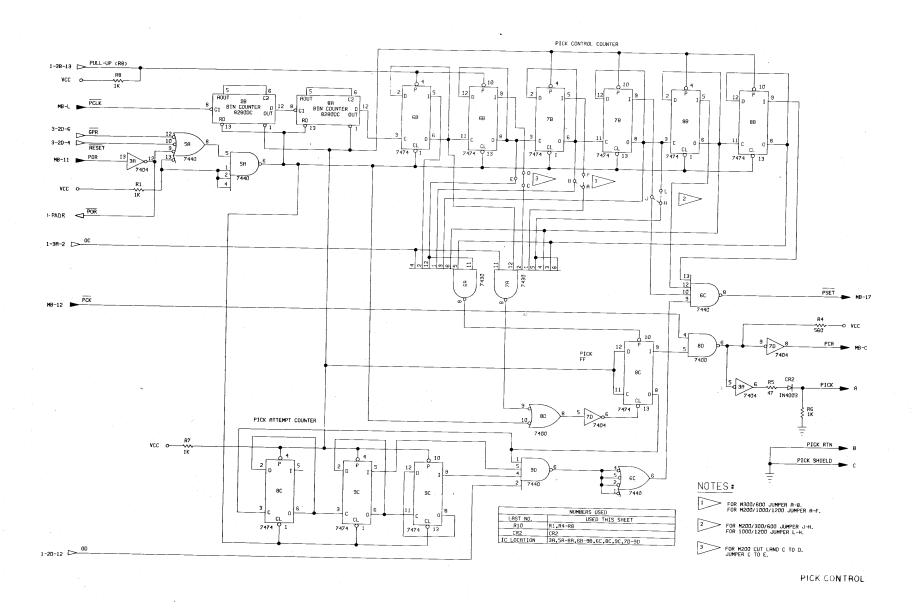
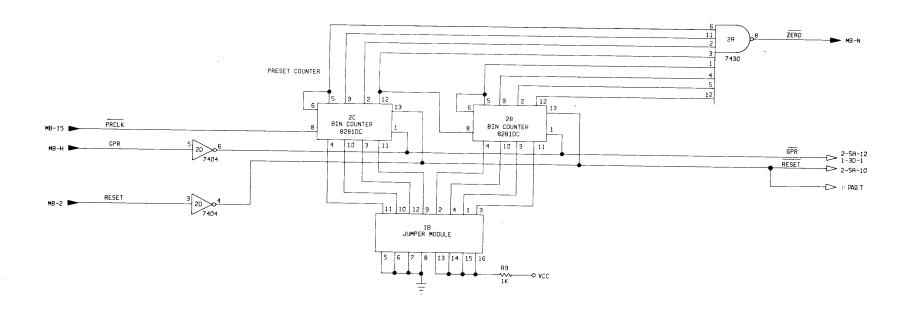


Figure 10-16. Schematic Diagram, Sync Card, (Sh. 2 of 3)



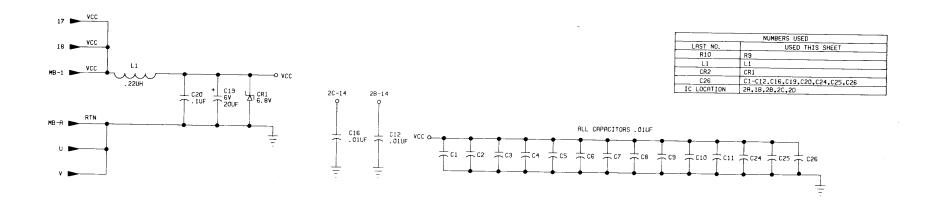
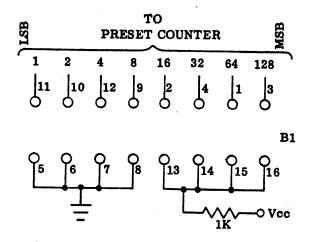
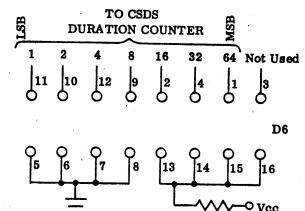


Figure 10-17. Schematic Diagram, Sync Card (Sh. 3 of 3)



M-SERIES PRESET TIMING REQUIREMENTS

Model	Count	Time in µsec
M 200	176	1466.0
M 200 (310 CPM)	164	1366.6
M 300/600	75	625.0
M 1000	43	358.3
M 1200	35	291.7



CSDS TIMING REQUIREMENTS

Model	Count	Time in μ sec
M 200	72	600.0
M 200 (310 CPM)	72	600.0
M 300/600	31	258.3
M 1000	18	150.0
M 1200	15	125.0

To program the counters, so that they are loaded with the complement of the required count, proceed as follows:

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

Figure 10-17A. Preset and CSDS Counter Strapping

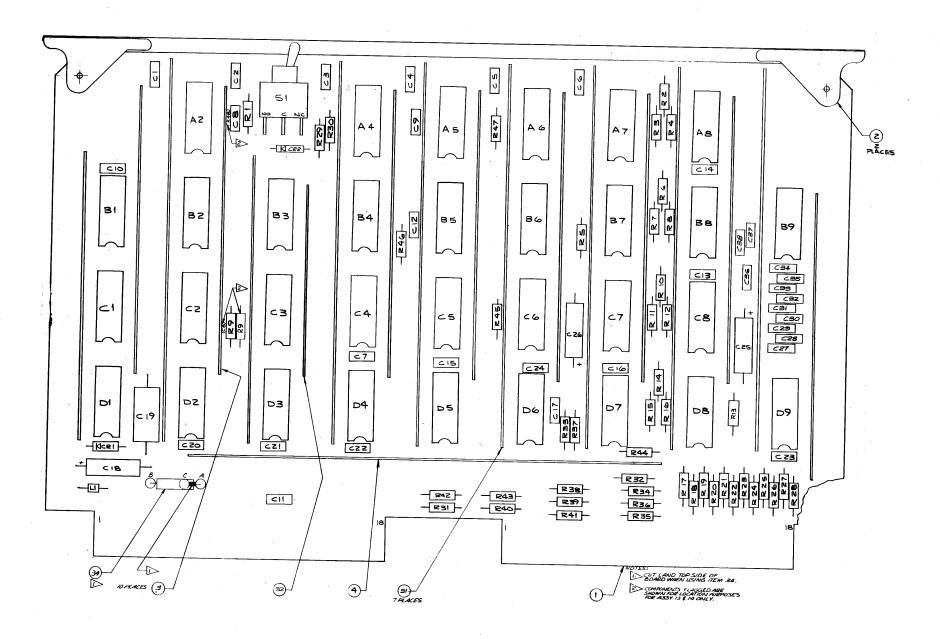


Figure 10-18. Assembly Diagram, Control Card (Dwg. No. 1040619)

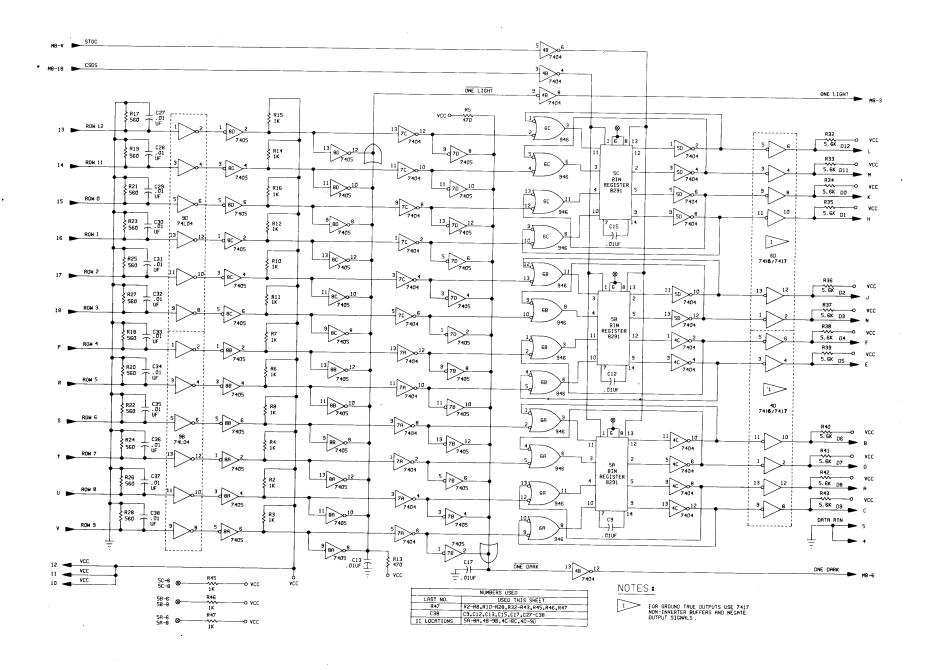


Figure 10-19. Schematic Diagram, Control Card (Sh. 1 of 2) (Dwg. No. 1040650)

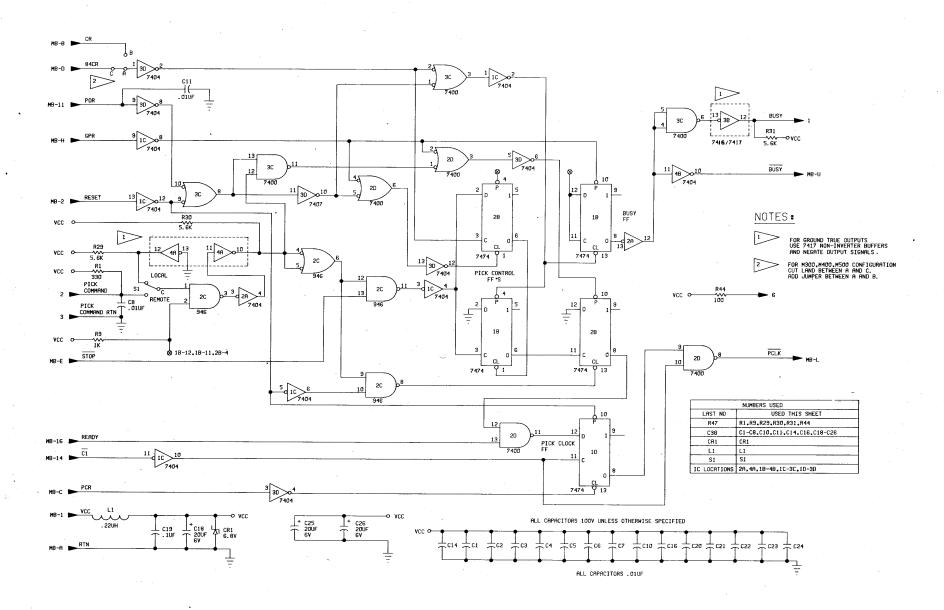


Figure 10-20. Schematic Diagram, Control Card (Sh. 2 of 2)

SECTION 11 SIGNAL MNEMONICS AND ABBREVIATIONS

		T -	
MATERICATIO	DEGGE TO THE STATE OF		ORIGINATING
MNEMONIC	DESCRIPTION	LOCATION	SOURCE
Vcc	+5 volts	MB-1	5 realt names and
	70105	MID-I	5 volt power supply
RTN	+5 volt return	MB-A	(Mother Board)
	VOIC LOUGH	INID-Y	5 volt power supply
			(Mother Board)
ØA	Clock Phase A	MB-S	Clock Card
ØВ	Clock Phase B	MB-F	Clock Card
ØC	Clock Phase C	MB-K	Clock Card
ØD	Clock Phase D	MB-9	Clock Card
81CR	81st Column Reset	MB-13	Clock Card
84CR	84th Column Reset	MB-D	Clock Card
BUSY	Busy Output	J8-1	Control Card
BUSY	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
D 8	Data Row 8 Output	J8-A	Control Card
D 9	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
DARK CHECK	Dark Check	B2-9	Error Card
ERROR	Error Output	J4-E	Error Card
ERROR RTN	Error Output Return	J4-M	Error Card
GPR	Good Pick Reset	МВ-Н	Clock Card
HCK	Hopper Check Output	J4-H	Error Card
HCK	Input or Output Hopper Check	C4-9	Error Card
HCK DR	Hopper Check Lamp Driver	J4-K	Error Card
HCK RTN	Hopper Check Output Return	J4-10	Error Card
HECK	Hopper Empty Check	B4- 8	Error Card
	·		
			

			ORIGINATING
MNEMONIC	DESCRIPTION	LOCATION	SOURCE
HOPPER EMPTY	Hopper Empty Switch	J4-5	Error Card
HOPPER EMPTY RTN	Hopper Empty Switch Return	J4-6	Error Card
STACKER FULL	Stacker Full Switch	J4-1	Error Card
STACKER FULL RTN	Stacker Full Switch Return	J4-A	Error Card
IM	Index Marks	J3-A	Clock Card
IM RTN	Return for Index Marks	J3-B	Clock Card
IMST	Index Mark Strobes	MB-T	Sync Card
LIGHT CHECK	Light Check	C2-9	Error Card
MOCK	Motion Check Output	J4-F	Error Card
MOCK RTN	Motion Check Output Return	J4-11	Error Card
OCR	Zero Column Reset	MB-5	Clock 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-9 MB-P	Clock Card
OSR	Offset Reset	MB-J	Clock Card
OSUCLK	Offset Up-Clock	MB-R	Clock Card
PCK	Pick Check	B2-5	Error Card
PCK DR	Pick Check Lamp Driver	Б2-5 J 4-J	Error Card Error Card
PCK DK PCKI	Pick Check Indicator	B2-2	Error Card
PCLK	Pick Clock	B2-2 MB-L	
PCLK	Pick Control Reset	MB-L MB-C	Control Card
PICK		МВ-С J5-A	Sync Card
	Pick Driver Output		Sync Card
PICK RTN	Pick Driver Output Return	J5-B	Sync Card
PICK COMMAND DELY	Pick Command Input	J8-2	Control Card Control Card
PICK COMMAND RTN	Pick Command Input Return	J8-3	
POR	Power On Reset	MB-11	Errør Card
POR TR	Power On Reset Trigger	A5-12	Error Card
PRCLK	Preset Clock	MB-15	Clock Card
PSET	Pick Check Set	MB-17	Sync Card
RCK DR	Read Check Lamp Driver	J4-P	Error Card
RDY DR	Ready Lamp Driver	J4-R	Error Card
READY	Ready	MB-16	Error Card
READY	Ready Output	J4-D	Error Card
READY RTN	Ready Output Return	J4-L	Error Card
RESET	Gated Reset Switch	MB-2	Sync Card
RESET SW	Reset Switch Normally Open	J4-9	Error Card
RESET SW	Reset Switch Normally Closed		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

MNEMONIC	DESCRIPTION	LOCATION	ORIGINATING SOURCE	
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	
RTN	Data Drivers Return	J8-5	Control Card	
SCK DR	Stack Check Lamp Driver	J4-N	Error Card	
SHIELD	Shield for Index Marks	J3-C	Clock Card	
SHIELD	Shield for PICK	J5-C	Sync Card	
SHIELD	Shield for Timing Strobe	J3-R	Reluctance Pickup	
SHUTDOWN STATUS	Mode Switch Input	S1-C	Error Card	
STACK	Stack Sensor Input	J4-C	Error Card	
STACK CHECK	Output Stacker Check	B5-8	Error Card	
STACK Vec	Stack Sensor +5 volts	J4-2	Error Card	
STøB	Column Strobe Phase B	MB-4	Sync Card	
STÓC	Column Strobe Phase C	MB-V	Sync Card	
STÓD	Column Strobe Phase D	MB-7	Sync Card	
STOP	Stop	MB-E	Error Card	
STOP DR	Stop Lamp Driver	J4-S	Error Card	
STOP SW	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	D9-9	Clock Card	
TST2	Timing Strobe Two	C8-9	Clock Card	
TSTR + POR	Timing Strobe Reset	MB- M	Clock Card	
Vcc	+5V to Read Sensor Array	J8-12	Control Card	
ZERO	Preset Decode	MB-N	Sync Card	

SECTION 12 ILLUSTRATED PARTS BREAKDOWN

(RECOMMENDED SPARES ONLY)

M300/600/1000

The figures contained herein call out only the recommended spares and show their location in the specified reader. The numbered callouts for each figure are listed together with the corresponding eight-digit part number and item description. For all other parts not in the recommended spares list, contact Spares Department.

NOTE

When ordering any part, spared item or otherwise, be sure to include the model and serial number (or numbers) of the reader (or readers) for which the part is to be used. This precaution will avoid the possibility of ordering a standard item instead of a customer specified item.

P.O. Box 1240
Melbourne, Florida 32901

Telephone: (305)-724-1111 TWX: 510-959-6286

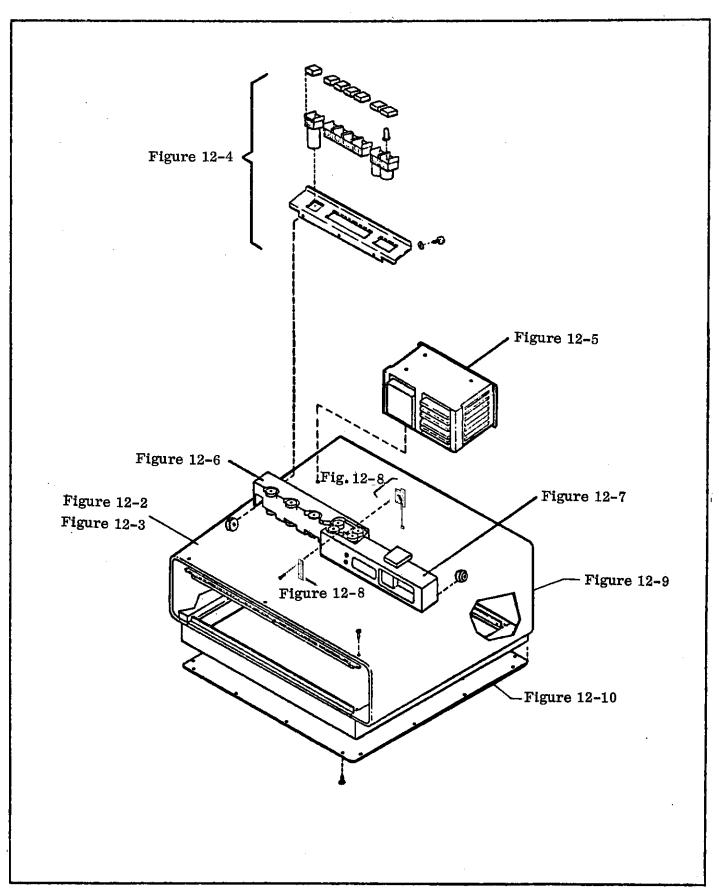


Figure 12-1. Figure Reference

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
12-1		FIGURE REFERENCE	
12-2 12-3 12-4 12-5 12-6 12-7 12-8 12-9 12-10		Main Frame Assembly, Bottom View Main Frame Assembly, Top View Control Panel Assembly Card File Assembly Stack Support Assembly Pick Support Assembly Read/Light Station Rear Panel Assembly Base Plate Assembly Accessories (Not Illustrated)	

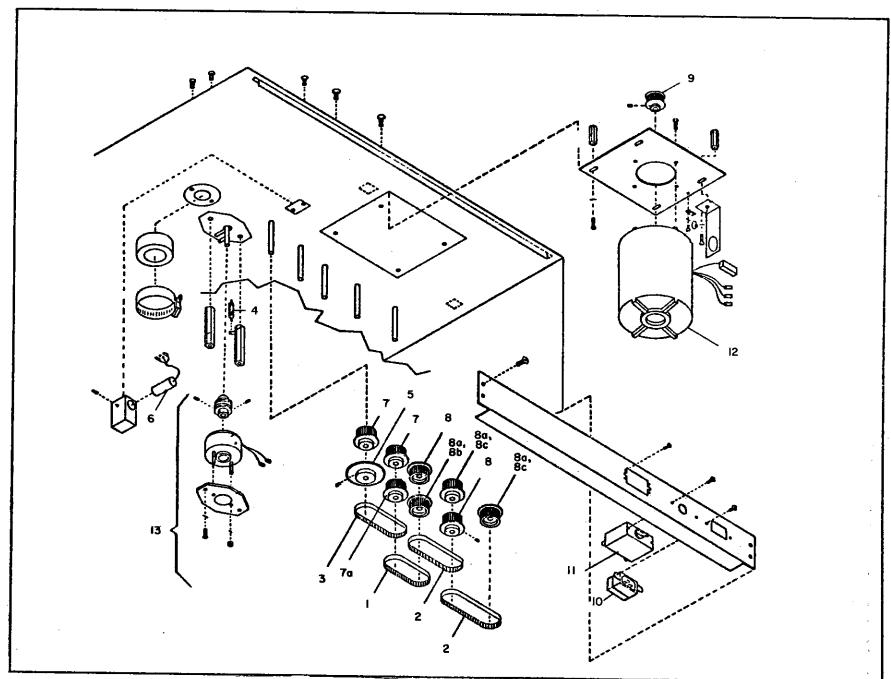


Figure 12-2. Main Frame Assembly, Bottom View

00000280 00000281 00000283 00000285 20125801 20016101 20127003 20127004 00000273 20080404 20080401 00000274 00000274 00000275 20127008 20127007 20127006 20127009	MAIN FRAME ASSEMBLY, BOTTOM VIEW BELT, Timing, NPRN Drive BELT, Timing, NPRN Drive BELT, Timing, NPRN Drive SPRING, Solenoid DISC ASSEMBLY, Timing PICKUP ASSEMBLY, Magnetic PULLEY, Drive, 14 Grv, Metal, (50/60 Hz) - (50 Hz, M10) PULLEY, Drive, 15 Grv, Metal (60 Hz, M10) PULLEY, Drive, 14 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Metal (60 Hz) PULLEY, Timing, 15 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz) PULLEY, Timing, 18 Grv, Metal (50 Hz)	1 2 1 1 1 2 2 1 2 2 3 1 2 1 1 2
00000281 00000283 00000285 20125801 20016101 20127003 20127004 00000273 20080404 20080401 00000274 00000274 00000275 20127008 20127006 20127009	BELT, Timing, NPRN Drive BELT, Timing, NPRN Drive SPRING, Solenoid DISC ASSEMBLY, Timing PICKUP ASSEMBLY, Magnetic PULLEY, Drive, 14 Grv, Metal, (50/60 Hz) - (50 Hz, M10) PULLEY, Drive, 15 Grv, Metal (60 Hz, M10) PULLEY, Drive, 14 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	2 1 1 1 2 2 1 2 2 3 1 2 1 1 1
00000283 00000285 20125801 20016101 20127003 20127004 0000273 20080404 20080401 00000274 00000274 00000275 20127008 20127006 20127009	BELT, Timing, NPRN Drive BELT, Timing, NPRN Drive SPRING, Solenoid DISC ASSEMBLY, Timing PICKUP ASSEMBLY, Magnetic PULLEY, Drive, 14 Grv, Metal, (50/60 Hz) - (50 Hz, M10) PULLEY, Drive, 15 Grv, Metal (60 Hz, M10) PULLEY, Drive, 14 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	2 1 1 1 2 2 1 2 2 3 1 2 1 1 1
00000285 20125801 20016101 20127003 20127004 00000273 20080404 20080401 00000274 00000274 00000275 20127008 20127007 20127006 20127009	BELT, Timing, NPRN Drive SPRING, Solenoid DISC ASSEMBLY, Timing PICKUP ASSEMBLY, Magnetic PULLEY, Drive, 14 Grv, Metal, (50/60 Hz) - (50 Hz, M10) PULLEY, Drive, 15 Grv, Metal (60 Hz, M10) PULLEY, Drive, 14 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	1 1 1 2 2 1 2 2 3 1 2 1 2 1
20125801 20016101 20127003 20127004 00000273 20080404 20080401 00000274 00000274 00000275 20127008 20127007 20127006 20127009	SPRING, Solenoid DISC ASSEMBLY, Timing PICKUP ASSEMBLY, Magnetic PULLEY, Drive, 14 Grv, Metal, (50/60 Hz) - (50 Hz, M10) PULLEY, Drive, 15 Grv, Metal (60 Hz, M10) PULLEY, Drive, 14 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	1 1 1 2 2 1 2 2 3 1 2 1 2 1
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20080401 00000274 00000275 20127008 20127007 20127006 20127009	PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 15 Grv, Nylon PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	2 3 1 2 1 1
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00000274 00000275 20127008 20127007 20127006 20127009	PULLEY, Drive, 15 Grv, Nylon (M10) PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	1 2 1 1
00000275 20127008 20127007 20127006 20127009	PULLEY, Drive, 16 Grv, Nylon (M10) PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	2 1 1 1
20127008 20127007 20127006 20127009	PULLEY, Timing, 15 Grv, Metal (60 Hz) PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	1 1 1
20127007 20127006 20127009	PULLEY, Timing, 14 Grv, Metal (60 Hz, M10) PULLEY, Timing, 18 Grv, Metal (50 Hz)	1 1
20127006 20127009	PULLEY, Timing, 18 Grv, Metal (50 Hz)	1
20127009		1
90109609 L	PULLEY, Timing, 16 Grv, Metal (50 Hz, M10)	1
20102602 00000188	FILTER, Receptacle, 230V	1
00000185	CIRCUIT BREAKER, 8A, 115V/60 Hz CIRCUIT BREAKER, 6A, 230V/50 Hz	1
00001104	MOTOR SPECIAL ASSEMBLY Drive CONT. (2011)	1
00001104	MOTOR SPECIAL ASSEMBLY, Drive, 230V/50 Hz (M10) MOTOR SPECIAL ASSEMBLY, Drive, 115V/60 Hz (M10)	1
00001100	MOTOR ASSEMBLY Drive, 115 / 60 Hz (M10)	1
t e	SOLENOID ASSEMBLY	1
10010501		1
		-
	20022501	20022501 SOLENOID ASSEMBLY

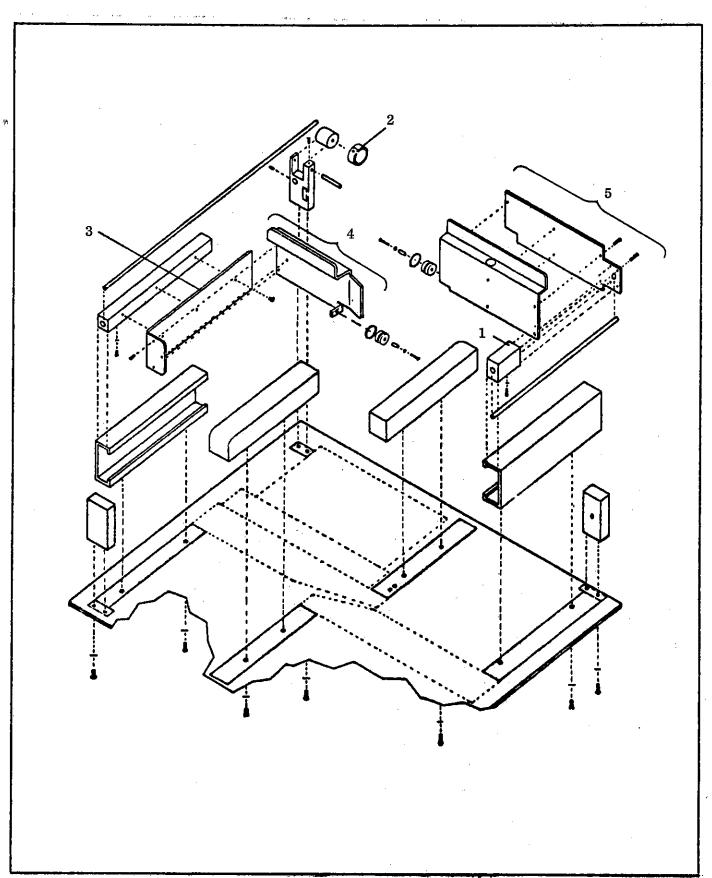


Figure 12-3. Main Frame Assembly, Top View

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	
12-3		MAIN FRAME ASSEMBLY, TOP VIEW		_
-1	00000900	SUPPORT ASSEMBLY, Picker Follower w/Bushings	1	
-2 -3	00000306	SPRING, Negator	1	
-4	40104303 30104401	CARD BUMPER ASSEMBLY	1	
-5	40104301	PICK FOLLOWER ASSEMBLY STACK FOLLOWER ASSEMBLY	1	
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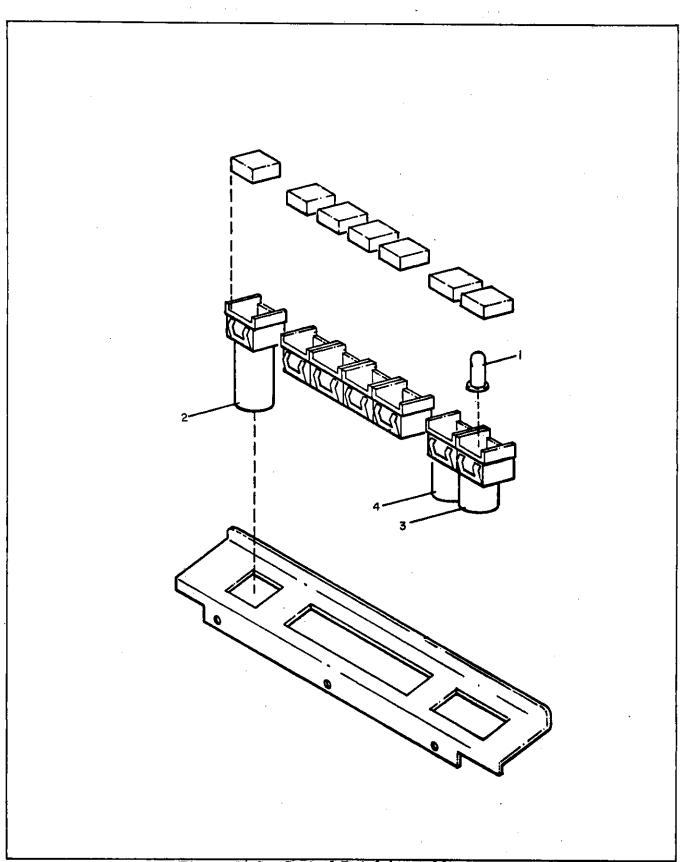


Figure 12-4 Control Panel Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION		UNITS PER ASSY
12-4		CONTROL PANEL ASSEMBLY		
-1 -2 -3 -4	00000318 00000319 00000320 00000321	LAMP, Incand., 6V, .20A, T- 1 3/4 SWITCH, PB SPDT, Altn Action (Power) SWITCH, PB SPDT, Mom Snap Action (Reset) SWITCH, PB SPDT, N.O. Mom Non-Snap (Stop)		7 1 1
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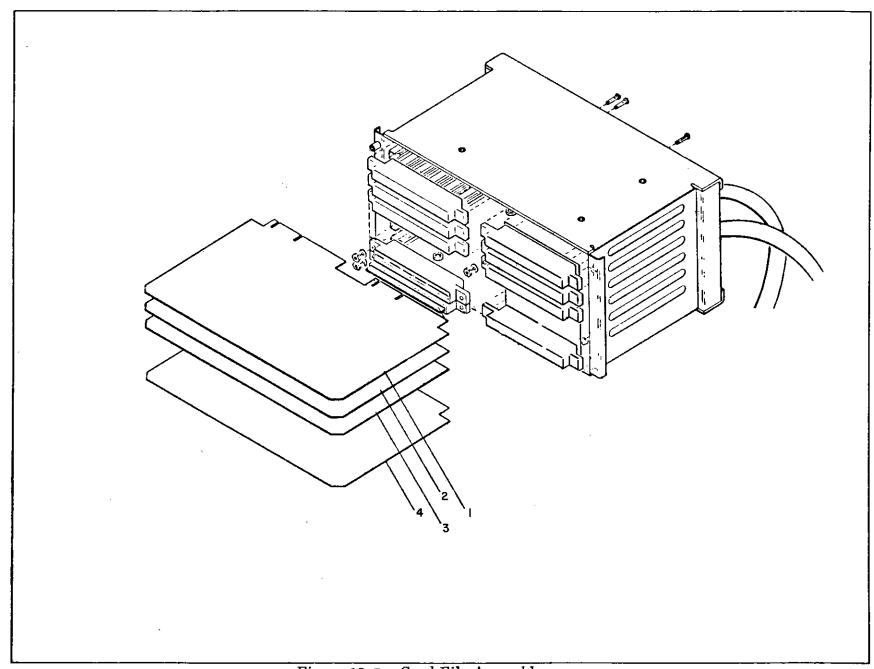


Figure 12-5. Card File Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION		UNITS PER ASSY
12-5		CARD FILE ASSEMBLY	OUTPUT INTERFACE DEFINITIONS PT - Positive True	
±2-0		CHILD FILE ASSEMBLE	GTOC - Ground True Open Collector PTRP - Positive True Resistive Pull-Up	
-1	400765XX	P.C. ASSEMBLY, Clock Card	GTRP - Ground True Resistive Pull-Up PTOC - Positive True Open Collector	1
_	-01	M200, M600, M1000, M1200	PT	*
	-02	M200, M600, M1000, M1200	GTOC	1
	-03	M200, M600, M1000, M1200	GTRP	
	-04	M300	GTRP	ŀ
	-05	M200, M600, M1000, M1200	PTRP	
	-07	M300	PT	Ĭ
	-08	M300	GTOC	
	-09	M300	PTRP	İ
	-10	M300	PTOC	
	-11	M200, M600, M1000, M1200	PTOC	
-2	400610XX	P.C. ASSEMBLY, Error Card		2
	-01	M200, M600, M1000, M1200	PT	
	-02	M200, M600, M1000, M1200	GTOC	
	-03	M200, M600, M1000, M1200	PTRP	
	-04	M300	PT	
	-05	M300	GTOC	
	-06	M300	PTRP	
	-07	M200, M600, M1000, M1200	GTRP	
	-08	M300	GTRP	
	-10	M300	PTOC	ļ
	-11	M200, M600, M1000, M1200	PTOC	}
	00000082	SWITCH PB, SPDT PC MOUNT		1
	00000083	SWITCH TOGGLE, SPDT		1
-3	400353XX	P.C. ASSEMBLY, Sync Card		1
	-01	M300, M600	All	1
	-02	M1200	All	
	-03	M200	All	
	-05	M1000	All	
-4	400619XX	P.C. ASSEMBLY, Control Card		1
	-01	M200, M600, M1000, M1200	PT	
	-02	M200, M600, M1000, M1200	GTOC	
	-03	M300	PT	
	-04	M300	GTOC	
	-05	M200, M600, M1000, M1200	PTRP	
	-06	M300	PTRP	
	-07	M200, M600, M1000, M1200	GTRP	
	-08	M300	GTRP	
i	-09	M300	PTOC	
	-10	M200, M600, M1000, M1200	PTOC	

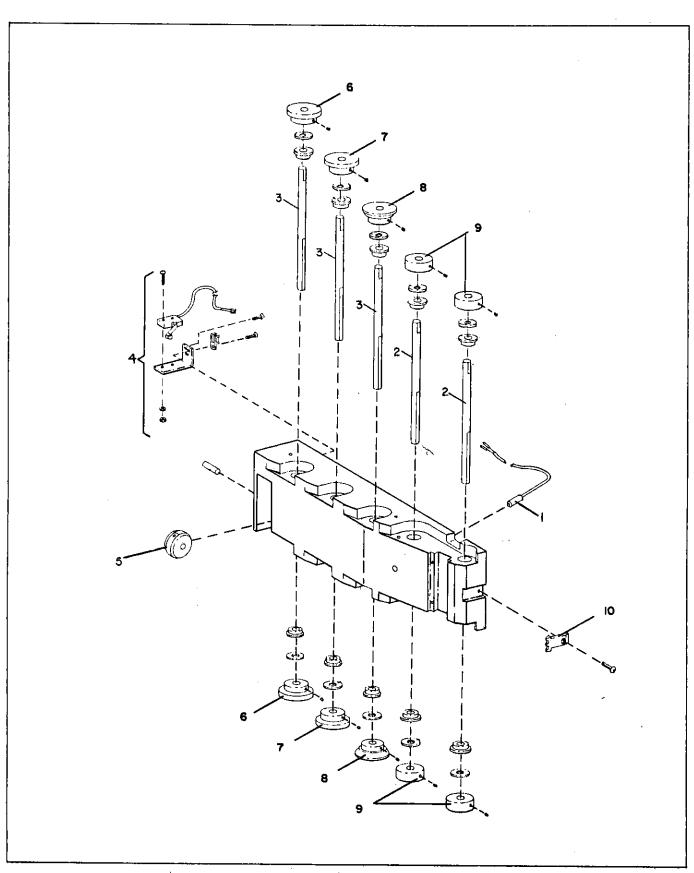


Figure 12-6. Stack Support Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
12-6		STACK SUPPORT ASSEMBLY	
-1 -2 -3 -4 -5 -6 -7 -8 -9 -10	20038201 00000871 00000872 20021101 00000499 20001505 20001504 20001506 20002101 10075801	PHOTOCELL ASSEMBLY, Stack SHAFT ASSEMBLY, 4th, 5th Stack Roller (Incl. Bearing) SHAFT ASSEMBLY, 1st, 2nd, 3rdStack Roller (Incl. Bearing) SWITCH ASSEMBLY, Stacker Full SPRING, Negator ROLLER, Drive, 1st Stack ROLLER, Drive, 2nd Stack ROLLER, Drive, 3rd Stack ROLLER, Drive, 4th & 5th Stack THROAT, Block	1 2 4 1 1 2 2 2 4 1
		·	

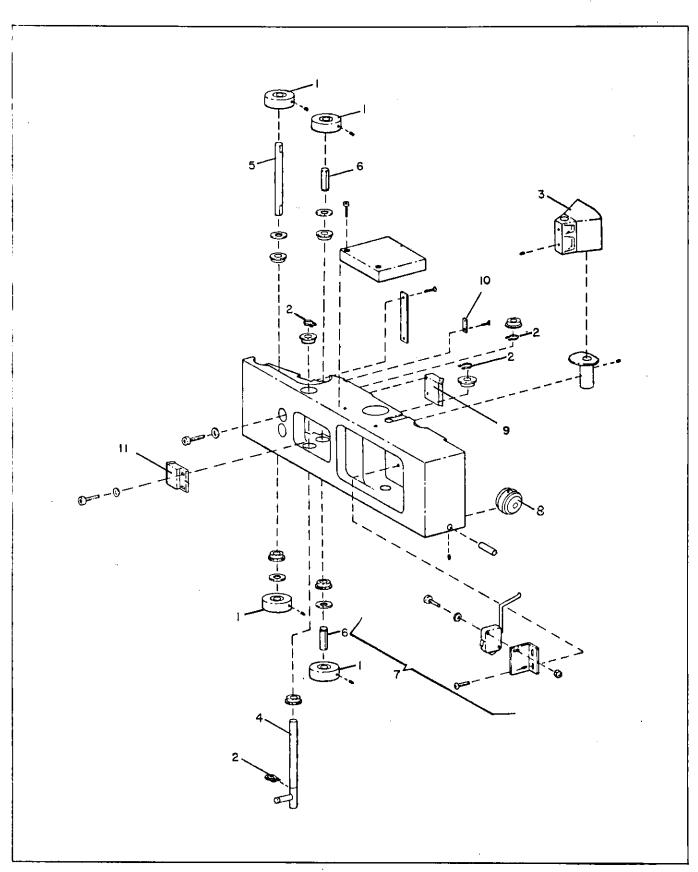


Figure 12-7. Pick Support Assembly

NO. NUMBER	PER ASSY
12-7 PICK SUPPORT ASSEMBLY	
-1 20005901 -2 00000467 -3 30003702 -4 00002513 -5 00001513 -6 00001514 -7 20027701 -8 00000306 -9 10004701 -10 20072801 -11 10004101 -12 30023303	4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

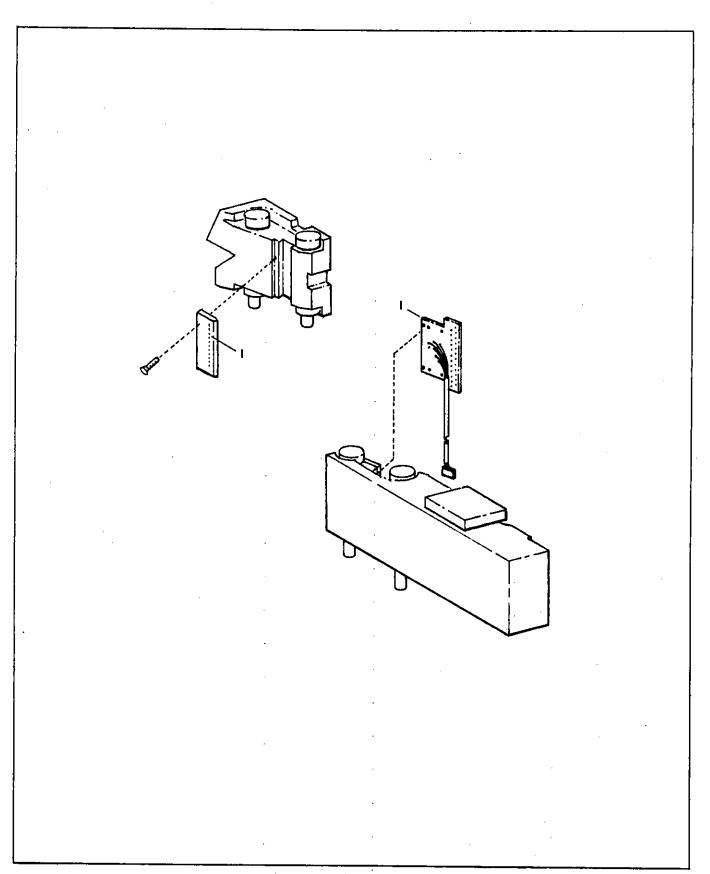


Figure 12-8. Read/Light Station Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
12-8		READ/LIGHT STATION ASSEMBLY	
-1	10158908	READ HEAD/LIGHT STATION (Matched Assembly)	1
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		,	

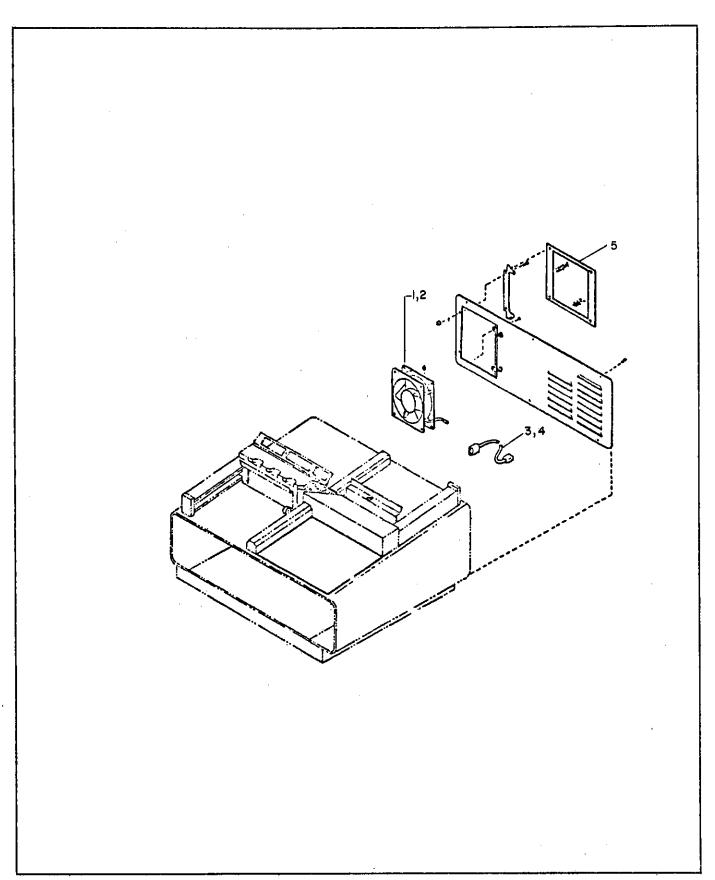


Figure 12-9. Rear Panel Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
12-9	·	REAR PANEL ASSEMBLY	
-1 -2 -3 -4 -5	20098302 00000325 20014801 00000456 30269001	FAN ASSEMBLY, 230V/50 Hz FAN, Cooling, 115V, 50/60 Hz POWER CORD ASSEMBLY, 9 Ft. (115V) POWER CORD ASSEMBLY, 9 Ft. (230V) GRILL, Fan, Metal Screen	1 1 1 1 1
		·	
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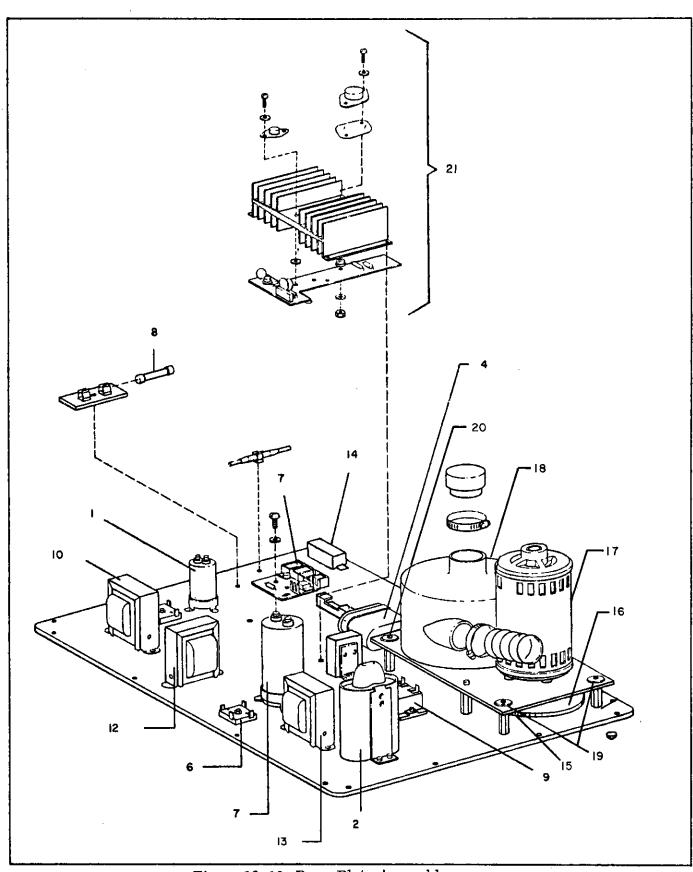


Figure 12-10. Base Plate Assembly

FIG. & INDEX NO.								
12-10		BASE PLATE ASSEMBLY Previous P	<u>/N</u>					
-1	00000200	CAPACITOR, Alum., 4600 μf, 15 VDCW	1					
-2	00002051	CAPACITOR, 10 µf, 230 V/50 Hz 0000088	0 1					
	00002049	CAPACITOR, 17.5 μ f, 115V/60 Hz 0000020	$2 \mid 1$					
	00002052	CAPACITOR, 25μf, 100V, 50/60 Hz	1					
-4	00001566	CAPACITOR, $3\mu f$, $115V/60 \text{ Hz}$ (100V/60 Hz) 0000020						
	00002050	CAPACITOR, $4\mu f$, 230V/50 Hz (100V/50 Hz) 0000020	4					
	00001743	CAPACITOR, 6μf, 115V/60 Hz (M10) 0000028						
	00002051	CAPACITOR, 10 μf, 230V/50 Hz (M10) 0000088	I					
-6 -	00000143	DIODE BRIDGE, 100V	2					
-7	30010001	DRIVER ASSEMBLY, Solenoid	1					
0	30010002	DRIVER ASSEMBLY, Solenoid (M10) FUSE, 1A, Slo-Blo	1					
-8	00000147 00000874		1					
-9	00000874	FUSE, 1.5A, Slo-Blo (M10) RELAY, AC, 25A, 120-240 VAC, 50/60 Hz	1					
-9 -10	20015601	TRANSFORMER ASSEMBLY, 12V-115V	1 1					
-10	20013001	TRANSFORMER ASSEMBLY, 12V-230V	1					
-12	20015501	TRANSFORMER ASSEMBLY, 24V-115V	1					
1.2	20074001	TRANSFORMER ASSEMBLY, 24V-230V	1 1					
-12,13	30030301	TRANSFORMER ASSEMBLY, 48V-115V (M10)	1					
,_	30074101	TRANSFORMER ASSEMBLY, 48V-230V (M10)	1					
*	00000134	TRANSFORMER, 50/60 Hz, 115/230V	1					
-14	00000311	FILTER, RFI, 50-400 Hz, 10A, 115/230 VAC	l ī					
-15	00000519	BELT, Timing, Peu-Blower, 60 Hz	1					
	00000520	BELT, Timing, Peu-Blower, 50 Hz	l ī					
-16	20076101	PULLEY ASSEMBLY, Blower Drive, 60 Hz	1					
	20076102	PULLEY ASSEMBLY, Blower Drive, 50 Hz	1					
-17	00001091	MOTOR ASSEMBLY, Blower, 2850 RPM, 230V/50 Hz	1					
	00001092	MOTOR ASSEMBLY, Blower, 2850 RPM, 115V/50 Hz	1					
	00001093	MOTOR ASSEMBLY, Blower, 3350 RPM, 115V/60 Hz	1					
	10095405	MOTOR, Blower, 100V, 50/60 Hz	1					
-1 8	00000541	BLOWER, Windjammer	1					
,	00002571	COVER, Blower	1					
-19	00000291	MOUNT, Shock, Rubber	2					
-20	00000505	MOUNT, Shock, Rubber	2					
-21	30029505	POWER SUPPLY ASSEMBLY, 5V	1					
		*Transformer only for Items 10, 12, 13						
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ACCESSORIES - Not Illustrated	UNITS PER ASSY
00000033	
00000033	1
00000029	4
00000028	1 4
00000523	1
00000510	100
00000516	100
00000036	100
00000034	100
00000508 LUBRICANT, No. 2 P.C. BOARD ASSEMBLY, Extender Card 00000663 SEALANT, Grade C, 10cc, Blu SPACER, Shaft, .004 SPACER, Shaft, .006 SPACER, Shaft, .016 TIE, Cable 0000090 TIE, Cable TOOL KIT AMP EXTRACT CONTACT EXTRACT CONTACT INSERT/EXTRACT ELCO EXTRACT RETAINING RING REMOVER MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT HOSE, Blue, 1 3/4 Inch, 4 Ft HOSE, Clear, 3/4 Inch, 3 Ft MATING CONNECTOR KIT, 56 Pins	100
No. 10000663 SEALANT, Grade C, 10cc, Blu	100
00000663	1
00000431	1
00000432	1
00000433 00000058 TIE, Cable 00000090 TIE, Cable TOOL KIT AMP EXTRACT CONTACT EXTRACT, Leaf CONTACT INSERT/EXTRACT ELCO EXTRACT RETAINING RING REMOVER MOD. FORK CONTACT EXTRACT MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) 100001178 HARDWARE KIT 100003256 10420201 MATING CONNECTOR KIT, 56 Pins	4
O0000058	4
00000900 TIE, Cable 100002301 TOOL KIT AMP EXTRACT CONTACT EXTRACT, Leaf CONTACT INSERT/EXTRACT ELCO EXTRACT RETAINING RING REMOVER MOD. FORK CONTACT EXTRACT MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	6
TOOL KIT AMP EXTRACT CONTACT EXTRACT, Leaf CONTACT INSERT/EXTRACT ELCO EXTRACT RETAINING RING REMOVER MOD. FORK CONTACT EXTRACT MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT 00003256 00003255 HOSE, Blue, 1 3/4 Inch, 4 Ft HOSE, Clear, 3/4 Inch, 3 Ft MATING CONNECTOR KIT, 56 Pins	40
AMP EXTRACT CONTACT EXTRACT, Leaf CONTACT INSERT/EXTRACT ELCO EXTRACT RETAINING RING REMOVER MOD. FORK CONTACT EXTRACT MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT HOSE, Blue, 1 3/4 Inch, 4 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	_10
CONTACT EXTRACT, Leaf CONTACT INSERT/EXTRACT ELCO EXTRACT RETAINING RING REMOVER MOD. FORK CONTACT EXTRACT MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft HOSE, Clear, 3/4 Inch, 3 Ft MATING CONNECTOR KIT, 56 Pins	1
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MOD. IV CONTACT EXTRACT GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft HOSE, Clear, 3/4 Inch, 3 Ft MATING CONNECTOR KIT, 56 Pins	1
GAUGE, Punch GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft 00003255 HOSE, Clear, 3/4 Inch, 3 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	-
GAUGE, Card HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) 00001178 HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	
HEXDRIVER SET (Inch) HEXDRIVER SET (Metric) 00001178 HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft 00003255 HOSE, Clear, 3/4 Inch, 3 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	1
HEXDRIVER SET (Metric) 00001178 HARDWARE KIT 00003256 HOSE, Blue, 1 3/4 Inch, 4 Ft 00003255 HOSE, Clear, 3/4 Inch, 3 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	ŀ
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00003255 HOSE, Clear, 3/4 Inch, 3 Ft 10420201 MATING CONNECTOR KIT, 56 Pins	1 1
10420201 MATING CONNECTOR KIT, 56 Pins	1
	1
I AAAAAAA I BAAWAAY AYAANDAWAD IZIN 90 Diga '	1
10139401 MATING CONNECTOR KIT, 38 Pins	1
00004104 PAINT TOUCH-UP KIT, Black	1
00004103 PAINT TOUCH-UP KIT, White	1

Dual Data Channel Card Reader Programmers Reference Manual

1.0 Introduction

Card readers provide data input from standard 12-row, 80 column cards at rates ranging from 200 to 1200 cards per minute (CPM). The dual data channel card reader controller is designed to operate with the Documation M-series card readers, with negative true interfaces. Table 1 lists the specifications of the various Documation card readers.

Model	'Transfer Rate	Cycle Time	Interchar- acter Time	Last column to EOC
M2ØØ	200CPM	311MS	2020US	7384US
 M300	3ØØCPM	195MS	864US	10,780US
1 M6ØØ	600CPM	 100MS	864US	3185US
M1000	1000CPM	60MS	 496US	1813US
 M1200 	 1200CPM 	i 5øms 	 4ø8US 	1 148ØUS

TABLE 1: Card Reader Specifications

The card reader is comprised of a card supply hopper, a read station, and a card stacker. A card is selected from the hopper by a mechanical pick, and is moved into the read station. Here it is read, one column at a time. Once the card has been read, it is stored in the card stacker, before being removed.

Two card readers may be connected to a single controller through 50 conductor ribbon cables, which may be up to 100ft long. The cables connect to the EMI hardened 50 pin, back plane adapter cable and connectors. Each controller has two connectors, labled J1 and J2. The card reader cables are also labled J1 and J2. THE CABLES CAN NOT BE INTERCHANED. J1 connects to cardreader 1 and J2 connects to card reader 2. The dual channel DMA controller is constructed on a Data General compatable MDB model 4190 General Purpose I/O board. Each channel on the controller is totally independent of the other. The controler characteristics are summarized in Table 2.

2.0 INSTRUCTIONS

Each card reader is driven by a DMA controller which contains a 12-bit Data Channel Data Register, a Word Count register, an Address Counter, and a 7-bit Status Register.

Three I/O instructions are used to program each card reader; the frist sets the address counter to the first address of the buffer that data will be transfered to, the second is used to set the number of words in

MNEMONIC (FIRST CHANNEL)									
DMA DATA TRANSFER FORMAT									
STATUS FORMAT (DIA)									
SIAIOS FORMAI (DIA)									
 DOBAddress Counter									
DOC									
(2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2									
DIBRead Address Counter									
CONTROL FUNCTIONS									
Set the Busy flag to 1, the Done flag to 0, and pick the next card.									
C Set both the Busy and Done flags to 0, and clear the Data Channel Overrun and Short Card status flags.									
P Not used.									

TABLE 2: Programming Summary

The card reader controller's Busy and Done flags are set according to the three device flag commands as follows:

- f=S Set the Busy flag to 1, the Done flag to 0, bring a card from the hopper into the read station, and start the DMA transfer of one card.
- f=C Set both the Busy and Done flags to 0, terminate any DMA transfer in progress, and clear the Short Card and Data Overrun status flags. If a card is in the reader, it will continue to move through the reader, but no data will be transfered and no interrupts will be generated.
- f=P No response.

2.1 READ STATUS DIA <f> ac,CDR

Ø	1	1	A	3	Ø	Ø	1	, I	?	Ø	Ø	1	1	1	Ø	•
										 -					11	
Ø	1	2	3	4	5	6	7	8	9	1Ø	11	12	13	14	15	

The contents of the controller's Status Register are loaded into bits 9 – 15 of the specified accumulator. Bits \emptyset – 8 are set to zero. After the transfer, the controller's Busy and Done flags are set according to the function specified by F. Status bits 9 and 10 are reset only by the clear function or by an I/O reset. The format of the status word is defined in Table 2.

2.1.1 RDR BSY --- Reader Busy

Indicates that a card is currently passing through the reader. Note that this status bit is independent of the controller's Busy/Done flags. Since a normal DMA transfer is complete before the card exits the read station, this status signal will usually be set during the servicing routine for the interrupt. It is permissable to set busy to read the next card while the RDR BSY status bit is set. The status is automatically reset when a card is not in the read station. The RDR BSY latency time, after the last column is read is given in Table 1.

2.1.2 RDY -- Ready

The card reader is turned on, loaded with cards, and ready to accept a card from the input hopper. The ready status does not generate an interrupt or stop a DMA transfer if lost. If the only fault is that the "RESET" button has not been pressed, the controller will wait indefinitely. Data transfer will begin when the card reader is started.

2.1.3 ERR -- Error

Indicates that a card is damaged, jammed in the reader, or that the reader has an electronics problem. This signal corresponds to the "READ CHECK" indicator on the card reader. If an Error occurs, Done is set and the DMA transfer is terminated. Operator intervention is equired to clear the damaged card out of the reader.

2.1.4 PICK FAIL -- Pick Fail

This signal is a composite of the PICK CHECK and the STACK CHECK alarms. The status signal indicates that an unsuccessful pick attempt occured. Operator intervention is needed to clear the card reader. When the signal occurs, the controller will pause and wait for the error condition to be cleared. No program intervention is required, except that the status word should be checked and the operator notified.

2.1.5 HE / SF -- Hopper Empty / Stacker Full

Shows that the input hopper has run out of cards or that the output stacker is full. When this condition occurs, the controller will wait for the error condition to be cleared, and no program intervention is required, except that the status word should be tested and the operator notified to clear the reader.

2.1.6 DCH OVR -- Data Channel Overrun

Indicates that the last character was not transfered to the computer's memory before the next character was received from the card reader. This is a fatal error which sets Done and terminates the DMA transfer. The status flag will remain set until an I/O instruction to the card reader is executed which uses the "C" function or an I/O reset occurs. The controller can not be restarted until this is done.

2.1.7 SHT CRD -- Short Card

If the card reader busy signal goes false before the word count reaches 0, the Done flag is set and the Short Card status bit is set. Assuming that the word count is set for 80 column cards, this condition would only occur is the reader detected a card with less than 80 columns or if a malfunction occured. The DMA transfer terminates when the status bit is set, but all data in the buffer is valid to that point. The address counter register can be read to determine the number of characters read. The status bit will remain set until an I/O instruction using a "C" function is executed or an I/O reset occurs.

2.2 Read Address Register -- DIB<f> ac,CDR

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	 	·	 		 	 	 	 	 	ĺ
		3								

The contents of the controller's DMA address register are loaded into the specified accumulator. The address register may be read anytime before, during, or after a DMA transfer.

2.3 Read Word Counter -- DIC<f> ac,CDR

This instruction does not exist for the dual data channel card reader controller. The contents of the word counter can be calculated from reading the address counter

- 2.4 DOA -- This I/O instruction is not used.
- 2.5 Load Address Counter -- DOB<f> ac,CDR

The Address Counter is located on the I/O controller and contains the 15-bit address of the memory location to be accessed during a particular data channel transfer. The register is automatically incremented after each transfer.

2.6 Load Word Counter -- DOC<f> ac,CDR

ΤØ	1	1	AC		1	1	Ø	1	Ē.	Ø	Ø	1	1	1	Ø	•
i	1		 							 						
Ō	ì	2	3	4	5	6	7	8	9	1Ø	11	12	13	14	15	

The word count register contains the 2's complement of the number of words to be transferred in a block transfer. The register is automatically incremented after each DMA transfer. Under normal operating conditions, the word counter is loaded with the 2's complement of 80, which is 177660 in octal. This represents the number of columns on the card. The MAXIMUM ALLOWABLE WORD COUNT SIZE IS 256.

3.Ø PROGRAMMING

When either card reader is on-line, and ready to transmit data, the program must first set up the word count and address registers and then the status should be tested to verify no error conditions exist. A start command sets the Busy flag to 1, the Done flag to 0, and gives a command to pick a card from the hopper. The pick command is removed after the first character is received, to prevent erroneously reading extra cards and to allow easy detection of a short card. The Busy flag remains set until either the word count reaches 0 or a malfunction occurs. At the conclusion of a complete card transfer, the Done flag is set, generating an interrupt, if not masked. The Done flag will also be set by the occurance of any errors indicated by status bits 9, or 10.

Bits 11, 12, and 13 are cleared by correcting the indicated problem on the card reader. The controller will automatically begin reading cards when the error is corrected, if BUSY has been set. Bits 9 and 10 indicate controller related problems, and will only be reset by issuing an I/O instruction using the "C" function.

It should be noted that the "READY" status bit does not set the Done flag. If the only problem with the card reader is that it is not on-line, the controller will wait for the reader to come ready. The program should check the status word before the first card is read, and inform the operator to press the "RESET" button on the card reader if it is not on-line.

When cards are read continously, the "READER BUSY" status bit will remain active. This condition is normal and the program may restart the controller while this status bit is still active. If the period between cards exceeds the interval indicated in Table 1, the "READER BUSY" status bit will reset.

The controllers status register, word counter and address register may be read under program control without affecting any transfer in progress. Between each card, the status word should be checked to verify an error has not occured. When an error occurs, the data in the memory buffer may not be valid.

INSTALLATION INSTRUCTIONS DUAL CARD READER CONTROLLER

- 1. Before begining installation, verify that all components are present, as listed below:
 - 1. Dual Card Reader Controller Board
 - 2. Modified, EMI backplane adapter cable assembly
 - 3. Two 50ft. card reader cables labeled J1 and J2
 - 4. Backplane jumpers for data channel and interrupt priority patching across unused slots, as required.
- 2. Verify the device codes are set as required. If it is necessary to change the device codes, remove the cover from the controller board by removing the two plastic screws on the bottom. Detailed instructions for setting the device code are attached to the controller. Use caution when setting the switches. If possible, have a second person verify the settings. Device codes for the first controller board are 16 and 56. For the second controller board in the system, use device codes 26 and 46.
- 3. Bring the system down, shut the power off, and install the board. For best results, and to prevent possible data channel and interrupt priority and contention problems, the card reader controller should be installed in the next available slot above all other borads (furthest from the CPU and memory borads for vertically mounted chassis.) If necessary, reposition the the data channel and interrupt priority chaining jumpers on the backplane (pins A96-A95 and A94-A93.)
- 4. VERY CAREFULLY install the backplane adapter cable harness to the backplane of the computer. Note that one connector is marked "A SIDE" and the other "B SIDE". Also note that the computer backplane is divided into two parts, one labled "A" and the other "B". When installing the connectors, make sure they are alligned properly, and make sure that none of the backplane pins are being bent or folded over. THIS STEP SHOULD BE PERFORMED ONLY BY PERSONEL FAMILIAR WITH INSTALLING PERIPHERIAL EQUIPMENT IN DATA GENERAL COMPUTERS.
- 5. Mount the connectors Jl and J2 at any convient mounting location. After they are mounted, clearly label the connectors "J1, CR#1" and "J2, CR#2". The system can now be closed up and powered back up.
- 6. Attach the 50ft card reader cable connector labeled "J1" to J1, and the one labled "J2" to J2. WARNING, do not interchange cables J1 and J2 at the computer. Connect the other ends of the cables to cardreader #1 and #2. If necessary, it is OK to swap the connectors that attach to the card readers. It is OK to remove and reconnect these connectors with the power on.

Parts List

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Integrated Circuits
                               74LSØØ
                                      Quad 2-Input NAND Gate
   3F, 14B
   1F
                               7400
                                       Quad 2-Input NAND Gate
   5K, 9K
                               74LSØ2
                                       Quad 2-Input NOR Gate
   5L, 9L
                               74LSØ3
                                       Quad 2-Input OC NAND
   7D-14D
                               74Ø3
                                       Quad 2-Input OC NAND
   4H, 7F, 7H, 11F, 11H
                               74LSØ4
                                       Hex Inverter
   6L, 7N, 1ØL, 11N
                               74LSØ8
                                       Quad 2-Input AND Gate
                               74Ø8
                                       Quad 2-Input AND Gate
   11A
   13A
                               74LS1Ø
                                       Triple 3-Input NAND Gate
                               74LS2Ø
                                       Dual 4-Input NAND Gate
   4B, 14H
   3B, 5B
                               7425
                                       Gated 4-Input NOR Gate
                                       Quad 2-Input NAND Buffer
   13C
                               7437
   2F, 13H, 13J, 14F
                               7438
                                       Quad 2-Input OC NAND Gate
   2H, 3H, 3J, 6M, 7L, 7M
                               74LS74 Dual Type D Flip Flop
   10M, 11L, 11M, 13B, 14A, 14J
   5D-6D, 7E-14E, 3C-6C
                                       Data Register, Counter
                               74177
   7K, 11K
                               74LS368 / 366 Hex Tri-state Buffer
   6F, 6H, 6J, 10H, 10F, 10J
                               40106 / 4584 Hex Schmitt Trigger
   8F, 8H, 12F, 12H
                               74LS374 Octal, Tri-state D FF
Resistor Arrays
   9F, 5F, 6K, 1ØK
                               16-2-472 15, 4.7K DIP Resistors
Diode Arrays
   9J, 5J, 4F
                               1N4148
                                         8 ea, on DIP Plug
DIP Plugs
                               PGDP16P02 16 Pin DIP Header
IC Sockets
   14 Pin
                  70 ea.
                               AGT814AG11D Hi Reliability Socket
   16 Pin
                  9 ea.
                               AGT816AG11D "
   20 Pin
                  4 ea.
                               AGT820AG11D "
DIP Switches
   10 Position
                   2 ea.
    4 Position
                  l ea.
Resistors
    1.0K
                  3 ea.
                               1/4 watt, 5%
    3.ØK
                  14 ea.
                               1/4 watt, 5%
Capacitors
    100pf
                  3 ea.
                               50V, ceramic disc
    Ø.luf
                  lø ea.
                               50V, ceramic disc
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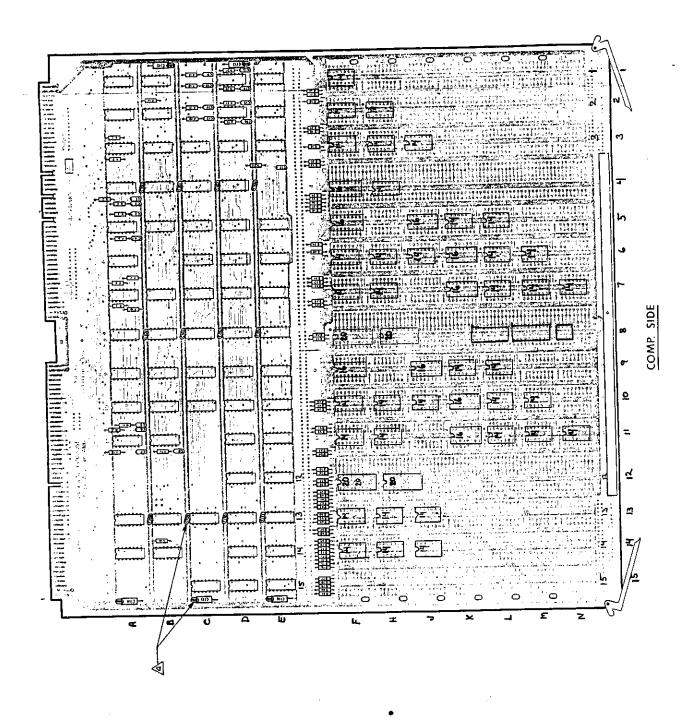
FABRICATION INSTRUCTIONS FOR THE MDB-4040 GPIB DUAL CARD READER CONTROLLER

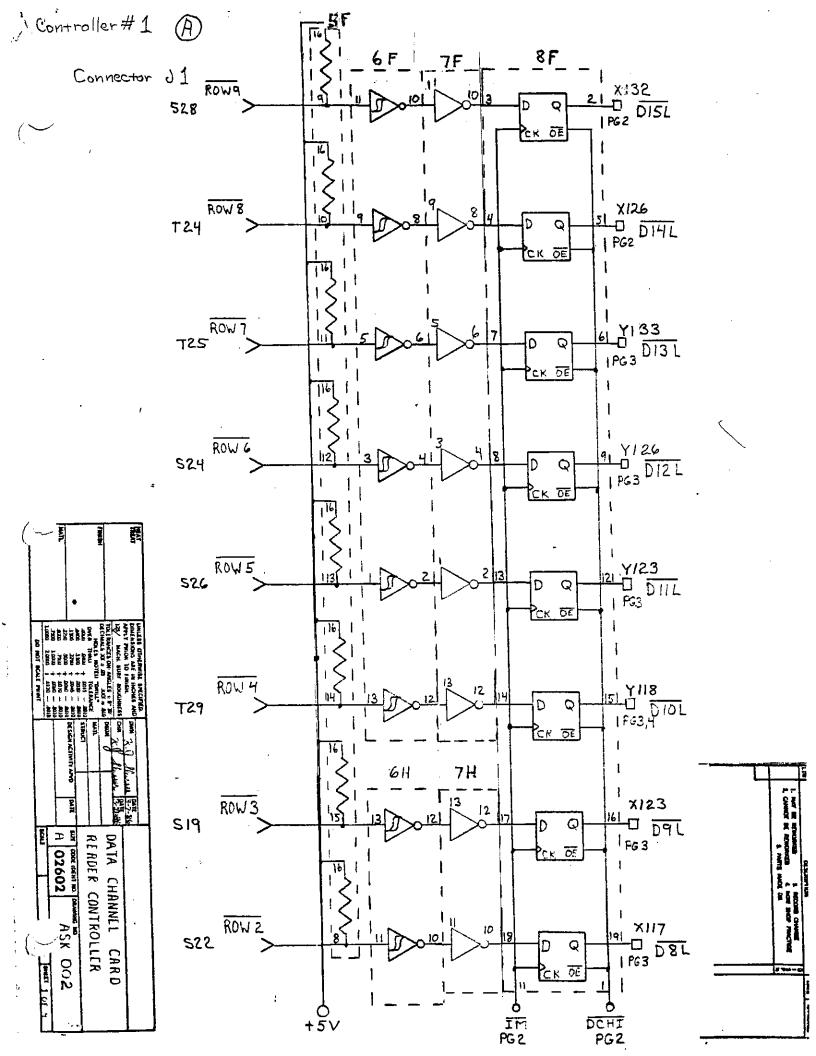
- Remove jumpers S-R, 1 and 2. (Refer to MDB schmatics, sheet 4 and component placement chart.)
- Install the following 3K ohm resistors: R16, R30, R32, R34, R36, R38, R39, R46, R49, R57, R61, R72, R78, R81
- 3. Install the following 1K ohm resistors: R6, R11, R12
- 4. Install the following 100pf capacitors: C4, C5, C6
- 5. Cut the trace between pins 6 & 7 on IC locations 11E, 12E, 13E, 14E, 3D, 4D, 5D, and 6D.
- 6. On the same IC locations, cut the trace between pin 8 and ground.

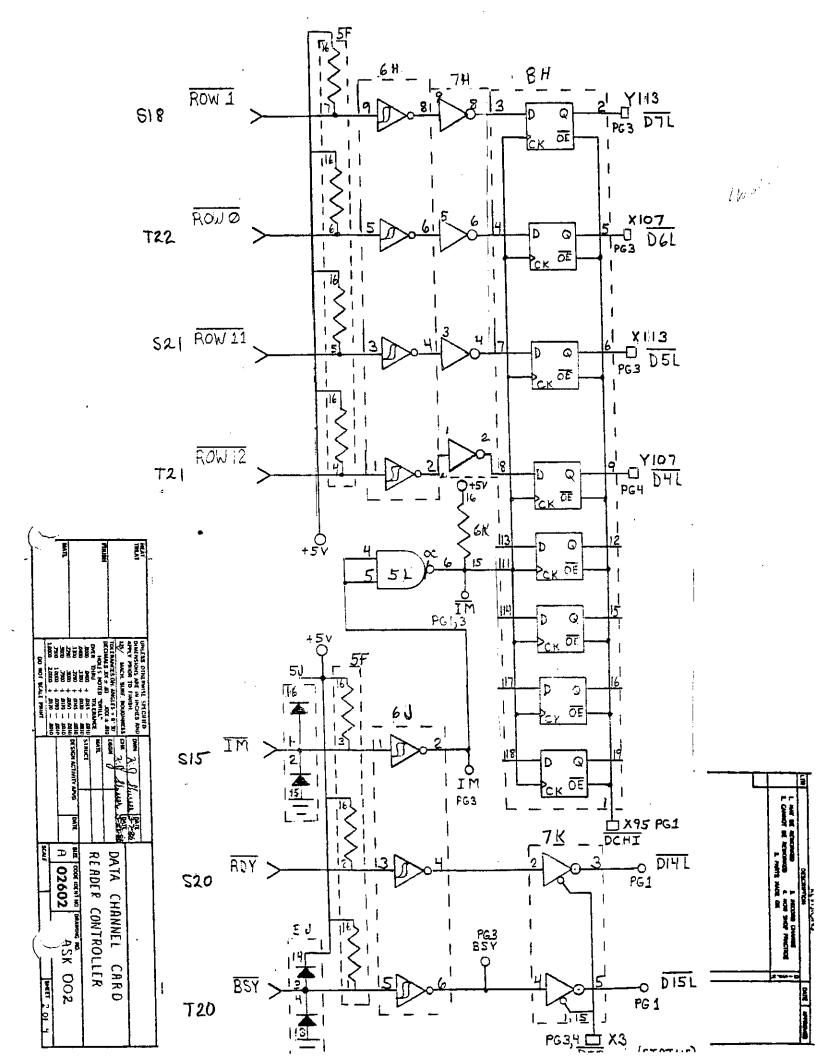
NOTE: The following two steps are best done by using 30ga wire wrap for the jumpers, installing the sockets into the same holes, and then soldering the socket and wires at the same time.

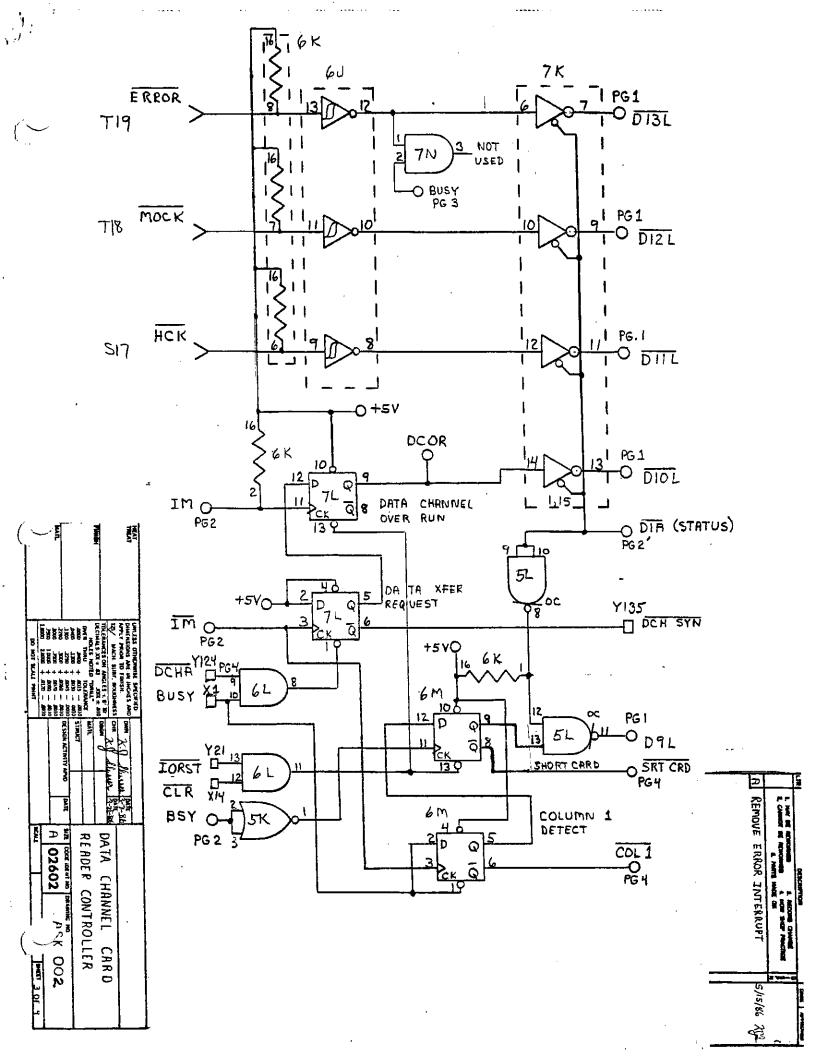
- 7. On the same IC locations as steps 5 and 6, install jumpers between pins 5 and 6.
- 8. Install jumpers as follows:
 - IC 14E, pin 12 to 13E, pin 8
 - IC 13E, pin 12 to 12E, pin 8
 - IC 12E, pin 12 to 11E, pin 8
 - IC 6D, pin 12 to 5D, pin 8
 - IC 5D, pin 12 to 4D, pin 8
 - IC 4D, pin 12 to 3D, pin 8
- 9. PLEASE NOTE: In the custom wire wrap area, on all socket locations, except columns 4, 8, and 12, pin 16 is etched to +5V and, pins 7 and 8 are shorted together and tied to ground. When installing 14 pin IC sockets, they must go into the upper 14 pins.
- a) For all 16 pin IC socket locations, the etch between pins 7 and 8 must be cut.
- b) For the 16 pin socket location 4F, the etch between pin 16 and 5V must be cut, as well as the two etchs between pin 8, pin 7, and GND.
- c) For the 16 pin IC socket locations 5F, 6K, 9F, and 10K, the two etchs between pin 7, pin 8 and ground must be cut.
- d) For the 14 pm IC Socket at location 4H, Tie Pin 7 to ground
- 10. For columns 4, 8, and 12, cut the 5V and Gnd etches at rows

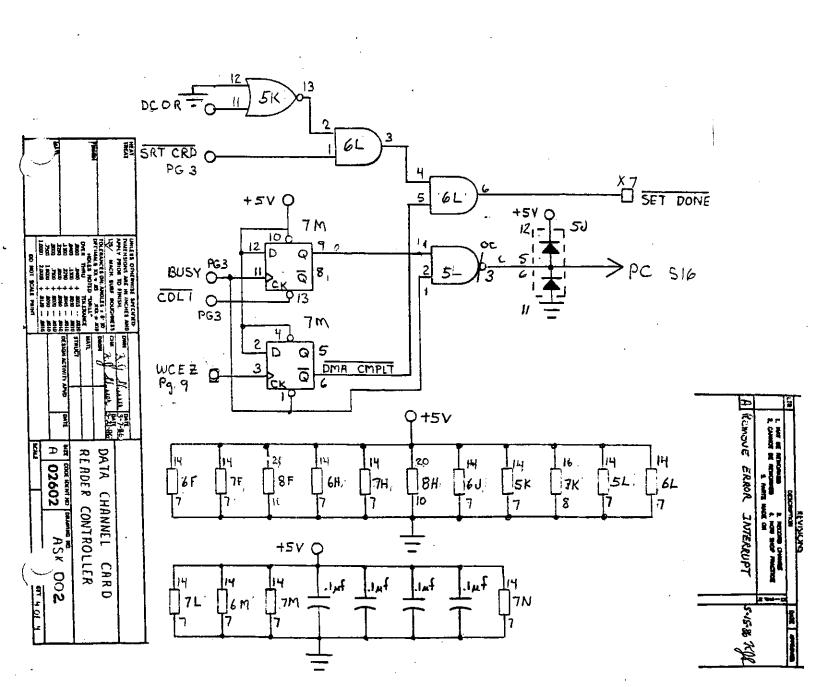
- F, H, and J. Also cut the traces where the DIP Switches are installed in column 8. After the sockets are installed, wire +5V and ground to the sockets in rows F and H. The DIP switches do not get power.
- 11. Install 20 pin IC sockets at locations 8F, 8H, 12F, and 12H
- 12. Install 16 pin IC sockets at locations 4F, 5F, 5J, 6K, 7K, 9F, 9J, 10K, and 11K.
- 13. On the standard, etched circuit portion of the board, install 14 pin IC sockets into all empty locations except 5E and 6E.
- 14. On the custom wire area, install 14 pin sockets as shown on the attached component layout sheet.
- 15. Install the two 10 position and one 4 position DIP switches as shown on the attached component layout sheet.
- 16. Install the Ø.luf power supply bypass capacitors at beneath the last socket in the following rows. (Note that 5V and GND are the first pair of holes beneath the sockets, between rows). 1, 2, 3, 5, 6, 9, 10, 13, 14, and 15.
- 17. Wire the circuit according to the attached schematics. Wire controller B first, then controller A, and, lastly, the logic on pages 9 12.

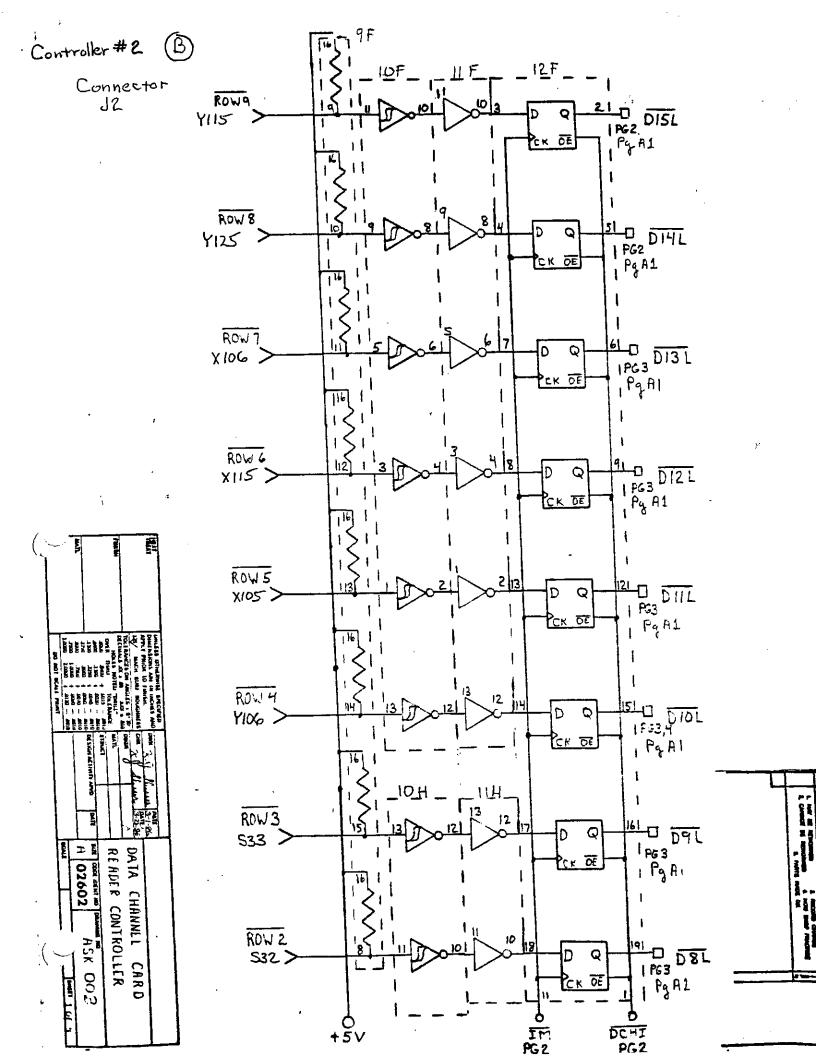


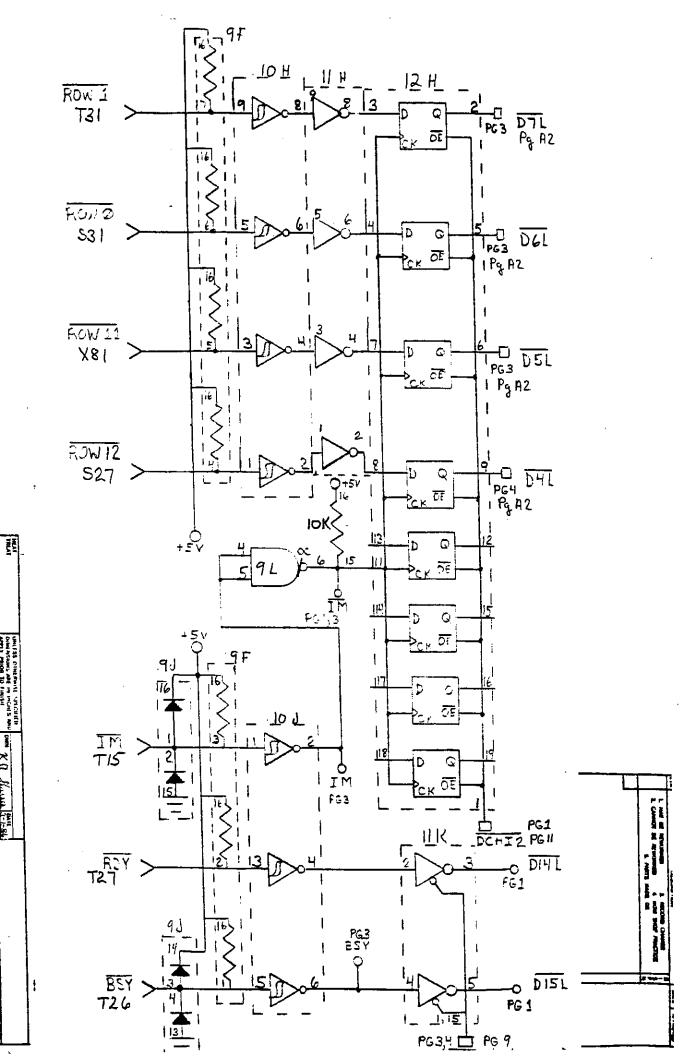












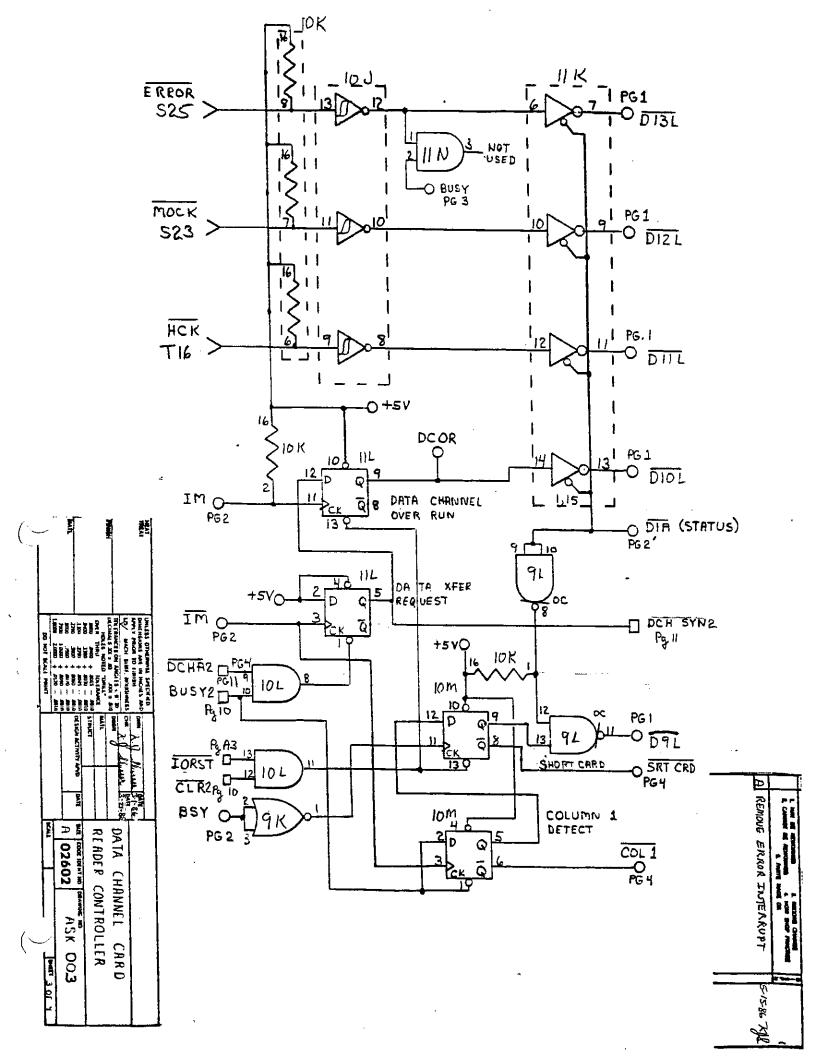
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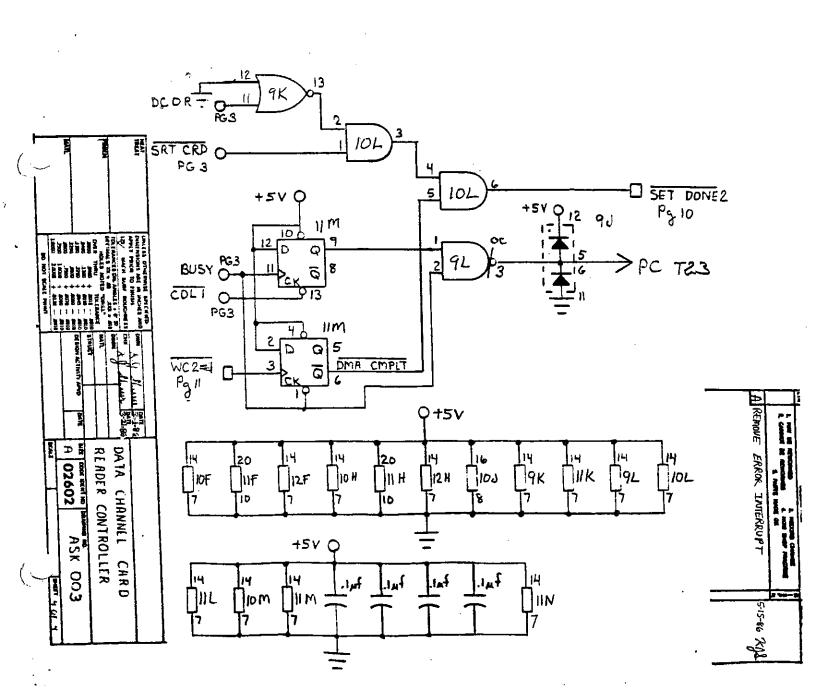
ASK DO3

DATA

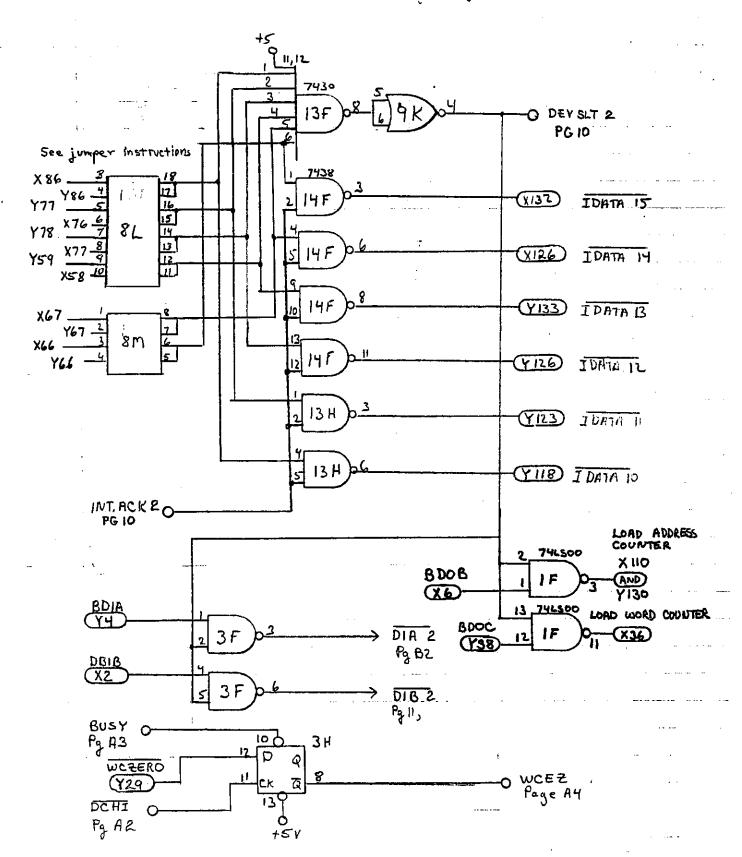
CARD

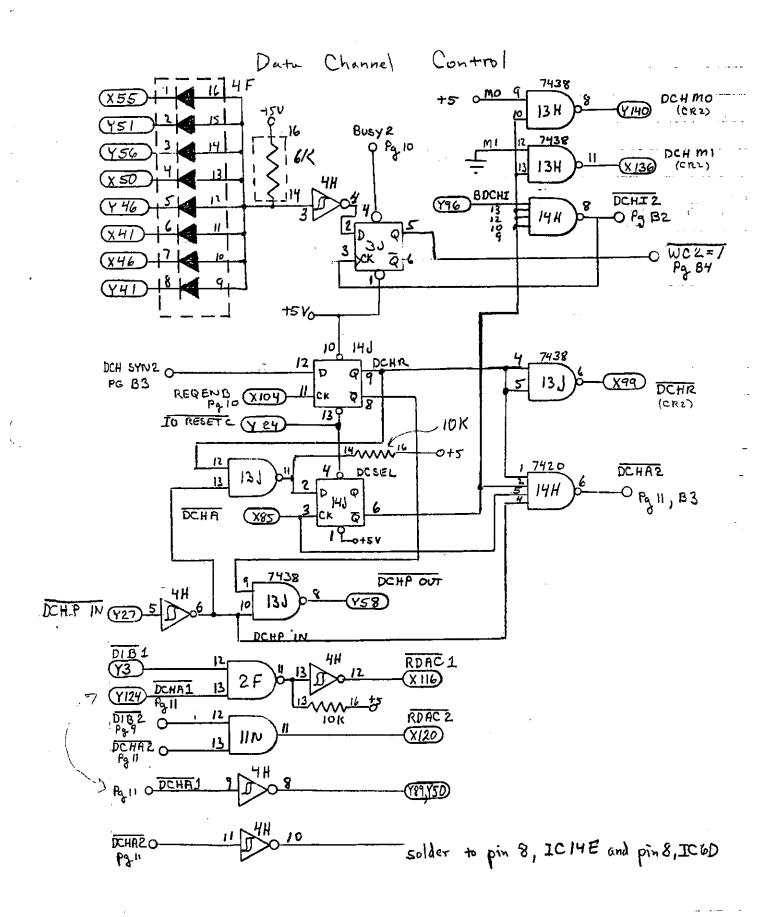
READER CONTROLLER CHANNEL

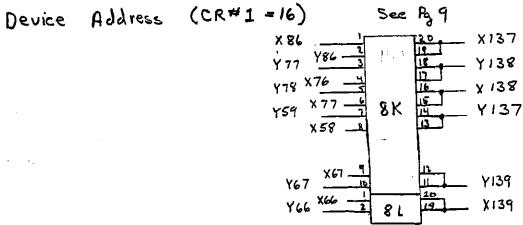




Channel 2 Control Logic







Done -> Interrupt X8 to X9

Addre	22	Counter	for	PMA	
Y 92	+0	Y 131	+0	X 53	DATA 15
X 89	to	X 128	+0	Y 53	, _DATA. 14
X 91	+0	X 130	†o	Y 54	DATA 13
Y 90	+0	Y 129	+0	X 52	DATA 12
Y 83	+0	x 121	40	Y 44	DATA II
x 80	+0	X 119	+0	X 43	DATA 10
X 82	+0	Y 121	+0	X 44	Drith 9
Y 81	+0	Y 120	+0	Y 43	DATA 8
X 72	+0	XIII	40	Y 3.3	DATA 7
Y 70	+0	Y 109	1 0	X 32	PATA 6
Y 72	+0	Y 111	+0	X 33	DATA 5
X 70	10	X 109	+0	Y 32	data 4
X 63	+6	Y 101	40	Y 23	DATA 3
X 61	to	X 98	to	χ 2Ζ	DATA 2
Y 63	+0	X 100	+0	x 23	DATA 1
Y 62	+0	Y 99	+0	Y 22	O ATRO

DMA DIRECTION
Y 136 to GND M1

Datu Channel Word Count Y 91 to X 71 to Y 6 X 37 to X 38 INTERRUPT MASK X10 +0 X43

Load Address Counter 1, DOBI Load Word Counter 1, DOCI