

6002

SUPER COMPACT CARD READER (6001 CARD READER MECHANISM)

TECHNICAL MANUAL

With
Illustrated
Parts
Breakdown

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6002

SUPER COMPACT CARD READER

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SECTION I GENERAL DESCRIPTION

1.1 INTRODUCTION

1.1.1 The MDS Models 6002/6002A Card Readers sense data punched in standard unit record cards (i.e. punch, tab or EAM cards) producing electrical output signals corresponding to the data sensed. This Technical Manual applies specifically to the Models 6002/6002A which contain a power supply plus control and interface logic circuitry; it is also generally descriptive of the Model 6001 which is a similar unit but without logics and power supply. The purpose of this manual is to provide installation, operating, maintenance and servicing information of the different units where applicable.

1.2 PHYSICAL

1.2.1 The readers are unusually compact; measuring approximately 13 inches high x 23 inches wide x 12 1/2 inches deep. Refer to Figure 1-1. A "u" shaped aluminum baseplate forms the bottom and ends of the enclosure serving as a rigid mount for the readers major components and assemblies. A vertical panel (A1), Figure 7-1 supports the card supply hopper, card picker and reader assembly, stacker capstan, the control panel assembly (A3), and other related components. A drive motor and vacuum pump are mounted to the main plate. A hinged panel at the rear (A2) on Models 6002/6002A contains the power supply components and logic circuitry. Logic circuits are on plug-in printed circuit boards utilizing integrated circuits and wirewrap interconnections. A hinged cover completes the enclosure.

1.3 FUNCTIONAL DESCRIPTION

1.3.1 The reader feeds a stack of cards through a photoelectric read station which



FIGURE 1-1 6001/6002 6001A/6002A CARD READERS

senses incident light via the punched data depositing the cards in a stacker hopper in their original order and orientation. The resulting signals are conditioned and gated out with strobe pulses, by the logic circuits. Typically, the reader is connected to a small computer or some data handling equipment, for which it serves as an input peripheral device. After a 'deck' of cards has been loaded into the hopper and the reader is placed in a 'ready' condition, the external controller transmits a Read Command signal which informs the reader to pick the bottom card and pass it through the read station.

1.3.2 Once a card has been picked and committed to the read station, the data punched on it is read at a fixed rate in a bit parallel, character serial, card image format. Each column of data is transmitted to the external equipment on 12 parallel lines, accompanied by a strobe line which indicates the time during which the data lines should be sampled. After reading, the card falls into the output stacker. Another Read Command signal from the external equipment will repeat the process; or by holding the Read Command line on, cards will be processed at the maximum throttle rate. In addition to data and strobe, the reader supplies various status or trouble signals to the external equipment.

1.3.3 The Model 6001 Card Reader has the same mechanical functions as the 6002/6002A, but contains no electronic circuits. Lamps, photocells, picker solenoid, and switch contacts are wired directly to connectors. The external equipment must provide appropriately timed picker solenoid drive current, and must derive data from the read station photocells using the output of a timing generator photocell.

1.4 CAPABILITIES

1.4.1 The Card Readers have a nominal operating speed of either 225 or 400 cards

per minute when reading standard 80 column cards. The hopper and stacker each accommodate approximately 500 cards. The reader can pick cards 'on demand', picking and reading one card for each Read Command signal; or can process cards continuously at the maximum throttle speed.

1.4.2 A check of the read station lamp and photocells, in both the light and dark state, is made with each card. The length of each card, as sensed by the metering capstans at the read station, is checked to detect any card slippage, or cards that are out of tolerance or damaged.

1.5 EQUIPMENT DIFFERENCES

1.5.1 Special circuit features, which can be installed in spare positions of the logic circuitry connectors, are described in accompanying publications if applicable. Model differences between the 6001/6002 and 6001A/6002A as noted in Figure 1-1, is the elevator stacker. Differences in the Model 6001/6001A without power supply/logic circuitry; are mentioned throughout this manual.

1.5.2 All models can be ordered for processing 51 column cards in addition to 80 column cards. Models having the 51 column card capability include adapters for the stacker and hopper, insertion of which conditions the logic circuitry as required. There is also a lever for varying elevator stacker spring tension to accommodate 80 or 51 column cards in these models.

1.5.3 Card readers can be ordered for operation at either 60 HZ or 50 HZ power source frequencies. The difference involves a change in pulley ratios to compensate for the difference in drive motor speed. The source frequency for which a unit is designed is indicated on the back of the enclosure at the power cable entry, and adjacent to the name plate inside the main chassis.

1.5.4 Card readers can be obtained with nominal processing rates of either 225 cards per minute or 400 cards per minute. The slower units use a picker pulley approximately 2 1/2" in diameter, and an idler pulley about 3/4" in diameter. Higher speed units use a picker pulley about 2" in diameter and an idler pulley about 1 1/4" in diameter. Specific part numbers are noted in the illustrated parts breakdown. Higher speed card readers also have a wiring change in the logic circuitry. The connection is noted in the logic diagrams.

1.5.5 Model 6001/6002 utilize a gravity type stacker in which cards drop as they are processed. A tinsel static eliminator lightly brushes the surface of the cards as they enter the stacker, to drain off static charges that would interfere with proper stacking. A transparent hinged plastic cover over the bin eliminates external airflow from interfering with the cards. However, cards cannot be removed from this stacker while the machine is operating.

1.5.6 Models 6001A/6002A utilize a spring suspended elevator that forms the stacker floor, gradually lowering as the weight of the cards increases.

1.6 POWER REQUIREMENTS

1.6.1 The input power requirements for all model card readers mentioned in this manual is as follows:

Source Voltage	115 VAC \pm 10%
Source Frequency	60 HZ or 50 HZ \pm 10%
Average Running Current	Less than 0.4 KVA
Maximum Starting Current	Less than 10 amperes

TABLE 1-1 CHARACTERISTICS

Physical:	
Dimensions	13" high x 23" wide x 12-1/2" deep
Weight	68 lbs.
Environmental Operating:	65° F to 80° F; 30% to 65% relative humidity
Storage:	0° F to 110° F; 5% to 95% relative humidity
Basic Components	Picker/Reader assy. control panel, 500 card vertical bins, drive motor, pump, on all models. Power supply and logic circuitry on 6002/6002A only.
Electrical:	
Control/Logic Circuitry	Wire wrap interconnections; plug-in printed circuit cards utilizing DTuL integrated circuits and discrete components.
	Nominal levels within the reader circuitry are 5.5V (1 or true), and Gnd (0 or false). Levels on the interface are inverted as given below.
Interface Logic Levels:	
Output Lines	'1' (true) = 0.25 + 0.25V (can sink 10 ma to gnd)
	'0' (false) = 5.5 + 1.0V (approx. 6K to Vcc)
Input Lines	'1' (true) = 0.4 + 0.4V (sinking 2 ma to gnd)
	'0' (false) = 5.0 + 2.0V
Data Output	12-parallel bit, character serial, 'card image', with strobe
Outputs	Code Levels (12 lines)
	Data Present Strobe
	Ready
	Trouble
	Hopper Empty/Stacker Full
	Pick Fail
	Card in Reader
Inputs	Read Command
Control Switches	
w/indicators	POWER
	MOTOR
	START
	STOP
Indicators	PICK (pick failure)
	MOTION (card motion error)
	LIGHT (light current error)
	DARK (dark current error)
Fuses:	
Primary AC (F1)	MDX3 or 313003
+12 VDC (F2)	AGC2 or 312002
-12 VDC (F3)	3AG AGC2 or 312002

SECTION II INSTALLATION

2.1 GENERAL

- 2.1.1 Installation of the card readers consists of unpacking, connecting the reader to the external equipment and plugging the unit into a primary AC source for operating power. The reader is packed in two corrugated cartons with a layer of rubberized hair between the cartons. There are no special unpacking procedures other than reasonable care for such equipment. Self-test procedures are given in Section III.

WARNING

This unit must be connected to a properly grounded 3 prong receptacle for electrical safety.

2.2 INTERFACE CONNECTOR

- 2.2.1 The 6002/6002A card readers are shipped with a 60 position mating plug for the interface connector (AMP Dualatch 582459-1). The interface connector pin locations for the signals are listed in Table 4-2. TOJ (pin 45) must be jumpered to TOJR (pin 50) on the back of the interconnecting cable plug to enable external control of the pick rate. Disconnecting the cable places the reader in a test condition with the pick rate controlled by the panel switches.

2.3 MODEL 6001 CONNECTIONS

2.3.1 The 6001 reader has no control/logic circuitry or power supplies; all photocells, light sources, and the picker solenoid are wired to terminals of a connector as shown in the schematics, Section VI. Switches and indicators are mounted on the control panel, and must be wired to appropriate control and logic circuitry. The motor is wired to a standard three prong plug, which must be plugged into a switched power source with appropriate operator and external equipment control. Detailed information concerning recommended circuitry for control of the 6001 is available from MDS. Note that the read station contains two additional sensors; beginning of card (BOC) and end of card (EOC) photocells which are placed to detect the leading and trailing edges of the cards as they pass through the read station. When the leading edge arrives at the BOC photocell, the center of column 1 is 1/2 column from the data phototransistors. When the trailing edge arrives at EOC, column 80 is 1/2 column past the data phototransistors.

2.4 EXTENDED STORAGE

2.4.1 If the reader is to be stored or repacked for an extended period of several months without use, wedge a small square of cardboard or plastic under the idler roller swing arms in order to lift the idler rollers from the metering capstans. This will prevent flats from developing on the soft idler rollers. Remove the wedged material before subsequent use. Refer to Figure 7-2, for identification of the idler roller swing arm.

SECTION III OPERATION

3.1 GENERAL

3.1.1 The card reader picks a card from the hopper on receipt of a Read Command signal from the external equipment. When the picked card is committed to the read station, the data on it is read and presented at the interface as 12 parallel bits with "1" representing a hole, "0" representing no hole. Characters are presented serially as they are read, with an accompanying strobe signal indicating the time at which the output lines may be sampled.

3.1.2 In normal operation, the operator loads a deck of about 500 cards to be read, places the unit in Power On, Motor On and start conditions. Card picking is now under control of the external equipment. As each card is picked and transported through the read station, the reader supplies the data and strobe signals. A ready signal to the external equipment indicates that the reader is in condition to accept a Read Command. Any trouble condition will inhibit the Ready signal, stop the reader's drive motor and light the appropriate indicator on the control panel. The end of file (hopper empty) or stacker full condition will also stop the reader, and provide a signal to the external equipment.

3.2 LOADING AND REMOVING CARDS

3.2.1 The input hopper holds a maximum of 500 cards. Normally, cards are loaded printed side down, column '1' toward the read station (operator's left) 9 edge in, 12 edge out. When loading cards, riffle or fan both ends, then flex the deck. Square the cards up on the jogger plate mounted on the reader. Place a small (about an inch thick) portion of the deck in the hopper, holding the right side of the deck higher so that the leading edge of the bottom

cards rest against the picker throat block. Allow the cards to fall in place in this position. Add the rest of the deck to be read. Additional cards can be added to a partially full hopper during reading. A stacker full switch halts processing automatically.

3.2.2 If the reader has an elevator stacker, cards can be removed from the bottom of the stacker while the reader is running. Pull the portion of the deck which has dropped below the two end guides, straight out. The elevator platform will rise to support the remaining cards. In this manner, it is possible to continue adding and removing cards to process a large file without interruption. Cards in the stacker are in the same sequences and orientation in which they were placed in the hopper.

3.3 CONTROL SIGNALS

3.3.1 Models 6002/6002A will accept one control signal from the external equipment: Read Command. If the reader is operable and in a ready condition, a Read Command will initiate a pick and read operation. All data on the card will then be presented at the interface at a constant rate, depending on the specific processing rate of the reader. The reader will provide a series of up to 80 characters in response to a Read Command. A steady 'true' Read Command signal will process cards continuously at the maximum rate. Regardless of when the Read Command signal goes false, a card in process will be completed before the reader stops.

3.4 OPERATOR CONTROLS AND INDICATORS

3.4.1 POWER (alternate switch/indicator) Applies operating power to the DC power supply lights green in Power On condition. Sets logic to initial conditions.

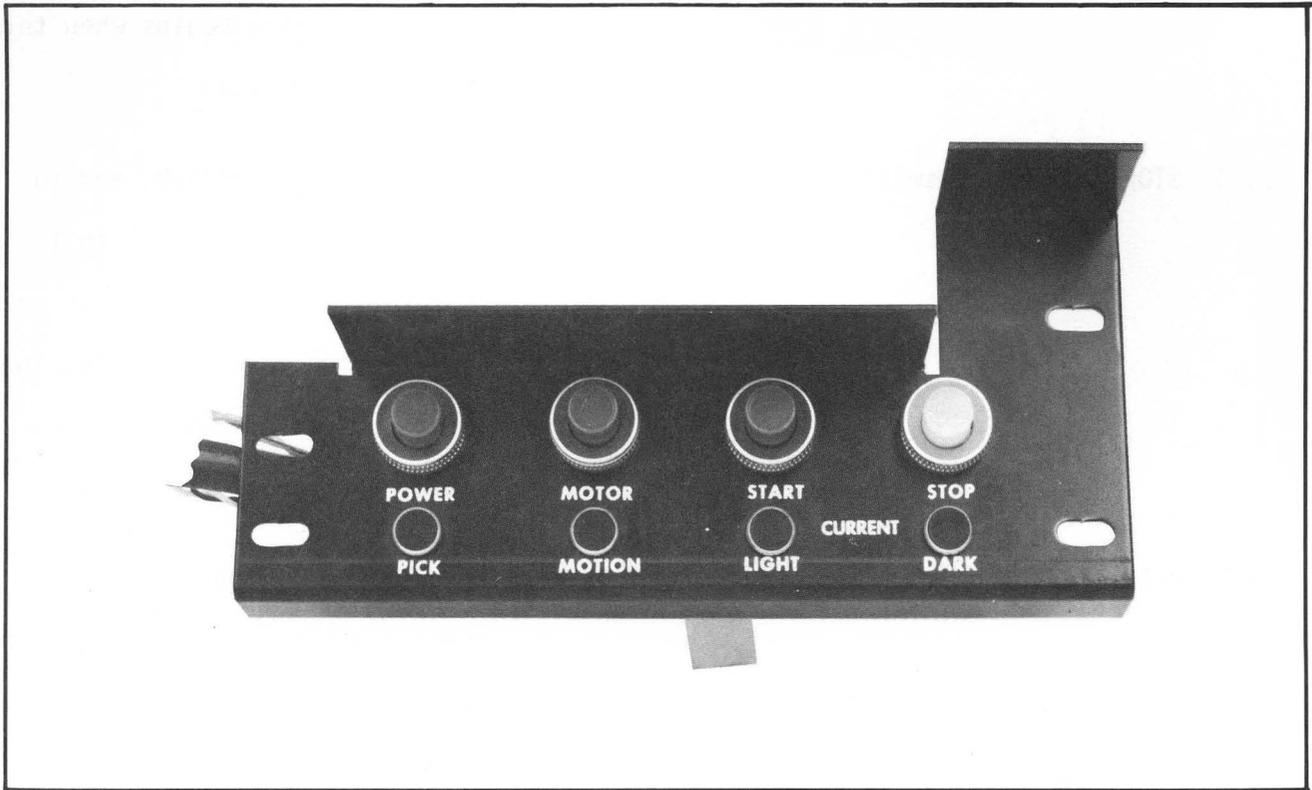


FIGURE 3-1 CONTROL PANEL

3.4.2 MOTOR (momentary switch/indicator)

Clears any trouble indications; starts drive motor, provided the conditions which caused the trouble indicated has been corrected. Lights green when motor starts.

3.4.3 START (momentary switch/indicator)

Conditions the logic to a Ready state, enabled to accept a Read Command, provided the motor is on and no trouble exists. Lights green is start condition. If a Read Command is present, or if the interface connector has been removed for testing,

card processing begins when this switch is actuated.

3.4.4 STOP (momentary switch/indicator)

Stops card processing, and inhibits the Ready signal to the external equipment. Lights amber in stop condition. Reading of a card in process will be completed before the stop.

3.4.5 PICK (indicator)

Lights red to indicate that a card did not reach the read station after a pick function. Stops reader motor.

3.4.6 MOTION (indicator)

Lights red to indicate an error sensed in the motion of a card through the read station. Stops reader motor.

3.4.7 LIGHT (indicator)

Lights red to indicate a malfunction of the read station in the "light" (no card) condition. Stops reader motor.

3.4.8 DARK (indicator)

Lights red to indicate a malfunction of the read station in the "dark" condition. Stops reader motor.

3.5 READING CARDS

3.5.1 Load up to 500 cards in the hopper, and actuate the POWER, MOTOR and START switches in order. Sequence the external equipment to provide a Read Command signal and to accept data from the cards. Card processing will continue until the Read Command signal is removed, or until a trouble condition occurs, the last card is processed, the STOP switch is operated, or the stacker is full.

3.6 51 COLUMN CARD PROCESSING

3.6.1 An optional feature for readers with the elevator stacker mechanism permits processing 51 column cards. To condition the reader for the 51 column, it is only necessary to insert the short card adapters in the supply hopper and in the stacker. These adapters fasten with thumbscrews. Inserting the adapters automatically actuates a switch which conditions the logic circuitry for the correct number of card columns.

3.6.2 When changing between 80 and 51 columns cards, raise the elevator platform to its upper limit and move the slide located at the top of the left side of the stacker. The slide disengages one spring and engages the other. This slide is marked to identify the card length selected. A 51 column card stop is inserted into the hopper to shorten the length to 51 columns.

3.7 TEST OPERATION

3.7.1 During testing, all major functions of the reader are exercised. To test the reader, disconnect the interface connector. This simulates a constant 'true' condition of the Read Command line. The reader will commence picking and processing cards immediately when the START switch is actuated, provided there are cards in the hopper, the power is on, the motor is running, and there are no trouble conditions. Card motion checks as well as light and dark current

checks are exercised during testing, just as they are during on-line operation.

3.8 PICK FAILURES

3.8.1 The usual causes of pick failures are out-of-tolerance cards, damaged leading edges or improper loading of cards in the hopper. Inspect the bottom card in the hopper if a pick failure occurs. Smoothing a rough leading edge may enable the card to be picked. Depress MOTOR to clear the indicator, and START to resume operation.

3.9 LIGHT CURRENT ERROR

3.9.1 The light current indication could occur because of an obstruction or a malfunction in the read station or in the logic circuitry. An infrequent, isolated light current error indication may occur as dirt or foreign material passes through the read station.

3.9.2 Actuation of the MOTOR and START switches will clear the indicator and permit normal processing to resume. If the indication remains, turn off the power. Trim a standard tabulating card down to about 2 1/2 inches wide and pass it through the picker throat and read station. This should clear any lodged obstruction. It is also possible that the read station's incandescent light bulb is burned out, or that a equipment malfunction exists. A light current indication could indicate that an error occurred while reading the last card (top card in the stacker).

3.10 DARK CURRENT ERROR

3.10.1 A dark current indication usually indicates a torn card, perforation or card defect which allows light to pass through the webs between the leading edge and the first column or between column 80 and the trailing edge. A dark cur-

rent indication means that an error may have occurred in reading the last or top card in the stacker. Remove the card if it is defective and either duplicate or replace it as required. Actuate MOTOR and START to resume reading. Continued or frequent dark current errors indicate an equipment malfunction when processing cards.

NOTES

NOTES

SECTION IV THEORY of OPERATION

4.1 GENERAL

4.1.1 Basically, the card reader, with the exception of Model 6001, consists of a picker/reader, card metering capstans and the logic circuitry for timing, control and data handling. A DC power supply furnishes the operating power for the logic circuitry, the light sources and the picker solenoid.

4.1.2 On a signal from the external equipment, the reader mechanically picks a card from the bottom of the stack in the supply hopper. This card is transported by the picker belts to the metering capstans and idler roller assembly. A metering capstan and idler roller is located just after the read station. Movement of the card past the aperture is precisely metered. The logic circuits derive card column positions from timing pulses generated as the capstans rotate. Data consisting of holes punched in the card, is sensed photoelectrically. Output signals corresponding to the punched codes are produced from the timing pulses and condition of the photocells.

4.2 CARD PICKER

4.2.1 The card picker consists of four perforated belts driven over a movable vacuum manifold (belt pusher) for the purpose of removing the bottom card from the input hopper and delivering it to the metering capstan for transport through the read station. A pick signal from the reader control logic actuates the solenoid operated belt pusher which pushes the four capstan driven perforated belts into contact with the card. This is accomplished through slots in the hopper floor.

4.2.2 The dimensions of the picker throat or pneumatic gate are such that only one

card thickness can pass. Vacuum is applied through holes in the bottom of the pneumatic throat to hold the leading edge of the card down, while the cards above are held back by an arrangement of pressurized air jets above the card at the picker throat. The timing disk for the clock pulse generator is located on the picker drive shaft which synchronizes the rotation of the timing disk with the metering capstans and motion of the picker belts.

4.2.3 Vacuum for the picker is provided by a belt driven, dry (oil less) carbon vane rotary vacuum pump. The same drive motor operates the picker, capstans and vacuum pump. The pump intake side supplies vacuum to the picker belt pusher and the vacuum throat. The exhaust side is tapped to supply pressurized air to the air jets at the pneumatic gate and to the elevator stacker gate jets.

4.2.4 A switch having very light actuating pressure detects the presence or absence of cards in the hopper, providing a Hopper Empty signal to the logic circuitry. A sensor on the first metering capstan mount detects the cards leading edge. After a successful pick, the resulting signal is used by the logic circuitry to turn off the pick solenoid drive current.

4.3 READ STATION

4.3.1 The read station consists of twelve phototransistors with fiber optic light paths to a single incandescent bulb light source. The light source and photocells are on opposite sides of the card path with the apertures for the fiber optics and those for the sensors positioned opposite each other. As the card passes through the read station, the logic circuits output signals to the external equipment according to the light (hole) or no light (no hole) condition of the phototransistor.

4.4 METERING STATION

4.4.1 A metering capstan and idler roller assembly, mounted between the picker assembly and the read station, grip the margins of the card as it emerges from the picker. The card is transported at a continuous rate through the read station. The metering capstans transport a card precisely 45 column through the read station for each revolution. The distance is adjusted to a high degree of accuracy by the pressure of the spring loaded idler rollers against the metering capstans.

4.5 CLOCK PULSE GENERATOR

4.5.1 A photoelectric clock pulse generator consisting of an optical timing disk on the picker drive shaft, a miniature incandescent lamp and a phototransistor provides the time base for reader operation. The disk interrupts a light beam 720 times for each revolution regardless of the read rate. Since the metering capstan and picker drive shaft transport a card precisely 45 columns per revolution, 16 clock pulses are generated for each card column (centerline to centerline of punch columns). On standard cards, this distance is 0.087 inch. This means that each pulse represents an increment of the distance the card travels through the read station. A four bit binary counter counts the clock pulses resetting to 0 at a count of decimal 16. This triggers a seven bit column counter which resets to 0 after a count of 127. Since the timing generator runs continually and card picking is intermittent, the clock pulses and counters are asynchronous until the beginning of card (BOC) signal is initiated by the card leading edge as it enters the read station. At this time, the clock pulse generator is jam set to a count of decimal 10 and the column counter is jam set to a count of decimal 125.5. Exactly two and three-eighths columns later (leading edge to first card column) both binary counters will reset synchronously to decimal 0 for the first card data

column. All signals related to column readings are functions of the clock pulse generator, while all card feeding signals are functions of both the clock pulse and column counts. A feed timing diagram is shown in Figure 4-1, and a read timing diagram in Figure 4-2.

4.5.2 The duration of each clock pulse and internally generated signal depends upon the rotational speed of the timing disk rather than card rate. For 225 cards per minute, the clock pulse is approximately 150 microseconds and 2.3 milliseconds for each column. For 400 cards per minute, the durations are approximately 75 microseconds and 1.2 milliseconds respectively. These durations must be considered when interfacing with external equipment.

4.6 POWER SUPPLY

4.6.1 In readers with power supplies, the components are mounted to the hinged chassis at the rear of the unit. The logic circuitry and motor capacitor are mounted to this chassis. Refer to the power supply schematic Section VI and to Figure 7-10.

4.6.2 This circuitry provides +12 VDC at 2 amp and -12 VDC at 1 amp. The unregulated outputs are used by the pick solenoid, indicator lamps and motor control relay (K1). The -12 volts is also applied to the circuitry of Q2 which provides approximately 4.3 volts regulated at a constant current for the read station lamp and the clock pulse timing lamp. Q1 is controlled by a signal from the logic circuitry (MOTOR) and drives K1, which switches power to the drive motor through J3.

4.6.3 The voltages are regulated by zener diodes CR1 through R1 to provide the lower +5.5 VDC supply required by the logic circuitry. J1 connects to the power switch on the control panel; J2 to the picker/reader's read station and timing lamps, timing pickup, and hopper empty switch; J3 is connected to the

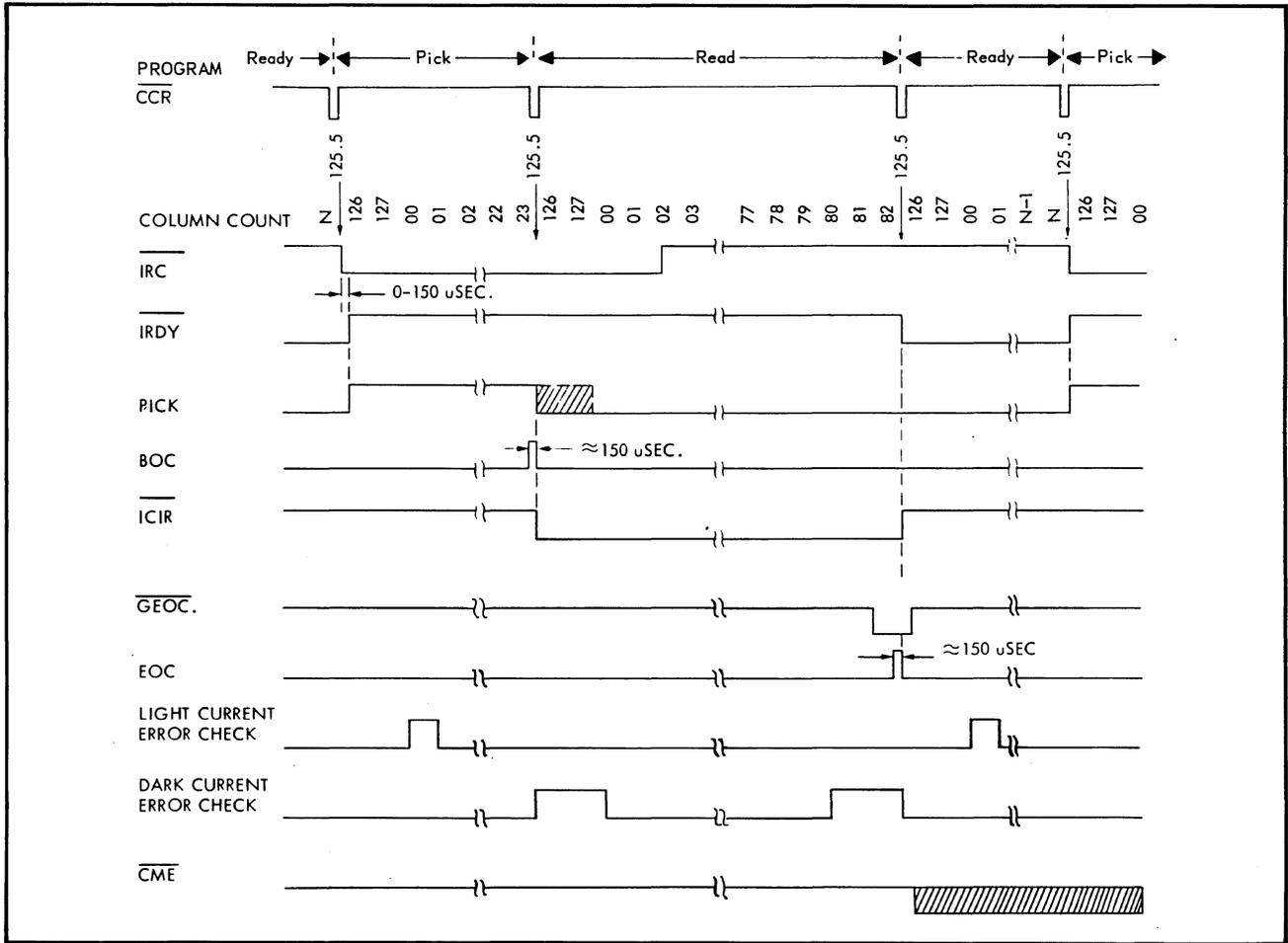


FIGURE 4-1 FEED TIMING DIAGRAM

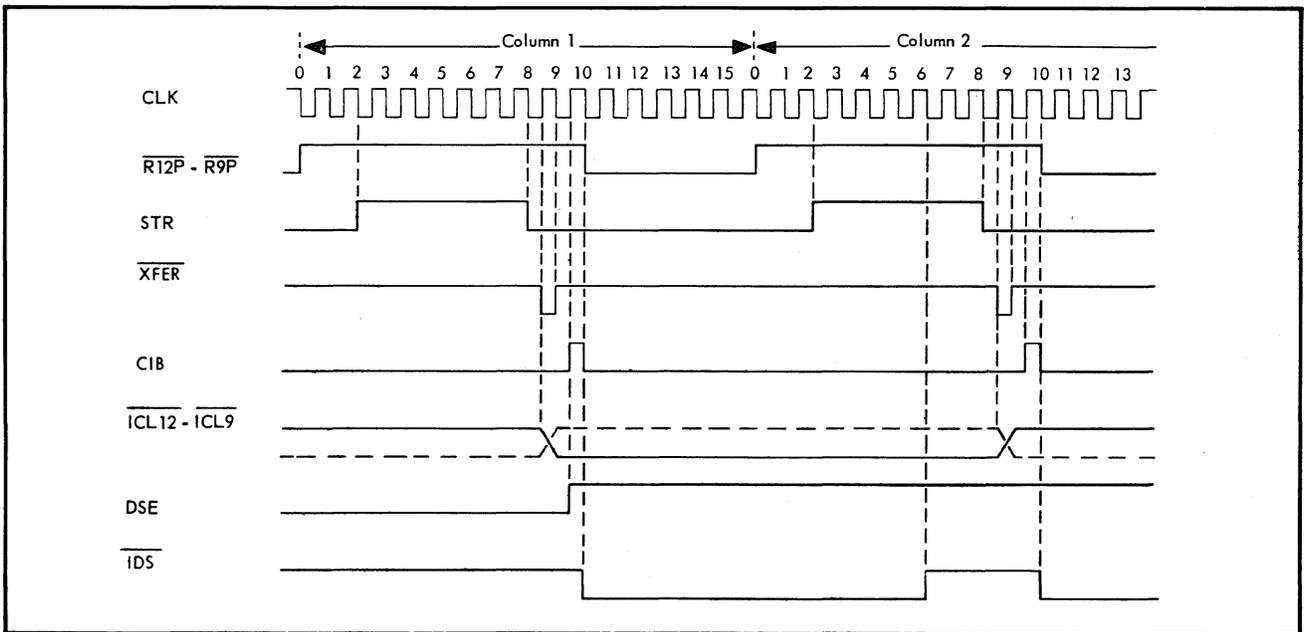


FIGURE 4-2 READ TIMING DIAGRAM

drive motor. The leads terminated with individual connectors, plug directly onto wirewrap terminals at the logic circuitry. The connections are designated by connector and pin; for example X5-9 indicators connector 5, pin 9.

4.7 CONTROL PANEL/CURRENT DRIVER CARD

4.7.1 The current driver card is in position six of the logic circuitry assembly. It varies from the other 5 cards in that it uses a combination of discrete and integrated circuits. The cable from the control panel is terminated directly on this card. When referring to the schematic of the current driver card, note that terminations are designated CABLE and numbered consecutively 1-17, refer to the connections to the attached control panel and to the picker solenoid (cable 15, cable 16). Other designations refer to the conventional card pin numbers.

4.7.2 When tracing the path of these signals, note that the current driver card plugs into the X6 position shown on sheet 7 of the logic diagram, thus providing the source and destination of the current driver card's pin connections. Similarly, the control panel schematic should be referred to for the destination of lines marked CABLE.

4.7.3 CONTROL PANEL. The power switch, S1, connects to the primary AC circuits of the power supply through P1. The other switches and indicators on this assembly are terminated on the current driver card. The -12 VDC supply is applied to one side of the indicator lamps, and is an alternate action switch, while the others are momentary contact switches.

4.8 LOGIC CIRCUITRY

4.8.1 Card Reader electronics, with the exception of the power supply, are solid state logic circuits composed of DTL integrated circuits and discrete com-

ponents. These components are on plug-in printed circuit cards mounted in a card cage on the electronic chassis. The circuits include counters, gates, buffers and inverters required for processing input or output signals and for providing control and monitoring functions.

4.8.2 Logic symbols are in accordance with MIL - STD - 806B. The logics are drawn so that each page is a complete functional description of one printed circuit card. The first line of the designation within each logic symbol denotes the integrated circuit package and the specific circuit within the package. For example, 6-2 denotes package number 6 on a card and circuit number 2 in the package JK flip flops contain the package number and their terminals. Cross connected NOR flip flops and other combined elements reference both circuit numbers; for example 6-5-1/5-2.

4.8.3 Inputs are to the left of the diagrams; outputs to the right. Each signal is identified by a mnemonic. Numbers in parenthesis identify the source of a signal by sheet and circuit, or the destination by sheet. An internal connection on the same sheet is indicated by a diamond. The digit or letter outside the parenthesis indicates the pin number, or card termination.

4.8.4 Logic levels used within the circuitry are as follows:

0 VDC (DC GND) = False, Logic '0' low, no hole in card.

5.5 VDC = True, logic '1' high, hole in card.

Note, however, that these levels are inverted on the interface output lines to external equipment. The overscore or bar over a signal designation indicates that the line is low when the designation is true. A list of mnemonic abbreviations and their meanings is given in Table 4-1.

4.9 BLOCK DIAGRAM

4.9.1 Refer to Figure 4-3. As a card passes between the light sources and the read

TABLE 4-1. MNEMONICS

Abbreviation	Signal	Abbreviation	Signal
BOC	Beginning of Card	MOTR	Motor Run
CCR	Column Counter Reset	MSTR	Motor Start
CC00-CC127	Column Counts	PCC	Program Control Count
CC1-CC7	Column Counter Bits	PCR	Program Control Reset
C1B	Clear Buffer Masters	PC1, PC2	Program Counter Bits
CLK	Clock	PF	Pick Fail
CL12-CL9	Code Levels 12 thru 9	PICK	Pick
CME	Card Motion Error	POR	Power On Reset
DCC	Dark Current Check	READ	Read (program)
DCE	Dark Current Error	READY	Ready
DCET	Dark Current Error (Trailing)	R	Reset
DSE	Data Strobe Enable	R12P-R9P	Read Station Photocells
EOC	End Of Card	R12-R9	Data Bits
GEOC	Gated End of Card	SCON	Stop Condition
HE	Hopper Empty	SRT	Start
HLT	Halt	SSRT	Switch Start
I (preface)	Interface (or Inverted)	SSTP	Switch Stop
ICL12-ICL9	Interface Code Levels 12-9	STP	Stop
IDS	Interface Data Strobe	STR	Strobe
IHE	Interface Hopper Empty	TOJ	Test Operate Jumper
IRC	Interface Read Command	TOJR	Test Operate Jumper Return
ITR	Interface Trouble	TC1-TC4	Timing Counter Bits
LCC	Light Current Check	XFER	Transfer
LCE	Light Current Error		

station photocells, the punched holes it contains are sensed and applied to the first (master) sections of the buffer. At the proper sample time, the master sections are enabled and set according to the data. The conditions of all the master sections are then transferred into the slaves. The character is now available on the output lines to the external equipment. The buffer control circuits time the sampling period, the transfer from master to slave, and the width of the data present strobe. After a Read/Pick command has been issued, the condition of all the photocells is gated into the buffer to check their operation in the 'light' state before the leading edge of the

card arrives. After detection of the leading edge, the 'dark' state of the photocells is checked before column one arrives at the read station.

4.9.2 An optical disk which rotates in precise synchronization with the metering capstans provides 16 clock pulses for each column of card movement through the read station. A 4 bit binary counter, which starts when the beginning of a card (leading edge) is detected, goes through a complete count of 16 for each card column. Each overflow of the clock pulse counter steps a 7 bit binary counter, which in effect identifies the card column being presented at the read station.

4.9.3 A 2 bit binary counter steps through the conditions of Stop, Ready, Pick and Read. In continuous card processing, this program counter does not return to the Stop condition between cards.

4.10 AND-INVERT-12 CARD

4.10.1 This card conditions the signals from the photocells. It contains the light current (LCC) and dark current (DCC) gates as well as the beginning (BOC) and end of card (EOC) detector circuitry. The signal CLK (clock) is a continuous train of pulses from the timing disk, and is applied at the transfer of BOC and EOC.

4.10.2 When a card pick cycle has been initiated, before the leading edge reaches the read station, all photocells should see light if there is no malfunction. At this time the count decode and buffer control circuitry provides the sampling and transfer timing pulses required to gate a column through the buffer. All buffer outputs should be set to the '1' state, providing a high on all code lines CL1-CL9. The low output is sampled before the card reaches the read station. If the output signal LCC is high during the sample time, it indicates a malfunction setting an error flip flop.

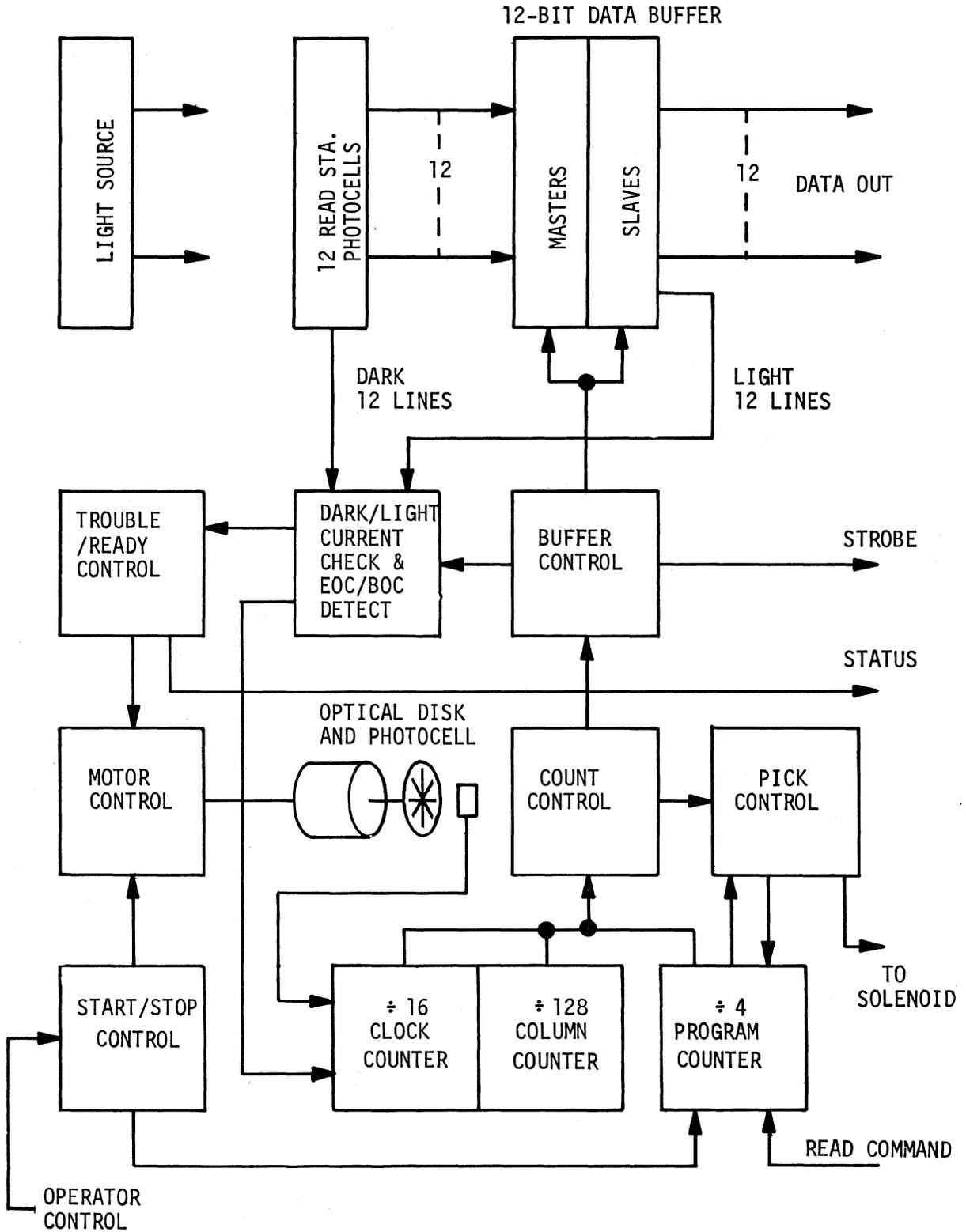


FIGURE 4-3 SIMPLIFIED BLOCK DIAGRAM

4.10.3 The dark current check provides a check of the read station photocells, the condition of the leading and trailing edges of the card and several functions of the control and timing circuitry. Inputs from the photocells $\overline{R12P-R9P}$ are high if all photocells are functioning properly in the dark condition. Thus $\overline{R12-R9}$ should be high with DCC low if there is no error. DCC is sampled at the beginning and end of the card.

4.10.4 The high output of R12-R9 while a card is still in the read station is applied with CLK (clock pulses) to an 'asynchronous to synchronous' convertor. The resulting high synchronized with CLK signifies the beginning of card. Similarly, the low which occurs at the trailing edge of the card produces one positive going pulse, EOC (end of card), synchronized with a clock pulse.

4.11 FF12 BUFFER CARD

4.11.1 Each circuit of the buffer theoretically contains two flip flops. The first or 'master' section accepts the data information from the punch code circuitry. The punch code is stored in the appropriate master until a low \overline{XFER} signal transfers the information to the second or 'slave' section of the buffer for transmission to the external equipment. The C1B (clear 1st section of buffer) signal clears the master section of the buffer. The data output to the interface is from the '0' side of the flip flops.

4.11.2 A positive pulse applied at CC clears all masters to the '0' state. The parallel bits of a 12 level code (R12-R9, page 2) are applied at the S inputs. When STR (strobe) goes high, the appropriate masters set to the '1' state. When the information has been transferred to the 'slave' section, the code remains at these outputs while a C1B pulse clears the masters for the next data column.

4.12 COUNTER CARD

4.12.1 The timing counter and column counter are connected to provide timing related to card motion through the read station. The program counter steps the reader through its operating functions.

4.12.2 The timing counter is a 4 bit binary counter using flip flops 4-12, 3, 9, and 2. The high order flip flop 4-2 is preset by \overline{CCR} (column counter reset) to a decimal 10 (1010_2) whenever the program counter is stepped; or 8 (1000_2) in the higher speed units. The timing counter counts the clock pulses which occur at approximately 150 microsecond intervals (at 225 cards/minute) providing 16 clock pulses per column. Outputs of the timing counter are used to determine the time during which the read station photocells are sampled, the time to transfer the data in the buffers and to time the data strobe signal to the external equipment.

4.12.3 The next 7 stages (6-8, 1, 7, 10, 16, 17, 11) comprise the 7-bit binary counter for card columns. This counter steps each time the timing counter overflows. Outputs of the high order counter (4-11) are used to determine the column of the card which is in the read station. This counter is preset at decimal 125.5 (1111101_2) by CCR in the same manner as the timing counter, each time the program counter is stepped.

4.12.4 Flipflops 4-15 and 4-18 comprise a 2 bit program counter which steps through the 4 basic program conditions of Stop, Ready, Pick and Read. It is stepped by PCC (program counter control) when a start, read command, BOC or EOC occurs.

4.13 COUNT DECODER

4.13.1 This card basically accepts the binary count from the timing and column count-

er, applying them to control the various reader operations. Whenever the program counter steps from Ready to Pick, the column counter is preset at decimal 125.5 and the timing counter is preset to decimal 10. The count continues until detection of the leading edge steps the program and resets the counter. When the count reaches zero, CC00 causes a light current check to be performed. During read, CC00 indicates the first column of data. When the counters are reset at the end of the card, CC00 enables another light current check.

- 4.13.2 During the reading of a card STR (strobe) determines the sample time for the data sensing photocells. This signal applied to the buffers, enables the 'master' sections to set according to the light/dark condition of the read station photocells. Strobe is present for approximately 60% of the time that a hole admits light to a photocell.
- 4.13.3 Immediately after sampling, the condition of the masters is transferred to the 'slaves' by \overline{XFER} . This pulse is obtained by combining the 8th timing count with CLK. The following paralleled inverters provide sufficient drive so that XFER can clear all 12 of the buffer flip flops.
- 4.13.4 Since the condition of the buffer 'slave' flip flops is always available on the interface lines, and strobe signals are generated continuously, it is necessary to enable output of \overline{IDS} (data strobe, interface) signals only for the correct number of columns, and only when a card is in the read station. DSE (data strobe enable) is thus provided by an RS flip flop, which sets when the C1B pulse for column 1 ($\overline{CC00}$) occurs. Similarly, the C1B pulse for the 51st ($\overline{CC51}$) or 81st ($\overline{CC80}$) clears the DSE flip flop.
- 4.13.5 \overline{IDS} is turned on at the beginning of the 10th timing count, to signify to the external equipment that a character is present from one of the 51/80 legitimate columns. \overline{IDS} remains on through the timing counter overflow until

the end of the 5th count. In effect, \overline{IDS} is turned on two counts after a character has been placed on the code lines and is turned off two counts before the next data is placed on the lines.

4.13.6 $\overline{CC82}$ indicates the time at which the trailing edge of the card should be detected at the read station. If the trailing edge is sensed within the correct range of counts, \overline{GEOC} (gated end of card) is produced. The end of card must occur during a column count of 82 (or 53) and a timing count of 0 thru 9, when both the second or third stages of the timing counter are at 0 or when the fourth stage is at 0. The low \overline{GEOC} pulse steps the program counter from read to ready, and enables execution of a halt and dark current error indication after completion of a card in process.

4.14 READER CONTROL

4.14.1 This card controls stepping the program counter, resetting the column counter and the motor control, as well as storage and gating circuits for various trouble conditions.

4.14.2 The 2 bit program counter outputs are decoded into pick, stop and read. At the initial start up of the reader, the program counter is cleared to the stop condition. When the START switch is actuated, \overline{SSRT} (switch start) is produced, causing the SRT level. This level remains until an error or operation of the stop switch causes \overline{PCR} (program counter reset). PCC (program control count) stops the program counter; and \overline{CCR} (column counter reset) presets the card column counter to decimal 125.5.

4.14.3 The motor flip flop is directly set by \overline{POR} and is directly cleared by \overline{MSRT} . Thus \overline{PCR} is produced at power on, forcing the program to stop condition. \overline{MOTR} is produced when the motor switch is actuated, operating the relay which applies operating power to the drive motor.

- 4.14.4 The first flip flop of the dark current error circuitry is set whenever the beginning of card is detected during a pick program condition. It is cleared when DCC goes low. When the card column counter reaches CC00, the condition is gated into the following flip flop causing \overline{DCE} . This lights an indicator and stops the motor at the end of the card. The first of the two flip flops is again set on the last column of a card, because DSE is high and CC4, CC5 are present during columns 51 and 80. DCC going low will clear the flip flop as the trailing edge of the card passes the read station. \overline{GEOC} will then gate the condition into the second flip flop if no error condition exists.
- 4.14.5 DCET, signifying the program is still in read at the trailing edge of the card because \overline{GEOC} was not produced, sets the \overline{CME} (card motion error) flip flop. CC00 is produced 2 1/2 counts after every program step pulse. It is also produced repetitively during the ready condition, if the reader is not receiving \overline{IRC} commands from the external equipment, or during the stop condition while the motor is running. This is because the counters continually receive clock pulses and process through CC125 approximately every 300 milliseconds. Whenever CC00 occurs and the reader is not in the read condition, LCC should be low indicating that all read station photocells are functioning properly. If LCC is not low, the light current error (\overline{LCE}) flip flop is set.
- 4.14.6 When acceptance of a read command causes the program counter to step from ready to pick, the states of the two counter flip flops are decoded applying PICK to the current driver card circuitry, where drive current for the picker solenoid is turned on. If BOC is not detected by the time the column counter reaches 124, the pick fail flip flop is set.
- 4.14.7 In order to exercise the reader in a test mode, off line from the associated

equipment, unplug the interface connector from A2J7 at the rear of the reader. This leaves TOJR (pin 10, 6-4-3) open, or high continuously, simulating a continuous read command.

4.15 INTERFACE SIGNAL LEVELS

4.15.1 The output signal levels at the interface connector pins are:

a. High (H) = 5.5 volts (± 1.0) approximately 6K ohms impedance to VCC

b. Low (L) = 0.25 volts (± 0.25) while sinking 10 milliamperes to ground.

The rise and fall times of the output signals are less than 1.0 microseconds between the 10% amplitude points measured at the output connector.

4.15.2 The input signal rise and fall times should be no greater than 20 microseconds between the 10% and 90% signal amplitude points.

4.15.3 The bar over the signal mnemonics signifies that the active signal level is low while the absence of the bar signifies a high level active signal.

4.16 INTERFACE SIGNAL DESCRIPTIONS

4.16.1 The signals at the interface connector are described in the following paragraphs. One of these signals is the control signal from the remote equipment. This is $\overline{\text{IRC}}$ (interface read command). The rest of the signals from Table 4-2 are output signals to the remote unit.

4.16.2 Ready Signal ($\overline{\text{IRDY}}$). When the card reader is in the start condition, the ready signal level goes low to indicate to the remote unit that the reader is ready to receive a read command ($\overline{\text{IRC}}$). $\overline{\text{IRDY}}$ will go high within one clock count after the leading edge of $\overline{\text{IRC}}$ has been received and remains high until the card leaves the read station. The ready signal is inhibited by a trouble condition.

- 4.16.3 Interface Read Command ($\overline{\text{IRC}}$). A low level IRC signals enables the reader to pick and read cards, while a high on the line inhibits card reading. The reader must be in the ready condition and the ready signal ($\overline{\text{IRDY}}$) must be at the interface before the reader will accept a $\overline{\text{IRC}}$ command. Returning the signal to the high level will stop card reading when the card in process leaves the read station, but will leave the reader in the ready condition.
- 4.16.4 Interface Data Strobe ($\overline{\text{IDS}}$). To identify valid data, the reader generates data strobe signals for each column of data as functions of the timing counts. Transmission of the data strobe is enabled only when a card is being read. The data strobe line goes low two timing counts (approximately 300 microseconds) after the punched data column has been transferred to the 'slave' section of the buffer and is on the data lines. The signal goes high two timing counts before the data column is updated by a new column.
- 4.16.5 Data Code Lines. The data read from punched data cards are presented at the interface on 12 parallel lines ($\overline{\text{CL12}}-\overline{\text{CL9}}$) in bit parallel, character serial format (card image form column by column). The signal levels are low for punched holes and high for no holes. Data outputs are present on the lines immediately after each column is read, remaining on the lines until they are updated by the succeeding column. The signal duration is approximately 2.3 milliseconds at 225 cards per minute and approximately 1.2 milliseconds at 400 CPM.
- 4.16.6 Card In Reader ($\overline{\text{ICIR}}$). $\overline{\text{ICIR}}$ low indicates to the remote unit that a card is in the read station. The line stays low until the last phototransistor starts to conduct after the trailing edge of the card opens all of the light paths or until it has been determined that the card has been in the read station for a period of time exceeding that required for 85 5/16 columns of card length to pass through the read station.

TABLE 4-2 INTERFACE CONNECTIONS

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	$\overline{\text{ICL12}}$	21	$\overline{\text{ICL8}}$	41	
2	$\overline{\text{ICL11}}$	22	$\overline{\text{ICL9}}$	42	$\overline{\text{IRC}}$
3	$\overline{\text{ICL10}}$	23	$\overline{\text{IDS}}$	43	
4	$\overline{\text{ICL1}}$	24	$\overline{\text{IRDY}}$	44	$\overline{\text{ICIR}}$
5	$\overline{\text{ICL2}}$	25	$\overline{\text{ITR}}$	45	TOJ
6	$\overline{\text{ICL12}}$ (RET)	26	$\overline{\text{ICL8}}$ (RET)	46	
7	$\overline{\text{ICL11}}$ (RET)	27	$\overline{\text{ICL9}}$ (RET)	47	$\overline{\text{IRC}}$ (RET)
8	$\overline{\text{ICL10}}$ (RET)	28	$\overline{\text{IDS}}$ (RET)	48	
9	$\overline{\text{ICL1}}$ (RET)	29	$\overline{\text{IRDY}}$ (RET)	49	$\overline{\text{ICIR}}$ (RET)
10	$\overline{\text{ICL2}}$ (RET)	30	$\overline{\text{ITR}}$ (RET)	50	TOJR
11	$\overline{\text{ICL3}}$	31	$\overline{\text{IHESF}}$	51	
12	$\overline{\text{ICL4}}$	32	$\overline{\text{IPF}}$	52	
13	$\overline{\text{ICL5}}$	33		53	
14	$\overline{\text{ICL6}}$	34		54	
15	$\overline{\text{ICL7}}$	35		55	
16	$\overline{\text{ICL3}}$ (RET)	36	$\overline{\text{IHESF}}$ (RET)	56	CHASSIS GND
17	$\overline{\text{ICL4}}$ (RET)	37	$\overline{\text{IPF}}$ (RET)	57	CHASSIS GND
18	$\overline{\text{ICL5}}$ (RET)	38		58	
19	$\overline{\text{ICL6}}$ (RET)	39		59	
20	$\overline{\text{ICL7}}$ (RET)	40		60	DC (GND)

4.16.7 Read Trouble ($\overline{\text{ITR}}$). This signal goes low upon detection of a trouble or malfunction condition and remains low until the condition has been corrected and the motor switch operated. Read troubles are; card motion error, light current error and dark current error.

4.16.8 Hopper Empty, Stacker Full ($\overline{\text{IHESF}}$). A low level signal is applied at the interface when the last card leaves the supply hopper or when the stacker full switch is operated. $\overline{\text{IHESF}}$ signal produces a stop condition and remains on the line until the condition has been corrected.

4.16.9 Pick Fail ($\overline{\text{IPF}}$). This signal will go low if a card has not been sensed at the read station within a set time after the picker was energized. The signal remains on the line until the trouble has been cleared.

NOTES

NOTES

SECTION V MAINTENANCE

5.1 GENERAL

5.1.1 This section includes a guide to troubleshooting by suggesting areas of possible malfunction in the event of various trouble indications; as well as procedures for the removal and replacement of parts and adjustments. No regular maintenance procedures are required, other than periodically cleaning the pump filter, flushing the pump and general cleaning of exposed areas where card lint or dust may collect. Lubrication of this unit is not necessary. The vacuum pump is a dry, carbon vane oil-less type, while the bearings and other moving parts are permanently lubricated.

WARNING

Observe standard safety precautions for electrical equipment when performing the following procedures. Keep hands away from belts and pulleys whenever power is not safely disconnected.

5.2 TOOLS AND TEST EQUIPMENT REQUIRED

5.2.1 SPECIAL TOOLS

<u>Description</u>	<u>Part Number</u>	<u>Reference No.</u>
Vacuum Gauge	008015001	5.9.2
Extender Card	110063601	Electrical Adjustments
Height Gauge	008014200	5.9.4

5.2.2 ELECTRONIC TEST EQUIPMENT

Oscilloscope Dual trace tektronic 422 or equivalent

5.3 TROUBLESHOOTING

5.3.1 Many significant signals are available at the wirewrap terminals on the printed circuit card connector assembly. The logics are arranged on boards according to their functions. For effective diagnosing and fault isolation within the logic circuitry, the explanations in Section IV should be referred to.

5.3.2 LIGHT CURRENT ERROR. Any interruption of the light to the read station photocells, except while reading a card, will cause this indication; even during power on, before the start button has been depressed. Troubles to look for include an obstruction in the read station, burned out read station bulb, or a defective photocell. Trouble in the constant current source which supplies the read station, could cause the indication. Since the light current check is made at the output of the buffer, the logic control, timing circuitry and the buffer are involved. Note that a light current check is performed every time the column counter resets to \emptyset , except during the read mode.

5.3.3 DARK CURRENT ERROR. The read station is checked for proper operation of the photocells in their darkstate when the unpunched margins at the leading and trailing edges of the card pass the read station. This indication could be caused by a hole in the margin or a torn leading or trailing edge. Other than a defective photocell, a dark current error could occur due to a logic malfunction. The condition of the photocells are sensed by anding the outputs of R12-R9.

5.3.4 CARD MOTION ERROR. Theoretically, the reader measures the length of a card as it is processed. This detects not only a card of improper length, but

slippage or other malfunction in the transport of a card through the read station. When the trailing edge of the card is detected, the column counter should be at a count 82, with the clock counter at a count of 5. However, an error is not indicated if the EOC occurs within 5 counts (zero to 9th count), allowing a tolerances of ± 0.027 " in card motion over the entire length of a card. If the cards are within tolerance and the logic circuitry checks out, motion errors are usually due to maladjusted picker/reader components. The metering capstan pressure should be check as explained in 5.9.3. If this does not correct the malfunction, check all picker adjustments.

5.3.5 It may be necessary to observe the relationship of the EOC signal and the timing count on an oscilloscope, while processing cards, in order to see the exact effect of metering capstan pressure adjustment. This is done by first observing the signal at pin 3 of XA3. This signal is TC4, the 4th timing counter bit. The reader motor should be running, but not processing cards. Adjust the positive TC4 pulse so that it spans exactly 8 divisions on the oscilloscope. Each division will then correspond to one clock timing count, now change the probe to pin 10 of XA4. This signal is CC8253, which goes positive on the column count of 82 and low when EOC resets the column counter. Start processing cards. CC8253 should be positive for 5 divisions (5 timing counts) if EOC is occurring at the proper time. If the trailing edge of CC8253 occurs within 2 divisions of the proper timing count, it is considered acceptable. Lighter capstan pressure, such as might be caused by extensive wear, will cause EOC to occur later (toward the right). If it is over two divisions to the right, increase pressure a small amount, equally for the two plungers, (see paragraph 5.9.3 for mechanical adjustments). If EOC occurs more than two counts early, pressure should be lightened slightly. If a small change in pressure (1/8 turn each plunger) does not effect an early or

late EOC time, then either the capstans are extremely worn or maladjusted.

- 5.3.6 An additional check can be made at this time for skew. With the oscilloscope calibrated for one timing count per division, as previously set up, observe and compare detection of the leading edge while processing cards. There should be less than one division (timing count) difference between R11P and R9P. R12P is not used because of interferences from the cut corner of the card. In the same way, observe the trailing edge at these two photocells. Excessive skew is caused by differing capstan pressure or an incorrect mechanical adjustment on the picker.
- 5.3.7 PICK FAILURE. Repeated pick failures can be the result of defective cards (ie. grease, torn leading edges or crumpled cards). Jog and square up a deck exactly; inspect the side formed by the leading edges. This will show up small, consistent edge damage resulting from maladjusted pickers. Be sure that the bottom cards in the deck lie flat on the picker plate or that they do not 'bridge' between the picker throat block and the hopper. If greasy cards are the problem, refer to 5.6.2 for picker belt cleaning. When it is apparent that pick failures are not due to defective cards or improper loading, check the picker adjustments in 5.7.3. These will include picker solenoid adjustment, picker belt tension and vacuum relief valve.
- 5.3.8 Picker force is a combination of several adjustable factors within the picker mechanism, and is thus a good overall check of picker operation. This check is done with the reader operating. Attach a right anglegram scale to the reinforced end of a card in the hopper. With the reader running, manually actuate the solenoid and note the reading.

NOTE

Steady the hand and scale against the back of the hopper; be extremely careful not to allow the card to enter the picker throat where it would be gripped and pulled through by the capstans.

When the belts are pulling on the card, picker force should be 1 lb (456 gm $\pm 2\%$). Insufficient picker force indicates a malfunction or bad adjustment in the picker or vacuum supply.

- 5.3.9 VACUUM AND AIR PRESSURE. The following problems can cause variations from correct vacuum and air pressure resulting in consistent picker failure, when all other components are functioning properly.
- a. Dirty filter
 - b. Damaged jar thread or gasket
 - c. Collapsed, damaged, plugged or leaky hoses
 - d. Relief valve not adjusted or damaged
 - e. Pump belt slipping
 - f. Pump malfunctioning

5.4 COVER PANEL REMOVAL

- 5.4.1 Access to the interior of the reader is by raising the hinged cover. An interlock switch protects the operator from operating the reader when the cover is open. The cover can be completely removed by loosening the socket head screws which serve as pin hinges. To completely remove the panel, unplug the interface connector and loosen the four screws on the read panel. Unfasten the two, quarter— Turn fasteners in the upper corners of the power

supply panel and lower the panel to its opened position. All components are now readily accessible for inspection and servicing. Refer to Figures 5-1, 5-2, and 5-3.

5.5 CARD LINT

5.5.1 Clean accumulated card lint from the picker, hopper and stacker at least every 100 hours of operation. Brush lint away carefully around the read station.

5.6 CLEANING PICKER BELTS

5.6.1 Reoccurring picker failure is often the result of greasy cards. The picker belts should be cleaned with Freon TF at least every 100 hours of operation to prevent grease built up. The reader must be turned OFF for this procedure. Saturate a clean cloth with solvent and apply to a picker belt. Manually rotate the picker assembly, insuring that the entire surface of the belt is clean. Repeat this procedure for each of the four belts.

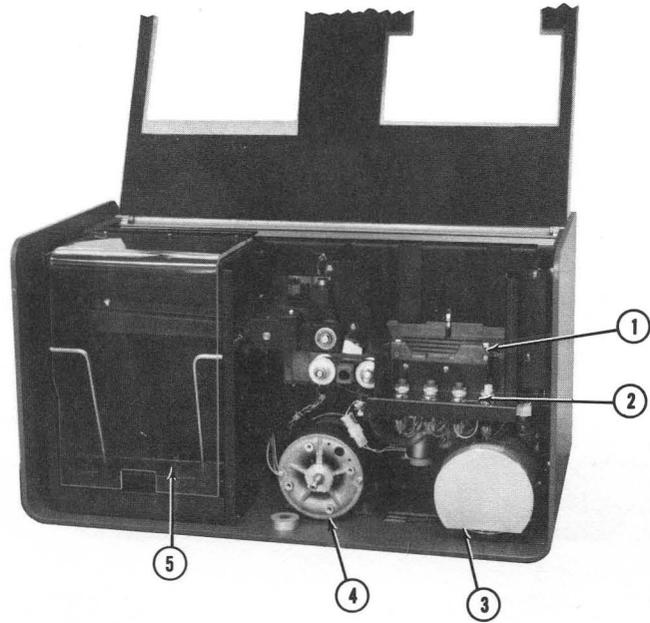
WARNING

Alcohol or carbon tetrachloride, formerly recommended as a solvent, is a hazardous substance and must not be used for this or any other such application.

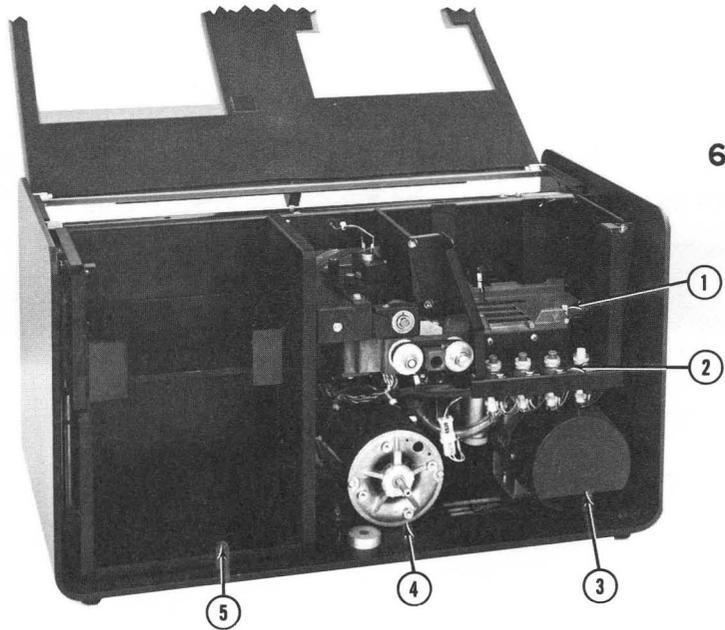
5.7 PUMP FLUSHING AND FILTER CLEANING

5.7.1 Pump flushing and filter cleaning for carbon vane pumps, is recommended every 100 operating hours. Frequent flushing is recommended and will not

6001/6002



6001A/6002A



Legend

- 1. Picker/Reader
- 2. Control Panel
- 3. Vacuum Pump
- 4. Drive Motor
- 5. Stacker

FIGURE 5-1 CARD READERS, COVER OPEN

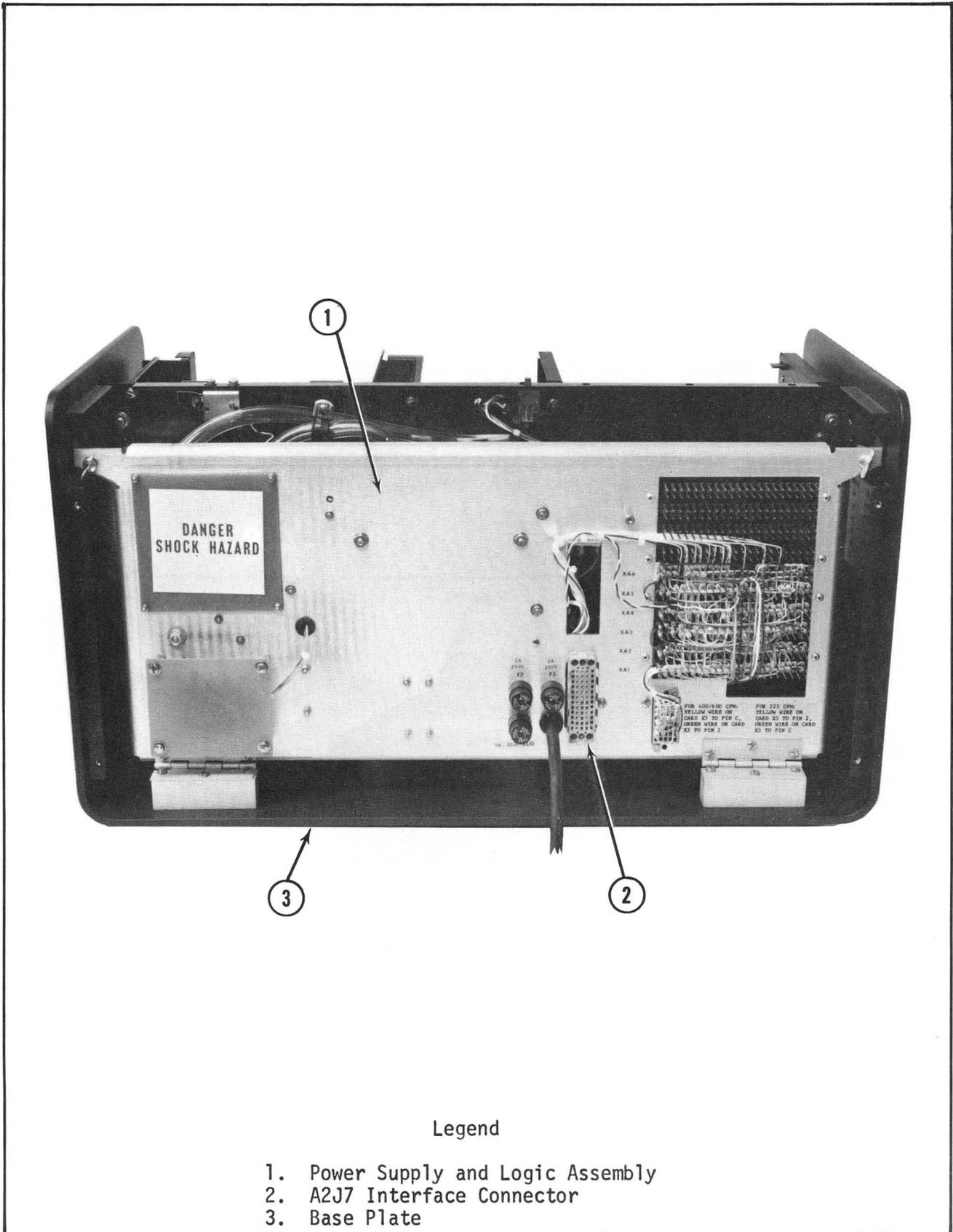
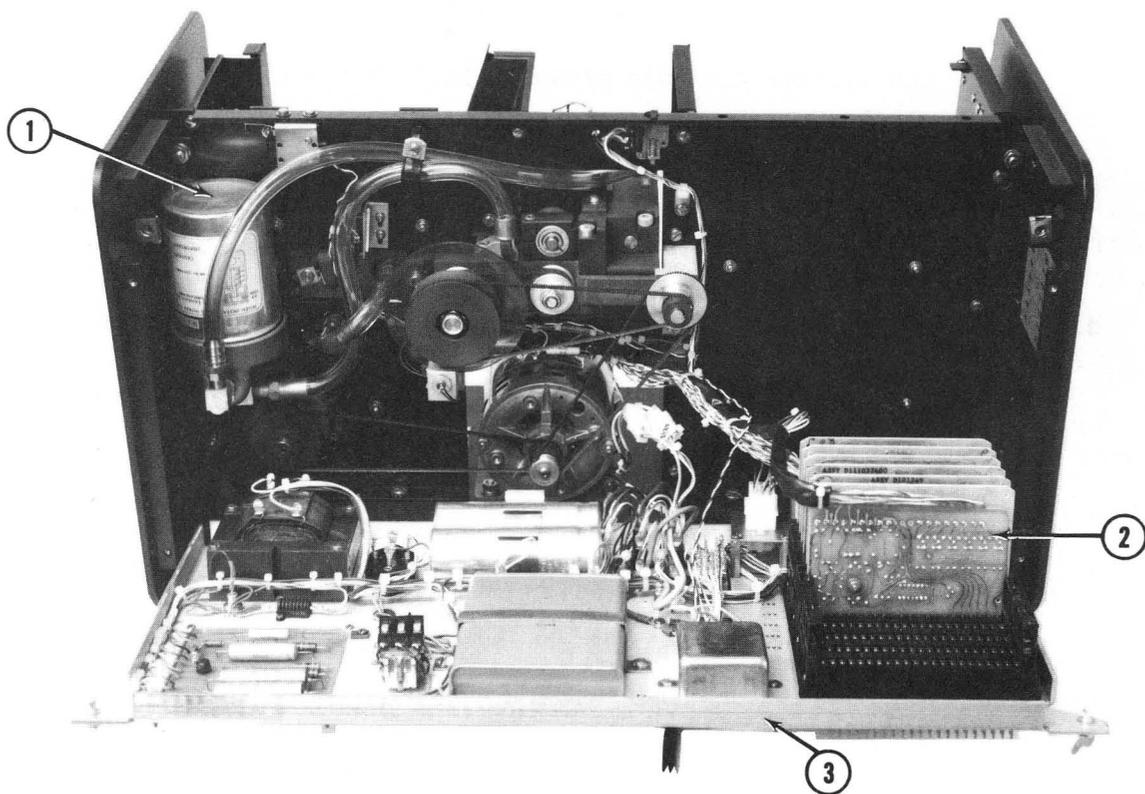


FIGURE 5-2 CARD READER, REAR VIEW 6002/6002A



Legend

1. Pump Filter
2. Logic Circuitry (Card Cage)
3. Power Supply and Logic Assembly

FIGURE 5-3 HINGED CHASSIS OPEN, 6002/6002A

harm the pump. Foreign matter or moisture will cause the vanes to stick in their slots and break. Use a Non-Flameable commercial solvent such as Freon TF. Do not use kerosene or any other petroleum based solvents. The filter element should be replaced with a new one at least twice yearly.

5.7.2 To flush the pump, proceed as follows:

- a. Remove the covers and open the panel.
- b. Pull the transparent vacuum hose (Figure 5-3) loose from the picker belt pusher manifold transition with the fingers.
- c. Detach the stacker manifold pressure hose at the muffler can. Plug the open fitting with a wad of paper or cotton. Unscrew the muffler can, remove the filter element and replace the can temporarily without the element.
- d. Pull the transparent pressure hose loose from the picker throat block tube. This is the hose from the pump output port, under the muffler can. Put the end of the hose in a container to catch the solvent as it runs through.
- e. Observe safety precautions when turning on the reader power and start motor.
- f. With the pump running, pour a small amount (1/2 oz.) of solvent into the vacuum hose. The fluid will pass through the pump, through the muffler can and out of the picker throat pressure hose. After all solvent has passed, flush again.
- g. Clean the filter element in solvent and allow to dry. Remove the muffler can, wipe dirt and solvent from inside the can and threaded castings with a clean dry cloth. Reinstall the filter and can.
- h. Replace the ends of the pressure and vacuum hoses on the belt pusher transition and throat block tube. Unplug the fitting and replace the stacker manifold pressure hose.

i. Replace panels and covers. Test the reader as in Section III.

5.8 PICKER, IDLER AND PUMP DRIVE BELT REPLACEMENT

5.8.1 To replace the belts, disconnect operating power and raise the cover, lower the power supply panel. Manually rotate the motor shaft, while gently pressing the belt out of the pulley groove. Install new belts in the same manner. Avoid stretching the belt.

5.8.2 DRIVE BELT TENSION. The picker idler and pump drive belts should be under sufficient tension to prevent slippage during operation. A properly tensioned belt deflects 1/8" to 3/16" under light (11b) finger pressure. To obtain correct tension of all belts, the motor should be mounted square with the pump and as close to the pump as possible. Tighten the motor and move the pump away from the motor to obtain correct tension. Insure that the pump and motor are still squared up. The two other drive belts (picker, idler) are adjusted for tension by means of a set screw in the idler roller support, which bears against the picker frame. This screw can be turned to square up the idler support and put tension on the belts at the same time.

5.9 PICKER/READER ADJUSTMENTS

5.9.1 The various adjustments to the picker and reader are given in the following paragraphs. These adjustments are required only when parts are replaced, or when various components are disassembled for repair. Picker belt tension can be adjusted only when the picker is removed from the reader panel.

5.9.2 VACUUM PUMP RELIEF VALVE

A throat vacuum should read 5 to 10 inch Hg. while picking. To check, use a 0.30 inch Hg vacuum gauge, connected to a short 3/8 inch ID plastic tee. Place the tee between the flexible hose and transition tube assembly. Take

the reading with the reader operating. If the reading is not within specifications, rotate the bottom nut located on the relief valve until a correct reading is obtained.

5.9.3 METERING CAPSTAN PRESSURE

- a. The metering capstans should apply a 2 lb (+1/4 lbs) pull to each edge of a card within 1/4 lbs of each other. To accomplish this, split a standard tab card lengthwise by cutting between card rows 3 and 4. Reinforce one end with masking tape on both sides, then punch a hole, through which the scale can be hooked. Use a right angle scale to check the capstan pressure if the picker/reader is mounted in the reader panel; if the unit has been removed from the reader, use a pull type scale. Insert the card strip lengthwise into the read station so that it is gripped by one capstan and idler. Holding the picker shaft pulley to prevent rotation, pull on the free end of the card with the scale. Measure the force required to start the card moving.
- b. To adjust the metering capstan pressure, turn the set screw over each idler arm. Clockwise to increase pressure counter clockwise to decrease pressure.

5.9.4 PICKER SOLENOID STROKE

- a. When the picker solenoid is electrically actuated, the picker belts should protrude through the slots in the picker frame 0.005" to 0.015" above the picker surface. The solenoid plunger travel should be 0.030" to 0.040". Insure that the solenoid plunger is centered on the bottom of the belt pusher. Next check the distance between the bumper (Figure 7-4-41) and the solenoid body with a feeler gauge. Then ground pin 18 of the current driver card (XA6) and apply power in the stop condition. This will electrically energize the solenoid. Measure the height of

the belts above the picker frame surface with a dial indicator gauge. If no gauge is available, the height should be less than half the thickness of a belt. Belts are approximately 0.035" thick.

- b. First insure that the jam nut on the plunger is not contacting the solenoid body when the solenoid is at rest. To adjust the plunger travel, bend down or up, the stop on the bottom of the solenoid bracket (figure 7-2-46), until the correct distance is obtained between the bumper and the solenoid body. Next loosen the jam nut (-AR) with a 5/16" wrench. Now, with the solenoid held in the actuated position, turn the hexagonal plunger extension (-44) using a 1/4" wrench, to raise or lower the belts. After tightening the jam nut, recheck the adjustment.

5.9.5 FRONT CARD GUIDE

- a. The outboard tab on the front card guide should clear the outboard card edge by 0.005" to 0.007". Place a card in the picker and manually turn the motor shaft to transport the card halfway through the read station. Do not stop or turn the shaft in reverse as this will upset the measurement. Using a small mirror, visually estimate the clearance. For comparison, a standard tab card is approximately 0.007" thick. To adjust, loosen the two attaching screws and reposition the guide as required; tighten the screws and recheck.

5.9.6 TIMING PHOTOCELL

- a. The output of the timing photocell should show clipping which does not vary more than 2:1 from symmetrical. The peaks should be approximately 0.2 volts (light) to 1.8 volts (dark). This will vary slightly between readers.
- b. To check, connect an oscilloscope set at 1 ms/cm, 5V p/cm, AC and Sync., internal trigger, on pin P of the card cage connector XA5, and return to

DC ground. This pin is the terminal of timing photocell lead. Turn on the reader and observe the wave form produced. To adjust (power off), loosen the photocell set screw in the mounting block and rotate the photocell, keeping the clearance between the cell and the timing disk approximately 0.015" (two tab card thickness). This distance is adjustable and is set by a collar and set screw at the rear of the photocell. Power on, and adjust the cell for maximum clipping, as evidenced by flattened peaks on the oscilloscope trace. This will occur when the reticle on the photocell is parallel to the radical lines on the disk. Tighten the set screw with light finger pressure. Then loosen the lamp set screw and move the lamp in or out for best symmetry of the waveform. Tighten the set screw with finger pressure. Insure the photocell is clean if approximate voltage can not be reached.

5.10 REMOVAL AND REPLACEMENT

5.10.1 In most cases, the removal and replacement procedures are straightforward and simple. The following paragraphs will give assistance in cases where procedures may not be self-evident.

5.10.2 READ STATION LAMP

- a. The plastic tipped locking screw is only finger tight. Loosen this screw, remove the leads, and unscrew the lamp. When replacing the lamp, screw it in just until the glass touches the rubber washer in the mounting block. Then tighten the locking screw with the fingers.

5.10.3 READ STATION LIGHT SOURCE ASSEMBLY

- a. This assembly is held in place by the two captive fasteners. Use fingers to release and tighten them. When replacing the assembly, position it with the locating pin in the slot and butt the assembly snugly against

the stacker end of the picker frame while tightening.

5.10.4 READ STATION PHOTOCCELL ASSEMBLY

- a. To remove this assembly, loosen two screws and unplug the connector A2J8, below the card cage. The cover glass of the light divider is very thin and fragile when exposed. When replacing the photocell assembly, insert it to engage the locating pin of the picker frame in the slot, butting the assembly snugly against the stacker end of the picker frame while tightening the screws.

5.10.5 COVER GLASS REPLACEMENT

- a. Remove the photocell assembly and remove damaged glass and adhesive remnants with a single edged razor blade. Be sure the apertures are clear of debris. Apply a thin layer of Eastman 910 adhesive on each side of the recess, away from the apertures. Set the new cover glass in place and rub with cotton or cloth to press the glass in place. Be sure no adhesive was squeezed into the light apertures. Edges of the cover glass must not protude above the adjacent surfaces of the assembly face. Allow adhesive to set for a few minutes before re-installing.

5.10.6 PHOTOCCELL BOARD REPLACEMENT

- a. Remove the photocell assembly, and loosen the six screws. Slide the photocell board, insulator and gasket from the holder. When replacing, tighten the six screws uniformly to seal the board assembly in the holder.

5.10.7 CONTROL PANEL AND HOPPER ASSEMBLY

- a. Open the power supply panel and separate the two connectors A3P1 and A3J2. These are the power switch and picker solenoid connectors. Unplug the current driver card (A6) from the card cage. Unscrew the muf-

fler can, and loosen the four screws which attach the left and right hopper sides to the main panel. Remove the two screws attaching the control panel to the front surface of the picker frame. Lift out the hopper and control panel as a unit. Work the current driver card and cable through opening in the panel. Do not disassemble the hopper sides from the control panel unless they are out of adjustment. If adjustment is necessary, the left side should be positioned toward the stacker as far as possible, with the lower end against the picker throat block. The right side must be positioned so that the lower end, adjacent to the picker frame, is one card length (7 3/8") plus 0.010" to 0.025" from the face of the picker throat block.

5.10.8 PICKER AND READER ASSEMBLY REMOVAL

- a. The picker and reader assembly should be removed only if required for such maintenance as picker belt replacement, or capstan and idler replacement. Removing this assembly disturbs several adjustments which are dependent on the exact picker frame to main panel relationship. Scribe the location of the picker at the front and rear of the main panel before loosening the three mounting screws. When installing the assembly back into the reader, used the scribe marks for proper alignment.
- b. Remove the control panel and hopper assembly as above.
- c. Remove the read station light source assembly and the read station photocell assembly (5.10.3, 5.10.4).
- d. Remove the plastic tube from the throat vacuum transition.
- e. Remove the spring between the belt pusher and the solenoid bracket.
- f. On the rear of the panel, remove the vacuum tube from the belt pusher. Note that there is a restrictor plug in this tube, which regulates the vacuum.
- g. Loosen the setscrew in the throat block, and pull out the right angle

pressure tube (figure 7-2-4).

NOTE

Be especially careful during this and the following steps, not to scratch or chip the timing disk. The emulsion is on the side toward the rear of the reader, and is easily scratched.

- h. Rotate the picker manually, guiding the picker belt off the picker shaft pulley with the fingers. Also remove the idler belt in the same way.
- i. Remove the inboard (rear) picker shaft end nut (AK). The front nut which remains on the shaft, is held by staking compound. The timing disk is now loose on the shaft. Slide the picker belt pulley off the end of the shaft.
- j. Remove the three socket head screws attaching the picker frame to the panel. Next slide the picker out the front of the panel while supporting the timing disk and hub. The edge of the timing disk will remain in the photocell bracket until the shaft is pulled out.
- k. The picker is replaced in reverse of the above steps. Try to reposition the picker in exactly the same location on the panel. Position the stacker end of the picker snugly against the idler support set screw, with the idler roller 0 to 0.025" above the surface of the card track. The hopper empty switch actuator wire must be clear of its slot in the picker frame. Reposition the rear of the picker frame using the scribe marks. The emulsion (dull) side of the timing disk and drive pulley, torque the end nuts to 10 ft. lbs. It will now be necessary to recheck

all adjustments to the reader, especially the solenoid adjustment.

1. If a new picker is being installed, be sure to check for and remove packing material, specifically the wedges which support the idler cams to prevent flats from developing on the idler rollers.

5.10.9 PICKER BELT REPLACEMENT

- a. In order to replace the picker belts, it is necessary to follow the procedure listed in 5.10.8 first. Refer to figure 7-2 when following this procedure.
- b. Remove the two attaching screws and lift off the heat shield (47).
- c. Loosen the two setscrews (CW) and slide out the pivot shaft (38).
- d. Loosen the spring loaded plungers (BG), and slide out the main shaft (16), which will permit the capstan belts, pulleys, and picker belt driver roller to come free.
- e. Slide the belt pusher (37) and belts, with the rear (idler) roller (23) out the back of the picker frame. It is not necessary to disturb the position plate (26) adjustment.
- f. Remove the outside belts, then remove the two inside belts by passing them through the pusher pivot arms.
- g. Now belts must be installed in a matched set of four. Lay two belts inside the belt pusher arms, and group the picker drive roller, belt pusher, and picker idler roller assembly inside the two belts, in working position. Then add the two outside belts. Note that the pusher pivot arms are below the idler roller assembly.
- h. Place the picker frame on its back. Lift the group of parts assembled above, turn them over, and lay into place. The sliders of the picker idler roller slip into the two square grooves at the rear of the picker assembly.
- i. Install the pivot shaft (38) to position the belt pusher. Check that

the setscrew grooves line up properly, then tighten the two setscrews (CW).

- j. Insert the main shaft through the outboard pulley (17), with the belt (18) in position around the pulley, and slide it through the bearings (19) which remained in the picker frame. Pick up the spacer (20) being sure the bevel is toward the bearing, then the drive roller (40), the inboard spacer (20), and pass the shaft through the inboard bearing which is held captive in the picker frame.
- k. Position the belt (18) over the inboard pulley (17), and slide the shaft all the way through.
- l. Adjust the picker belt tension as explained in 5.10.10.
- m. Replace the heat shield (47). After the picker belt tension is properly adjusted, the picker is ready to reinstall in the panel. All picker adjustments are then required.

5.10.10 PICKER BELT TENSION ADJUSTMENT (picker removed from reader).

- a. Picker belt tension should be within 4 lbs. to 6 lbs at each spring loaded valier plunger, and alike within 1/4 lbs. To check, press the probe of a push type spring loaded scale against each valier plunger. Press until a small movement of the white nylon slide block is noted. Read the scale at this point. Repeat for each side. To adjust, use an allen wrench to rotate the plunger screws in the slider blocks. Clockwise to increase tension, counter clockwise to decrease tension.

5.10.11 READ STATION IDLER ROLLER REPLACEMENT

- a. The idler rollers are mounted on the ends of swing arms (Figure 7-2-14, 12). Adjustable spring loaded valier plungers bear on the arms to press the idlers against the metering capstans. The idlers and the swing arms are mounted in a support block (5) which is bolted to the picker frame at one side by two bolts. During factory assembly, this block is aligned

to be perpendicular to the inboard card guide surface of the picker frame to within ± 0.001 ", as the bolts are tightened. It is recommended not to loosen the bolts or disturb this relationship since any maintenance likely to be required can be performed with the reader assembled. The following procedures are performed with the picker and reader assembly removed from the panel as in paragraph 5.10.9.

1. Relieve the pressure on the arms by loosening the spring loaded plungers (BF)
2. Remove the shaft retainer rings (BH). The idler and shaft (13) can now be removed from inside the swing arms.
3. When replacing, the idler roller pressure must be adjusted as given in 5.9.3.

5.10.12 METERING CAPSTAN REPLACEMENT

- a. The picker/reader assembly must be removed from the reader (5.10.9) to replace the metering capstans. Do not remove the support block (Figure 7-2-5) from the main assembly.
- b. Two holes are provided in the capstan faces (2) in which to insert a spanner so that the shaft end nuts (AL) can be removed.
- c. Hold the soft idler roller away from the metering capstan and tap lightly on the metering capstan shaft with a plastic faced hammer. Metering capstan and shaft can be withdrawn through the opening where the read station photocell were. Note the location of shims and washers, to insure reinstalling them in the same position.
- d. When reassembling the capstan drive rollers and shafts into the reader, hold the belts and pulleys loosely in position while pressing the shafts through the bearings with the fingers. Torque the shaft end nuts at 6 ft. lbs., while holding the capstans with a spanner in the slots provided, to prevent rotation.

- e. Before remounting the picker/reader assembly, adjust the metering capstan pressure (5.9.3).

5.10.13 PICKER THROAT BLOCK ADJUSTMENT

- a. The picker throat adjustment can be made with the picker/reader assembly on or off the reader. The throat clearance should be 0.009" to 0.011". If not, adjust the three allen screws located on the top of the throat block assembly. Insure that the measurement is equal the complete length of the throat block.

5.11 VACUUM PUMP REPAIR

- 5.11.1 The vacuum pump uses dry oil-less vanes made of hard carbon, which will last up to 5,000 hours depending on speed and degree of vacuum. Excessive dirt, foreign particles, oil, or moisture would cause the vanes to stick in the rotor slots or break. Periodic flushing, as explained in paragraph 5.7, will prevent this.
- 5.11.2 When running continuously, pump temperature can reach 150° 250° without harm. However, excessive heating or noise requires that the pump be stopped immediately for repair.
- 5.11.3 To replace the vanes or inspect the pump interior, remove only the dead end plate (opposite the drive shaft end). The retainer ring is under tension. First remove the end plate bolts and use a standard gear puller to remove the dead end plate and bearing assembly. Do not disturb the drive end plate. Insert the new vanes with the beveled edge fitting the contour of the body bore. Turn the pump to a vertical position, drive shaft end down. Replace the dead end plate and end plate bolts finger tight (end plate should be free to move). Insert the rubber deflector over the bearing shoulder on the bearing (on inner race only) until it bottoms on the shaft shoulder. An

arbor press is recommended. Replace dowel pins and tighten the end plate bolts. Install the belleville springs, washer, and retainer rings. Check for free rotor movement by turning it by hand. If interference is detected, the rebuilding procedure was not correctly followed.

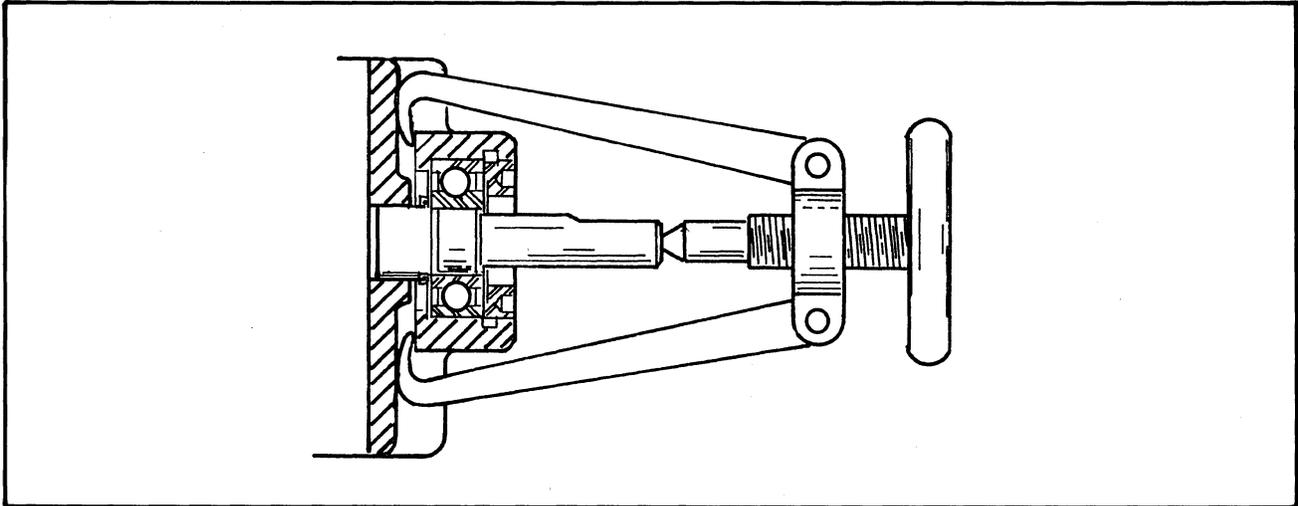


FIGURE 5-4 GEAR PULLER PLACEMENT

5.12 STACKER BIN AND ELEVATOR

5.12.1 The left side plate of the stacker bin supports the elevator platform spring and a pneumatic dashpot which cushions the return of the elevator when cards are removed. In readers equipped for both 80 and 51 column cards, there are two springs. One is selected by lifting the platform and positioning the 80/51 column stacker lever.

5.12.2 The entire left side plate assembly can be removed as a unit by removing the screw which attaches the base spacer bar to the right side plate, and removing the three 6-32 x 3/8 bhm screws which fasten the left side plate assembly through the rear of the main panel. If removing or inserting this assembly, be careful not to damage the wire actuator for the stacker full switch with the platform end roller which rides in the right side plate slot.

- 5.12.3 Spring tension is correct when the empty elevator platform rests approximately 1/4" below its maximum high point of travel. The adjustment can be made by repositioning the spring hanger wire.
- 5.12.4 Two screws at the top mounting of the platform slide rod can be loosened in order to position the rod parallel with the platform end slot in the side plate. Move the platform to the extremes of travel to check that there is no interference between the bearing end of the platform and the slot.
- 5.12.5 The two card end guides are attached to the side plates with 3/32" Allen head screws. If necessary, loosen the attaching screws and reposition the card toward the front of the reader to provide more clearance for cards entering the elevator. There must be 0.030" clearance for a card in the stacker both endwise and edgewise.
- 5.12.6 Position of the stacker jet manifold is not critical. It should be flush with the face of the right side plate and toward the top of the plate opening.
- 5.12.7 The stacker full switch should actuate with from 500 to 600 cards on the elevator, depending on the punch data density. Adjust when required by loosening the mounting screws and repositioning the switch; not by bending the actuator wire.

NOTES

SECTION VI CIRCUIT DIAGRAMS AND LOGICS

6.1 GENERAL

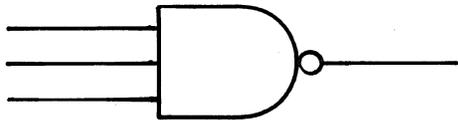
6.1.1 This section contains circuit card assemblies, component breakdown, logics and wiring diagrams. Table 6-1 lists the drawings, the particular unit they pertain to and the page on which they appear.

TABLE 6-1 DRAWING INDEX

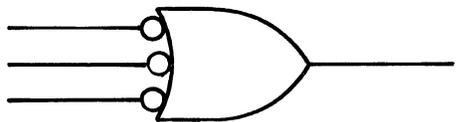
PART NUMBER	DESCRIPTION	PAGE
110110200	AND - INVERT - 12	6-3
110100001	FF 12	6-4
110117900	Counter	6-6
111037400	Count Decoder	6-7
110124900	Reader Control	6-8
111037301	Connector	6-9
111138300	Interconnect Block Diagram (6002, 6002A)	6-11
111052300	Logic Diagrams (6002, 6002A)	6-12 thru 6-20
110151700	Chassis Wiring Schematic	6-21
110154601	Power Supply Schematic	6-22
110151800 Sh. 1	Current Driver Schematic	6-23
110151800 Sh. 2	Control Panel (6002, 6002A)	6-24
111160900	Interconnect Block Diagram (6001)	6-25
110228900	Chassis Schematic	6-26

6.2 LOGIC SYMBOLS

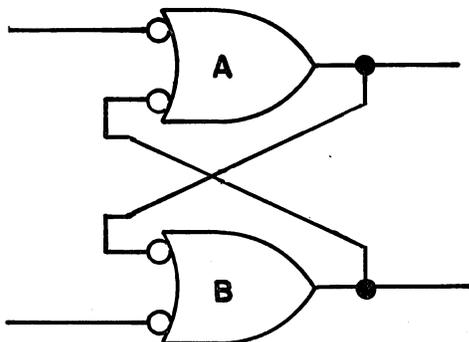
6.2.1 The following is a description of the types of symbol legend, used in this manual.



NAND Gate
All inputs must be high "ANDED" for a low output.



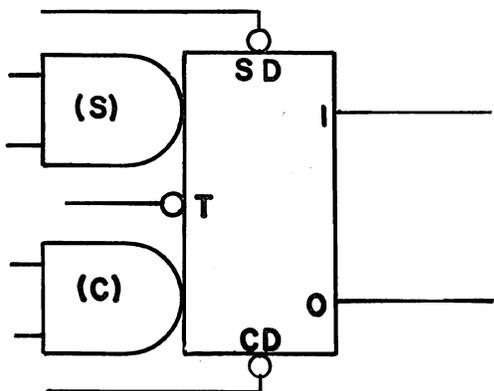
NOR Gate
Any one input low produces a high output.



Cross Connected NOR Flip-Flop (FF).

Low input to (A), output of (A) high, output of (B) low.

Low input to (B), output of (B) high, output of (A) low.

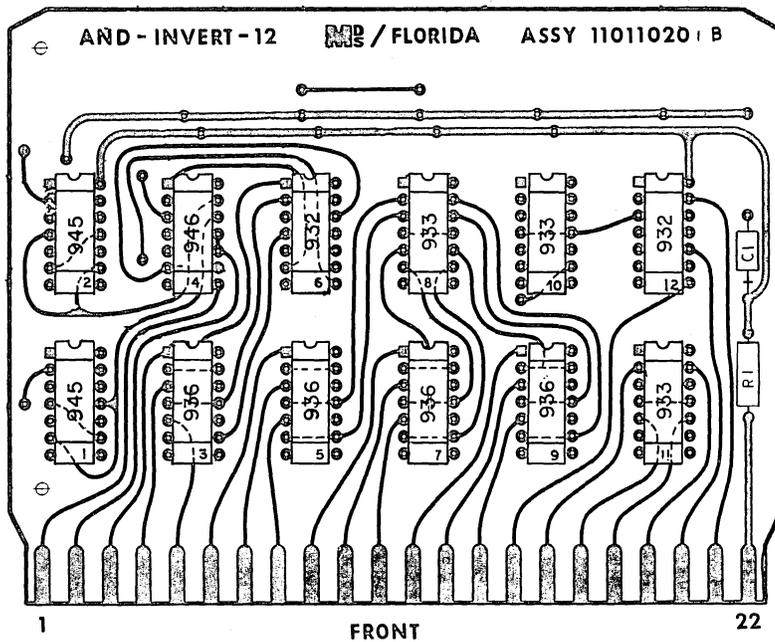


JK Flip-Flop (FF)

Both inputs to (S) high, a low to "T" will set the "1" terminal high and "0" terminal low. Both inputs to (C) high, a low to "T" will reset the "0" terminal high and the "1" terminal low.

A low input to "SD" will set the "1" terminal high and "0" terminal low. A low input to "CD" will reset the "1" terminal low and "0" terminal high.

LOGIC SYMBOLS LEGEND



NOT USABLE		USABLE	
Revision(s)	Update With	Revision(s)	P.C.N.#

INPUTS	
SIGNAL NAME	PIN
CLK	A
CL12	20
CL11	21
CL10	X
CL1	Y
CL2	16
CL3	17
CL4	T
CL5	U
CL6	18
CL7	19
CL8	V
CL9	W
RT2P	3
RI1P	4
RI0P	5
RT1P	6
R2P	7
R3P	8
R4P	9
R5P	10
R6P	11
R7P	12
R8P	13
R9P	14

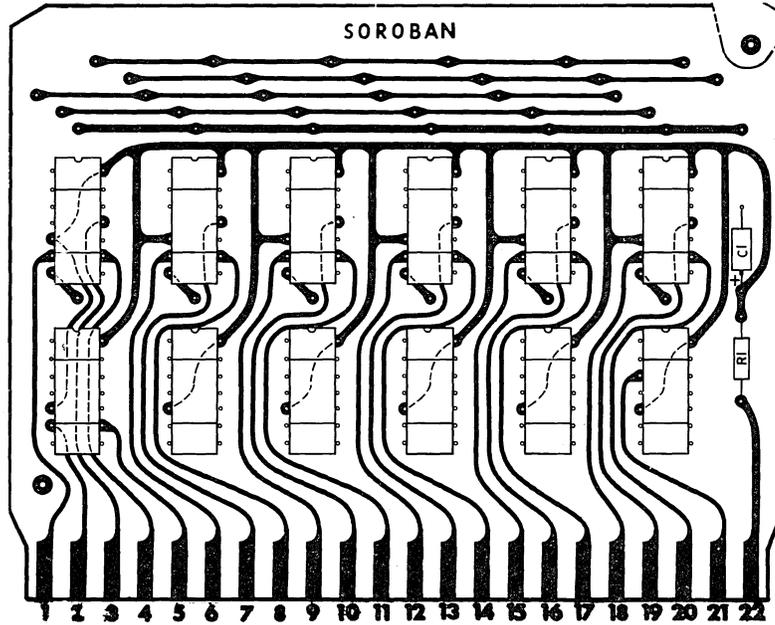
OUTPUTS	
SIGNAL NAME	PIN
RI2	C
RI1	D
RO	E
RI	F
R2	H
R3	J
EOC	B
BOC	I
R9	R
DCC	S
LCC	15
R4	K
R5	L
R6	M
R7	N
R8	P
R9	R

POWER PIN
+5.5V 22
GRD Z

FIND NO.	PART NO.	DESCRIPTION
C1	134006101	Cap., Fxd., Elect, 4.7 MFD, 10V
IC1, 2	261011001	Integrated Circuit Module
IC3, 7, 9	261010201	Integrated Circuit Module
IC4	261010401	Integrated Circuit Module
IC6, 12	261010101	Integrated Circuit Module
IC8, 10, 11	261010801	Integrated Circuit Module
R1	387000001	Res., Fxd, Comp. 2.7 ohms, 1/4W, 5 Pct.

Refer to page 6-13 for schematic

LOCATION		
 MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE P.C. CARD SCHEMATIC & ASSY, AND INVERT - 12		
DATE 7/10/70	REV. C	DRAWING NO 1101102



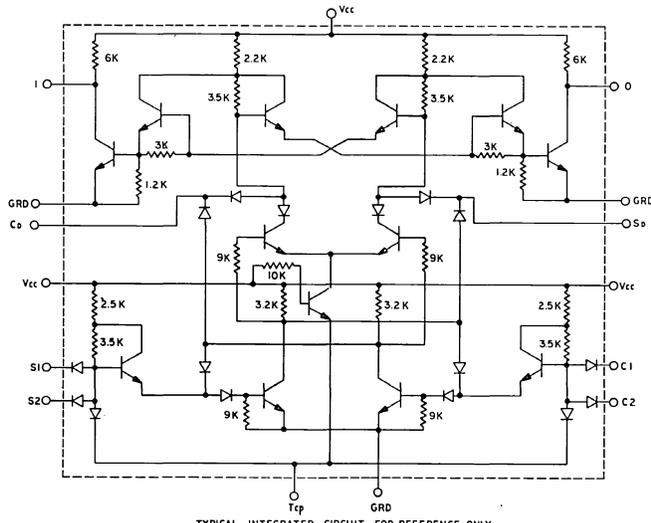
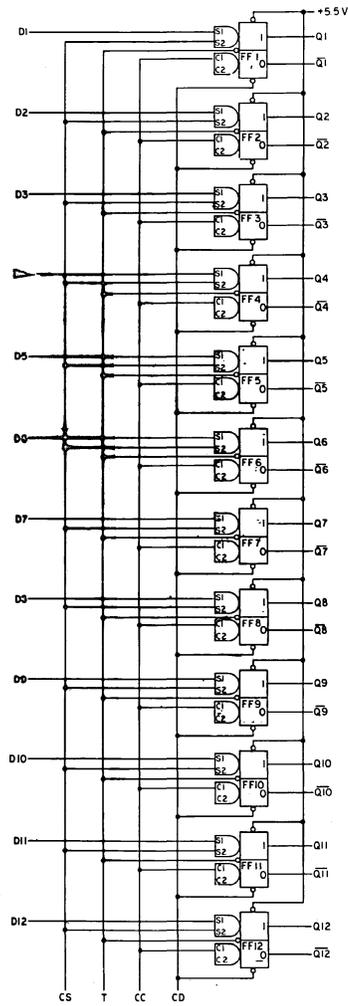
NOT USABLE		USABLE	
Revision(s)	Update With	Revision(s)	P.C.N.#

POWER PIN
 + 5.5V 22
 GRD Y

FIND NO.	PART NO.	DESCRIPTION
C1	134006101	Cap., Fxd, Elect, 4.7 MFD, 10V
ICA-N	261011001	Integrated Circuit Module
R1	387000001	Res., Fxd, Comp. 2.7 ohms, 1/4W 5 Pct.

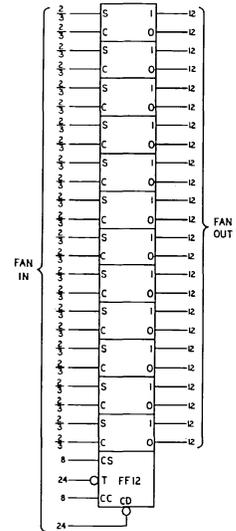
Refer to page 6-14 for schematic

LOCATION		
MS MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE		P.C. CARD SCHEMATIC & ASSY, FF - 12
DATE	REV.	DRAWING NO
	C	1101000

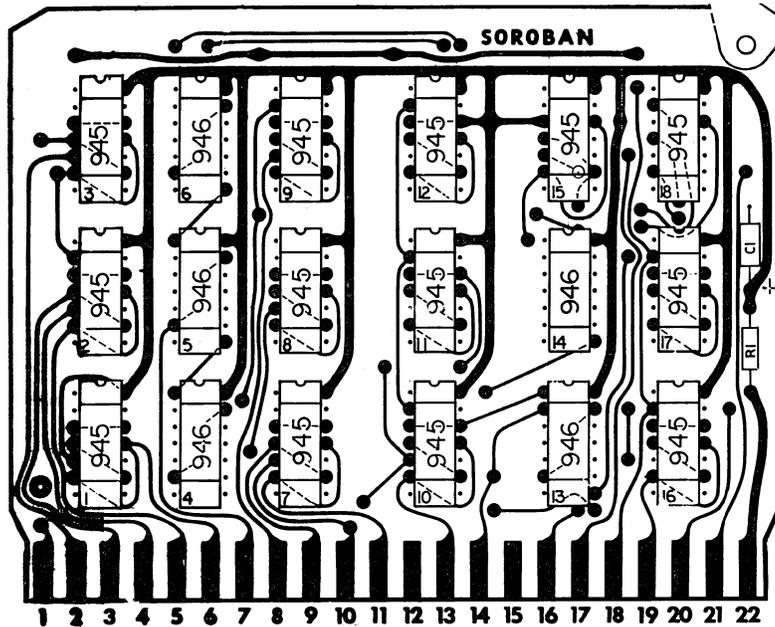


TYPICAL INTEGRATED CIRCUIT FOR REFERENCE ONLY

FLIP FLOP	S	CC	O	I	CS	T	CD
1	3	21	1	4	X	A	B
2	C	21	2	5	X	A	B
3	7	21	6	B	X	A	B
4	F	21	D	F	X	A	B
5	10	21	9	11	X	A	B
6	L	21	J	K	X	A	B
7	13	21	12	14	X	A	B
8	P	21	M	N	X	A	B
9	16	21	15	17	X	A	B
10	T	21	R	S	X	A	B
11	19	21	18	20	X	A	B
12	W	21	U	V	X	A	B



DRAWING NO
11010001



NOT USABLE		USABLE	
Revision(s)	Update With	Revision(s)	P.C.N.#

INPUTS	
SIGNAL NAME	PIN
CCR	4
CCR	10
CCR	S
CCR	C
CCR	H
PCR	17
PCC	16
CLK	18

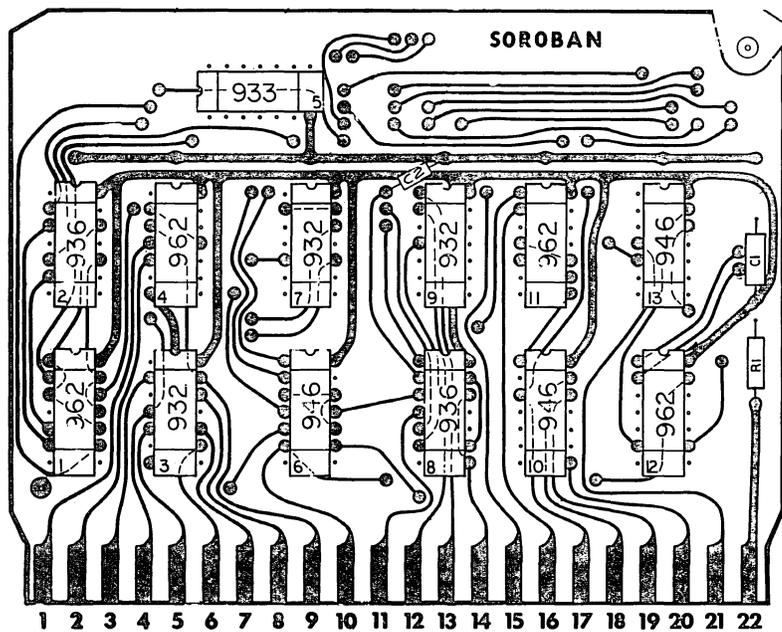
OUTPUTS	
SIGNAL NAME	PIN
TC1	R
TC2	I
TC3	L
TC4	3
CC1	J
CC2	B
CC3	9
CC4	14
CC5	X
CC6	Y
PC1	Y
CC7	0
CC7	N
PC2	21
PC2	W
PC1	U
CC6	20
CC5	19
CC4	13
CC3	11
CC2	6
CC1	K
TC4	5
TC3	M
TC2	A
TC1	T

POWER PIN
+5.5V 22
GND Z

FIND NO.	PART NO.	DESCRIPTION
C1	134006101	Cap., Fxd, Elect, 4.7 MFD, 10V
IC1-3, 7-12, 15-18	261011001	Integrated Circuit Module
IC4-6, 13, 14	261010401	Integrated Circuit Module
R1	387000001	Res., Fxd, Comp. 2.7 ohms, 1/4W 5 Pct.

Refer to page 6-15 for schematic

LOCATION	
 MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.	
TITLE P.C. CARD SCHEMATIC & ASSY, COUNTER	
DATE	REV. DRAWING NO C 1101179



NOT USABLE		USABLE	
Revision(s)	Update With	Revision(s)	P.C.N.#

INPUTS	
SIGNAL NAME	PIN
CC5	5
CC7	3
CC1	9
CC3	8
CC4	7
CC6	6
CC2	4
CC5	2
CC7	1
CC2	D
CC3	E
CC4	F
CC6	H
CC1	15
S51COL	M

INPUTS	
SIGNAL NAME	PIN
TC1	V
CLK	13
TC1	12
READ	P
TC2	T
TC3	U
TC4	17
TC5	19
TC4	21
EDC	16
TC4	L
TC2	J
TC3	K
STP	18
TC1	V

OUTPUTS	
SIGNAL NAME	PIN
CC00	B
TC00	C
STR	11
CIB	14
CC124	A
TCFER	N
DS	W
CC8253	P
CC8253	10
S*10N	20
GEDC	S

POWER PIN
+5 5V 22
GRD Y

Refer to page 6-16 for schematic

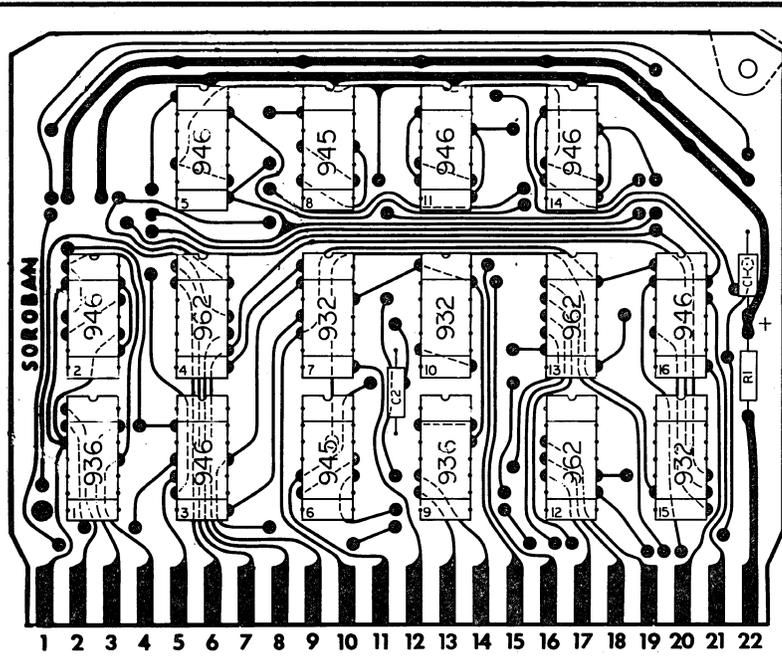
LOCATION

MD MOHAWK DATA SCIENCES CORP.
HERKIMER N.Y.

TITLE P.C. CARD SCHEMATIC
& ASSY, COUNT DECODER

DATE	REV.	DRAWING NO
6/26/70	D	1110374

FIND NO.	PART NO.	DESCRIPTION
C1	134006101	Cap., Fxd, Elect, 4.7 MFD, 10V
C2	134000004	Cap., Fxd, Ceramic, 100PF, 100V
IC1, 4, 11, 12	261011301	Integrated Circuit Module
IC2, 8	261010201	Integrated Circuit Module
IC3, 7, 9	261010101	Integrated Circuit Module
IC5	261010801	Integrated Circuit Module
IC6, 10, 13	261010401	Integrated Circuit Module
R1	387000001	Res., Fxd, Comp. 2.7 ohms, 1/4W 5 Pct.



NOT USABLE		USABLE	
Revision(s)	Update With	Revision(s)	P.C.N.#

INPUTS	
SIGNAL NAME	PIN
PC1	1
PC2	4
SSRT	16
PCR	L
CLIZ1	5
R	Y
READ	3
CC00	T
LCC	5
SSTP	15
CC8253	6
TC15	7
DCE	X
CME	J
LCE	P
TRC	14
READ	B
PICK FAIL	E
HE	9
BOC	H

INPUTS	
SIGNAL NAME	PIN
STP	D
CLK PC	P
MSRT	21
TOJR	8
POP	11
CC4	17
CC5	18
SCCN	U
GEOC	10
DSE	12
DCC	V
CC00	W

OUTPUTS	
SIGNAL NAME	PIN
PICK	2
STP	C
STP	D
READ	3
READ	B
CME	J
PF	E
LCE	R
TRF	F
IHE	20
IOJ	13
RDY	A
PCC	N
CCR	12
R	Y
MO.R	M
PCR	L
TCR	3
CLK	K
DCE	X
IPF	E

POWER PIN
+5.5V 22
GRD Z

Refer to page 6-17 for schematic

LOCATION

MDS MOHAWK DATA SCIENCES CORP.
HERKIMER N.Y.

TITLE P.C. CARD SCHEMATIC &
ASSY, READER CONTROL

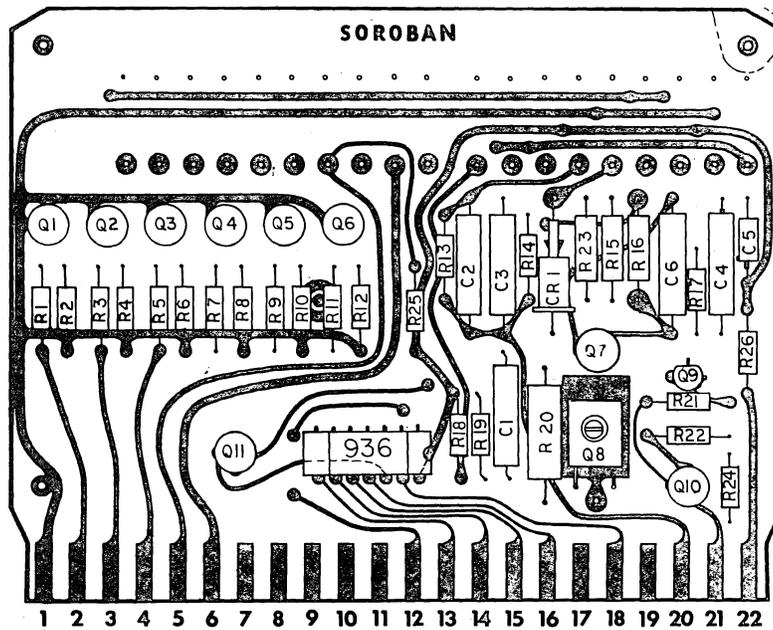
DATE

REV.
C

DRAWING NO

1101249

FIND NO.	PART NO.	DESCRIPTION
C1	134006101	Cap., Fxd, Elect. 4.7 MFD, 10V
C2	134005805	Cap., Fxd, Plastic, 0.0047 MFD, 100V
IC1, 9	261010201	Integrated Circuit Module
IC2, 3, 5, 11, 14, 16	261010401	Integrated Circuit Module
IC4, 12, 13	261011301	Integrated Circuit Module
IC6, 8	261011001	Integrated Circuit Module
IC7, 10, 15	261010101	Integrated Circuit Module
R1	387000001	Res., Fxd, Comp., 2.7 ohms, 1/4W 5 Pct.



NOTE

Refer to parts list on page 6-10

NOT USABLE		USABLE	
Revision(s)	Update With	Revision(s)	P.C.N.#

INPUTS	
SIGNAL NAME	PIN
STP	D
STP	C
CME	4
DCE	3
MSRT	5
LCE	2
SSRT	X
TO MOTOR	E
PICK	18
PF	B
SSTP	20
PF	V
PF	T
READ	R
RDY	14
RDY	16
MOTR	12

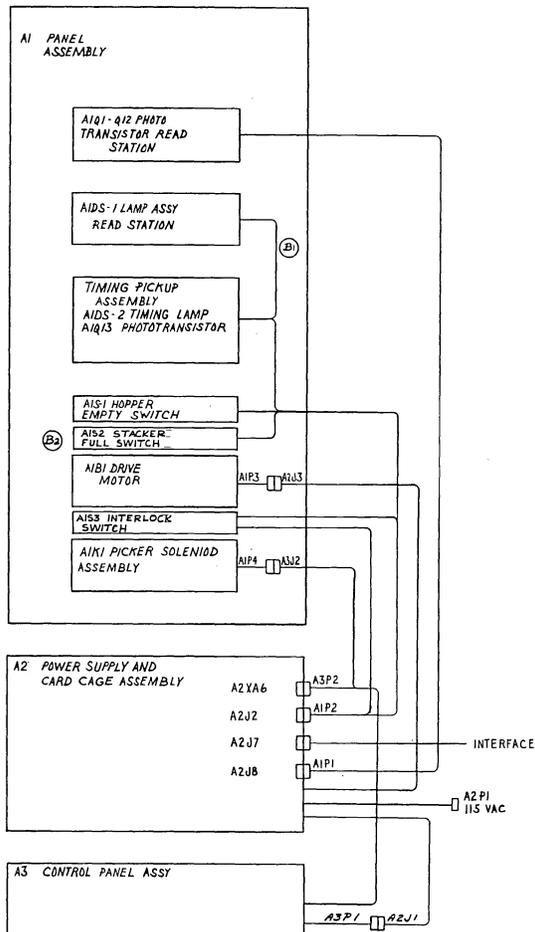
OUTPUTS	
SIGNAL NAME	PIN
STP	6
STP	5
PF	4
CME	3
DCE	2
LCE	1
(CABLE)	14
	11
	13
	12
	19
	18
	17
	9
	10
	7
	8
	16
(CABLE)	15
FOR	21
PF	U
TPF	5
ICIR	P
TRDY	13
RDY	15

POWER	PIN
+12V	1
-12V	A
+5.5V	22
GND.	Z

Refer to connector page 6-18

LOCATION		
 MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITTLE P.C. CARD SCHEMATIC & ASSY, CURRENT DRIVER		
DATE	REV.	DRAWING NO
7/10/70	E	111037301

FIND NO.	PART NO.	DESCRIPTION
CR1	167000901	Semiconductor Device, Diode
C1, C2	134005808	Cap., Fxd, Paper, 0.01 MFD, 100V
C3	134005804	Cap, Fxd, Plastic 0.0033 MFD, 100V
C4	134202024	Cap, Fxd, Elect, 0.39 MFD, 35V
C6	134005806	Cap, Fxd, Plastic, 0.005 MFD, 100V
C5	134006101	Cap, Fxd, Elect, 4.7 MFD, 10V
ICA	261010201	Integrated Circuit Module
Q1-Q7	436404001	Transistor
Q8	436001501	Transistor
Q9	436000801	Transistor
Q10	436002101	Transistor
Q11	436000501	Transistor
R1, 3, 5, 7, 9, 11	387000042	Res, Fxd, Comp. 6.8K ohms, 1/4W 5%
R2, 4, 6, 8, 10 12	387000029	Res, Fxd, Comp. 560 ohms, 1/4W, 5%
R13	387000056	Res, Fxd, Comp. 100K ohms, 1/4W, 5%
R14, 18, 19	387000044	Res, Fxd, Comp. 10K ohms, 1/4W, 5%
R15, 23	387000032	Res, Fxd, 1K ohm, 1/2W, 5%
R16	387000033	Res, Fxd, Comp. 1.2K ohms, 1/2+, 5%
R17	387000068	Res, Fxd, Comp. 1 megohms, 1/4W, 5%
R20	387111035	Res, Fxd, Comp. 27 ohms, 1W, 5%
R21, 25	387000040	Res, Fxd, Comp, 4.7K ohms, 1/4W, 5%
R22	387000036	Res, Fxd, Comp. 2.2K ohms, 1/4W, 5%
R24	387000041	Res, Fxd, Comp. 5.6K ohms, 1/4W, 5%
R26	387000001	Res, Fxd, Comp. 2.7 ohms, 1/4W, 5%



B-CC-1102170 (335 CPM)
 B-CC-1102177 (400 CPM)
 B-CC-1102178 (600 CPM)

E-110233600	Ⓢ	MAIN ASSY
D-110151701	Ⓢ	MAIN PANEL ASSY
D-110184701	Ⓢ	MAIN PANEL ASSY SCHEMATIC
D-110143100	Ⓢ	HARNESS ASSY, MAIN PANEL
D-110184601	Ⓢ	POWER SUPPLY & CARD CAGE ASSY
D-110154600	Ⓢ	HARNESS ASSY, POWER SUPPLY & CARD CAGE
B-11052300	Ⓢ	SCHEMATIC, POWER SUPPLY
A-WLD-11052300	Ⓢ	LOGIC DIAGRAM, CARD CAGE
D-11052400	Ⓢ	WIRE LIST
D-110151800	Ⓢ	CONTROL PANEL ASSY
D-110151800	Ⓢ	CONTROL PANEL SCHEMATIC

LOCATION

MS MOHAWK DATA SCIENCES CORP.
HERKIMER N.Y.

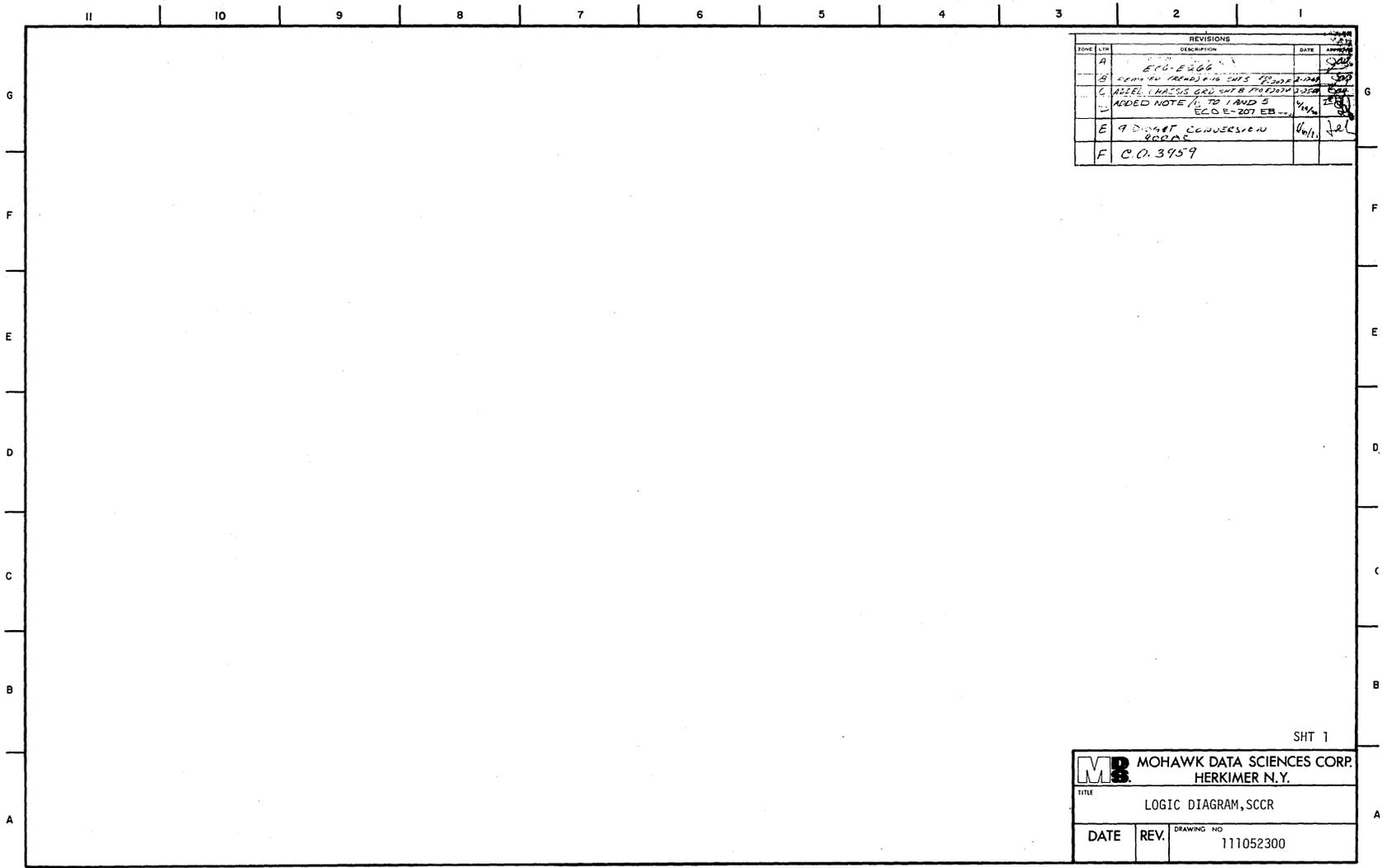
TITLE

BLOCK DIAGRAM with CIRCUITS

DATE
12/7/70

REV.
C

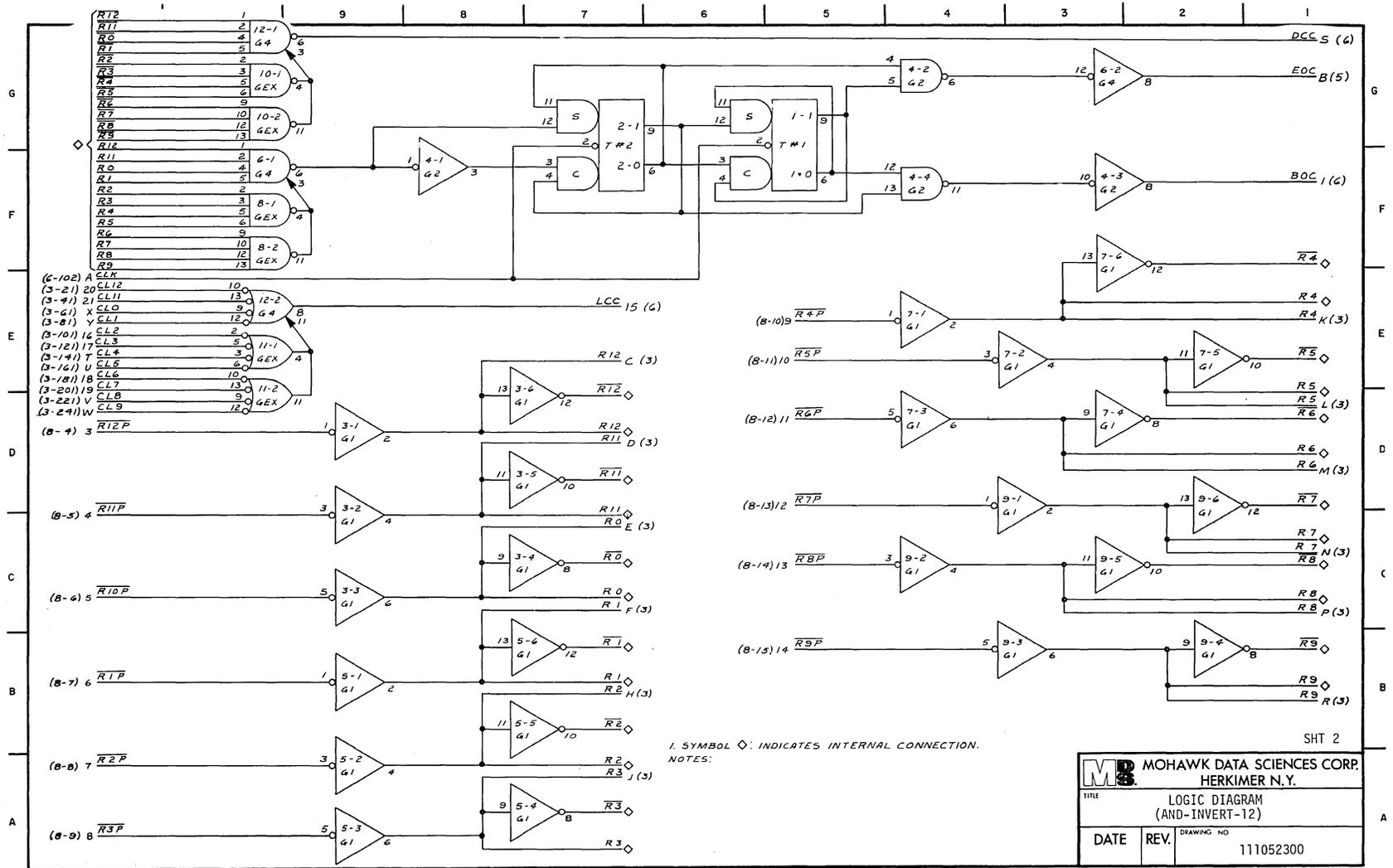
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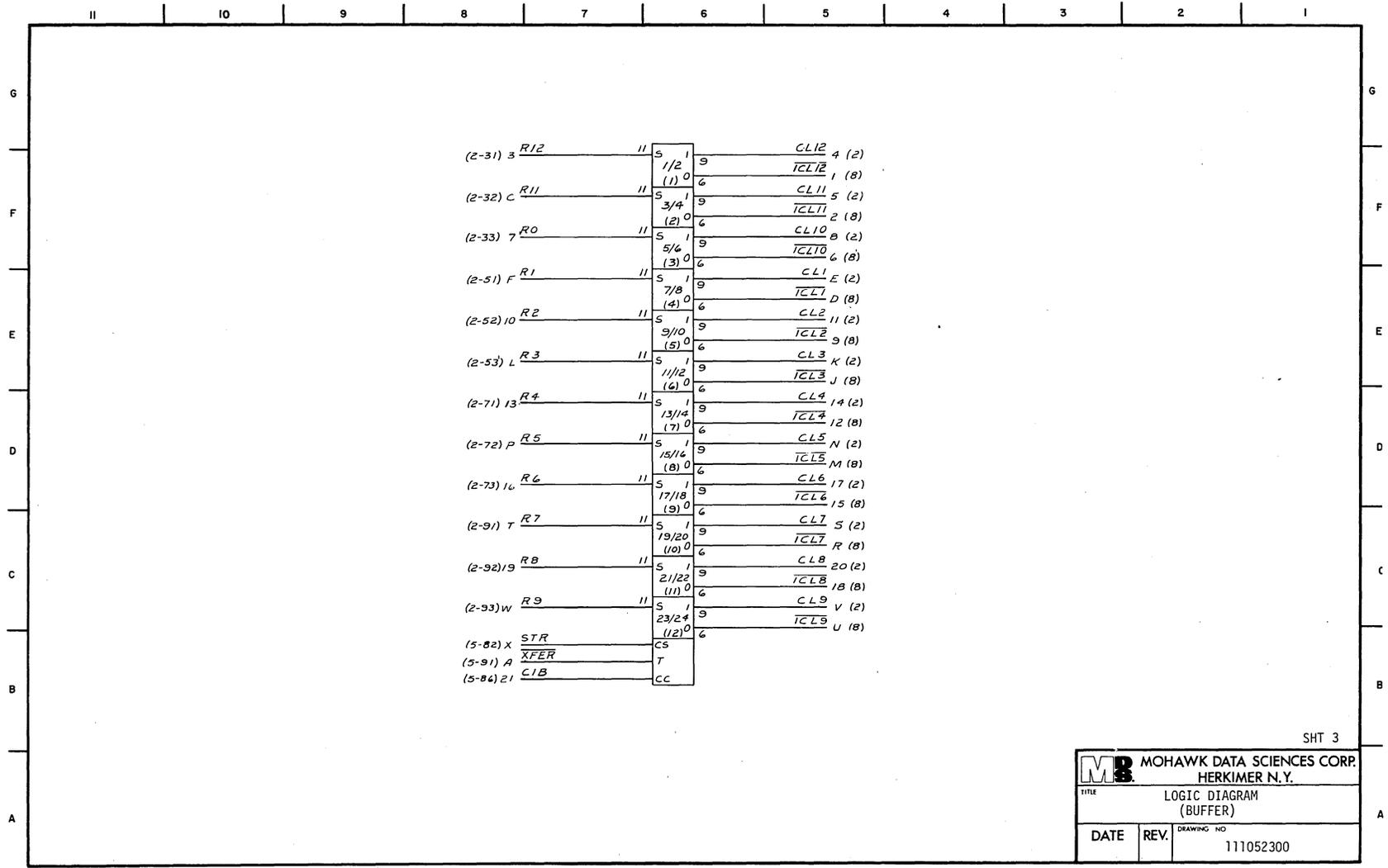


REVISIONS			
NO.	DATE	DESCRIPTION	BY
A			
B		EGG-E-266	
C		CHANGE FROM 1 AND 2 TO 1 AND 5	
D		ADDED NOTE TO 1 AND 5	
E		EGG-E-207 E	
F		ADDED CONVERSION	
		EGG-E-3959	

SHT 1

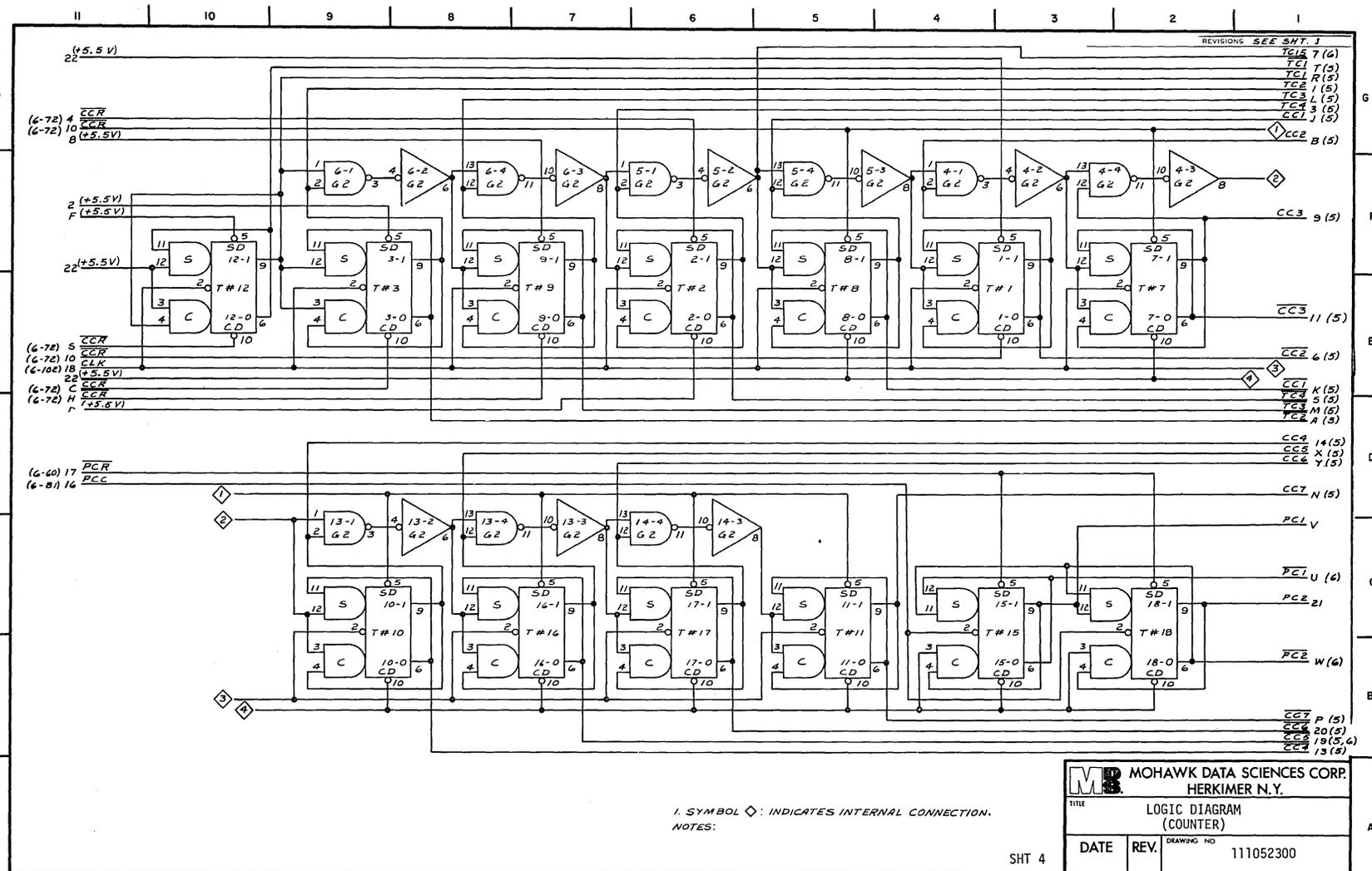
MB		MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.	
TITLE LOGIC DIAGRAM, SCCR			
DATE	REV.	DRAWING NO. 111052300	



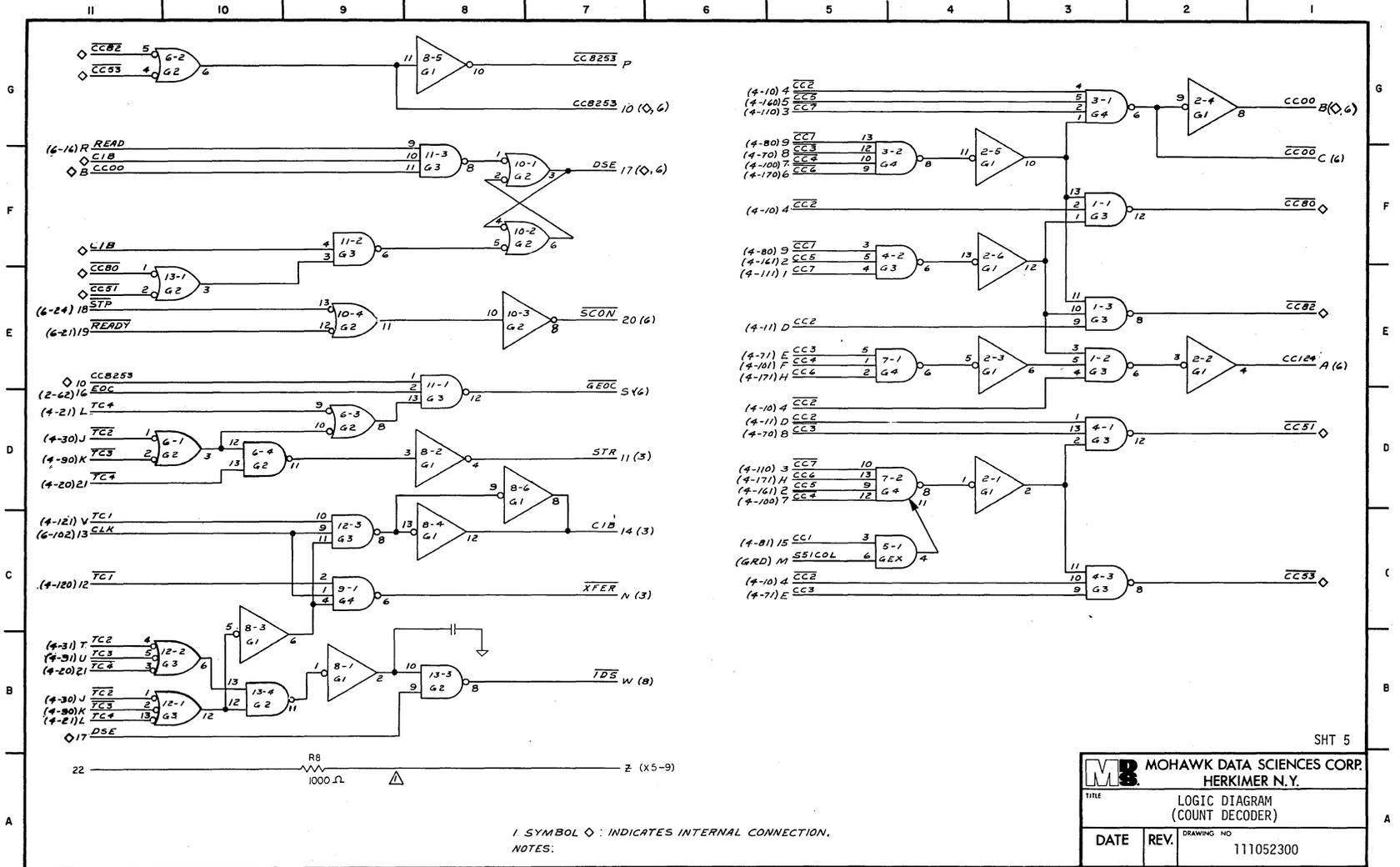


SHT 3

MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE LOGIC DIAGRAM (BUFFER)		
DATE	REV.	DRAWING NO 111052300



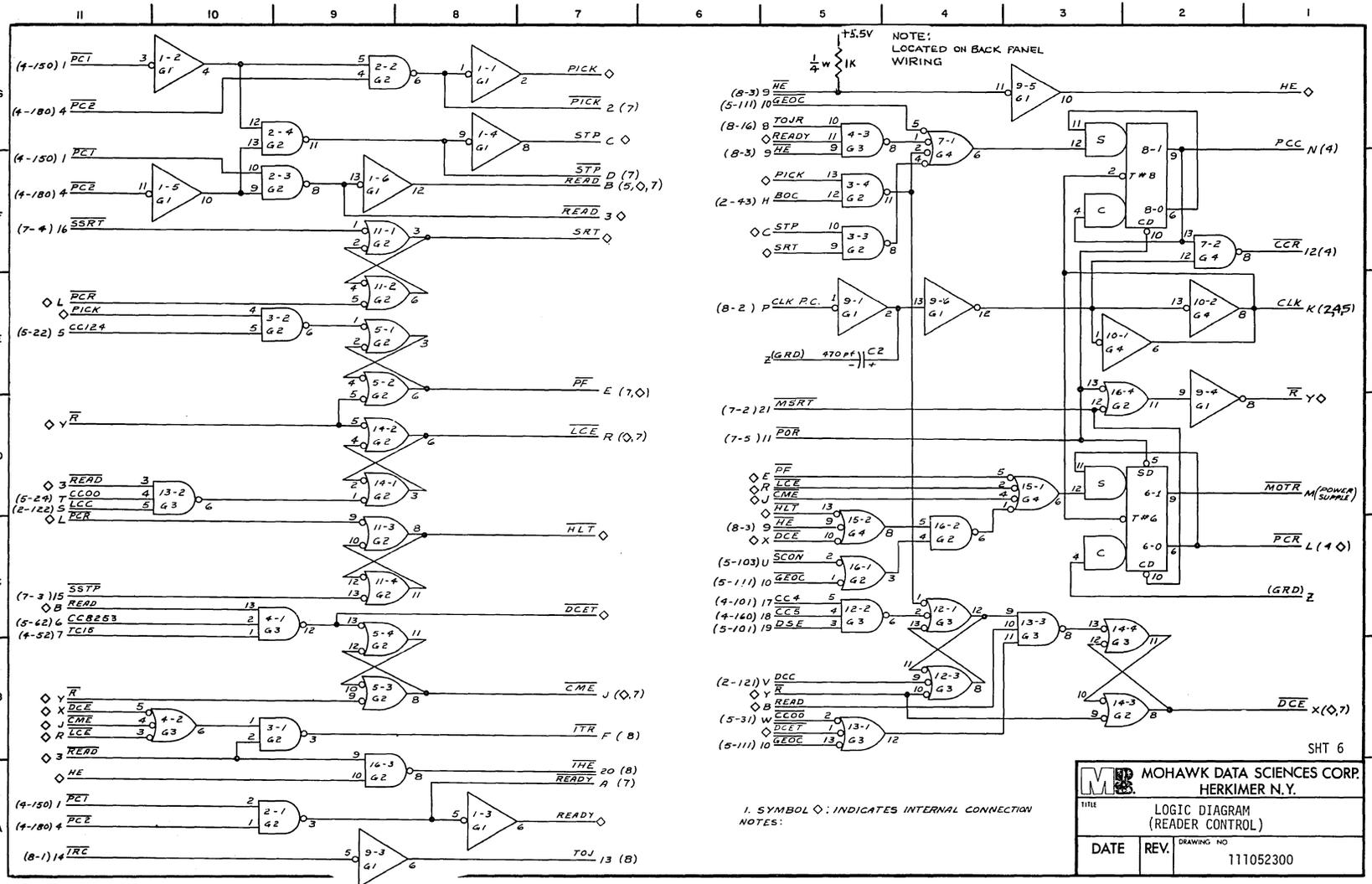
MD MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.	
TITLE LOGIC DIAGRAM (COUNTER)	
DATE	REV. DRAWING NO. 111052300



1. SYMBOL ◊ : INDICATES INTERNAL CONNECTION.
NOTES:

MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE LOGIC DIAGRAM (COUNT DECODER)		
DATE	REV.	DRAWING NO. 111052300

SHT 5



MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.	
TITLE LOGIC DIAGRAM (READER CONTROL)	
DATE	REV.
DRAWING NO. 111052300	

X 6 CURRENT DRIVER																			
PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.
I	(+12V)				I					I					I				
A	(-12V)				A					A					A				
2	LCE		6-142		2					2					2				
B	PF		6-52		B					B					B				
3	DCE		6-143		3					3					3				
C	STP		6-24		C					C					C				
4	CME		6-53		4					4					4				
D	STP		6-14		D					D					D				
5	MORT	2		6	E					5					5				
E	MOTR LAMP		POWER SUPPLY		E					E					E				
6	(SPARE)				6					6					6				
F	(SPARE)				F					F					F				
7					7					7					7				
H	PICK		7-11		H					H					H				
8					8					8					8				
J	PSOL	12		7	J					J					J				
9					9					9					9				
K					K					K					K				
10					10					10					10				
L					L					L					L				
11					11					11					11				
M					M					M					M				
12					12					12					12				
N					N					N					N				
13	TRDY	6		8	13					13					13				
P	ICTR	7		8	P					P					P				
14	READY		7-8		14					14					14				
R	READY		6-16		R					R					R				
15	READY	8		7	15					15					15				
S	TPF	9		8	S					S					S				
16	READY		6-21		16					16					16				
T	PF		7-10		T					T					T				
17	PICK	11		7	17					17					17				
U	PF	10		7	U					U					U				
18	PICK		6-22		18					18					18				
V	PF		6-52		V					V					V				
19					19					19					19				
W					W					W					W				
20	SSTP	3		6	20					20					20				
X	SSRT	4		6	X					X					X				
21	FOR	5		6	21					21					21				
Y	PSOL		7-12		Y					Y					Y				
22	(+3.5V)				22					22					22				
Z	(GRD)				Z					Z					Z				

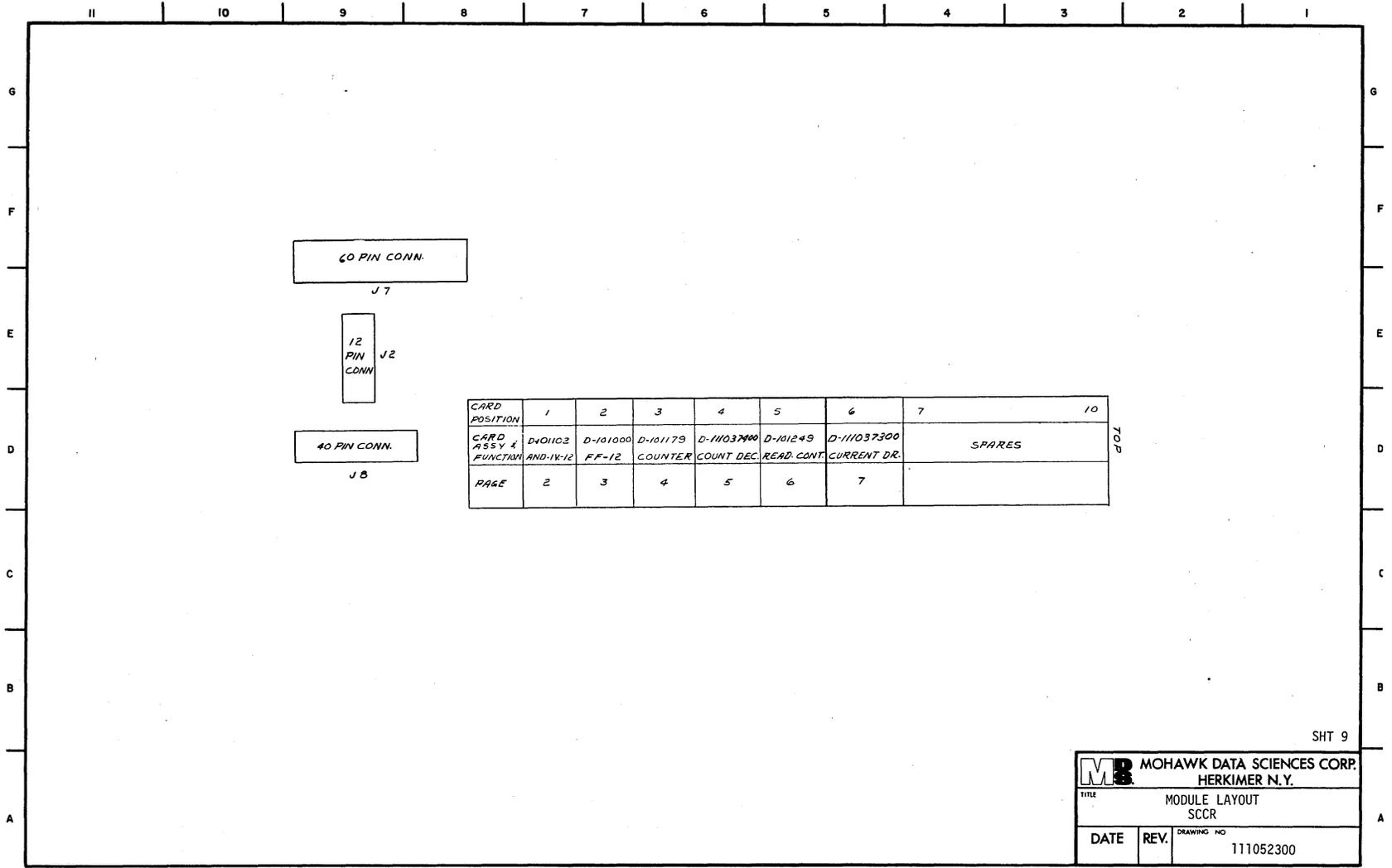
SHT 7

MB		MOHAWK DATA SCIENCES CORP.	
		HERKIMER N.Y.	
TITLE			
CONNECTORS			
DATE	REV.	DRAWING NO.	
		111052300	

	11	10	9	8	7	6	5	4	3	2	1
G	J7 INTERFACE DATA										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	1	ICL12		3-10							
	2	ICL11		3-30							
	3	ICL10		3-50							
	4	ICL1		3-70							
	5	ICL2		3-90							
	6	ICL12 (RET)									
	7	ICL11 (RET)									
	8	ICL10 (RET)									
F	J7 (CONT)										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	45	TOJ		6-93							
	46										
	47	TRC (RET)									
	48										
	49	ICIR (RET)									
	50	TOJR	16		6						
	51										
	52										
E	J8 PHOTO-CELL DATA										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	1	R12P		4	2						
	2	R11P		5	2						
	3	R10P		6	2						
	4	R1P		7	2						
	5	R2P		8	2						
	6	R12P (RET)									
	7	R11P (RET)									
	8	R10P (RET)									
D	J2 MISC. DATA										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	1	CLOCK P.C.	2		6						
	2	DC (GRD)									
	3	CONSTANT CURRENT									
	4	D.C. GRD									
	5	HE	3		6						
	6	D.C. (GRD)									
	7	DC (GRD)									
	8										
C	J7 (CONT)										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	53										
	54										
	55										
	56	CHASSIS (GRD)									
	57	CHASSIS (GRD)									
	58										
	59										
	60	DC (GRD)									
B	J8 PHOTO-CELL DATA										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	11	R3P		9	2						
	12	R4P		10	2						
	13	R5P		11	2						
	14	R6P		12	2						
	15	R7P		13	2						
	16	R3P (RET)									
	17	R4P (RET)									
	18	R5P (RET)									
A	J2 MISC. DATA										
	PIN	SIGNAL	COMP NUMBER	SOURCE	DEST.						
	19	R6P (RET)									
	20	R7P (RET)									
	21	R8P		14	2						
	22	R9P		15	2						
	23										
	24										
	25										
	26	R8P (RET)									
27	R9P (RET)										
28											
29											
30											
31											
32											
33											
34											
35											
36	IHE (RET)										
37	IPF (RET)										
38											
39											
40											
41											
42	TRC			6							
43											
44	ICIR		7-7								

MOHAWK DATA SCIENCES CORP.	
HERKIMER N.Y.	
TITLE	
CONNECTORS	
DATE	REV. DRAWING NO.
	111052300

SHT 8



60 PIN CONN.

J7

12
PIN
CONN.

J2

40 PIN CONN.

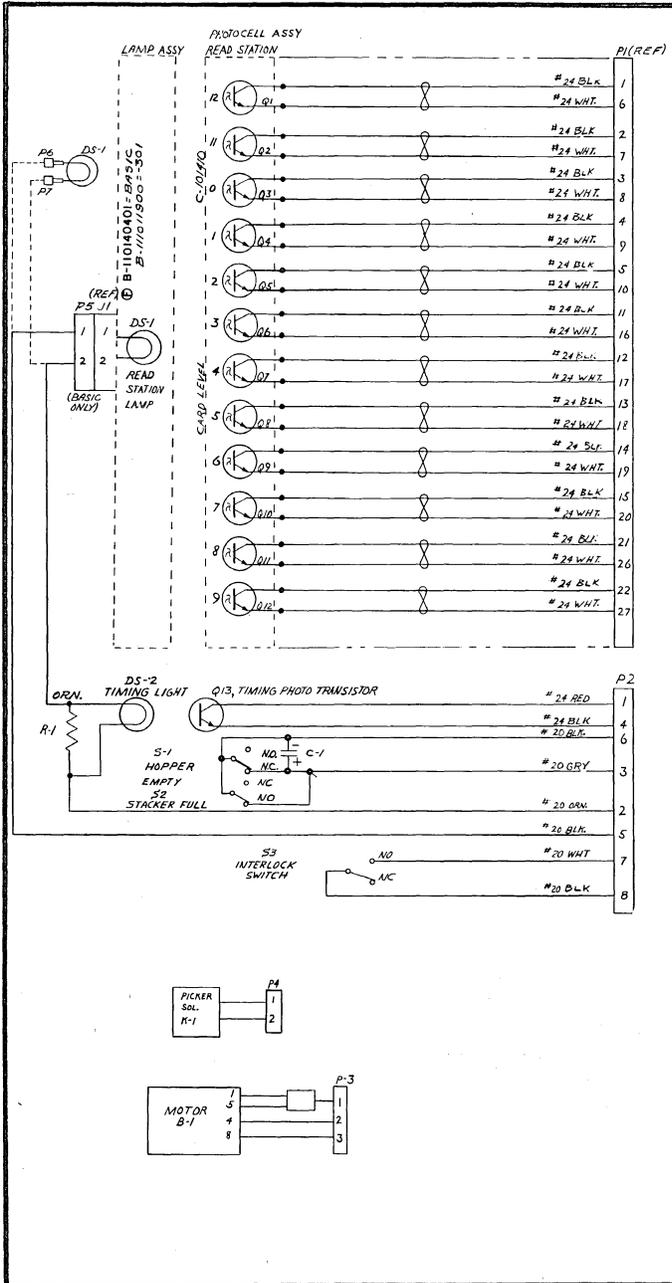
JB

CARD POSITION	1	2	3	4	5	6	7	10
CARD ASSY & FUNCTION	D-01103 AND-IV-12	D-101000 FF-12	D-101179 COUNTER	D-111037400 COUNT DEC.	D-101249 READ. CONT.	D-111037300 CURRENT DR.	SPARES	
PAGE	2	3	4	5	6	7		

TOP

SHT 9

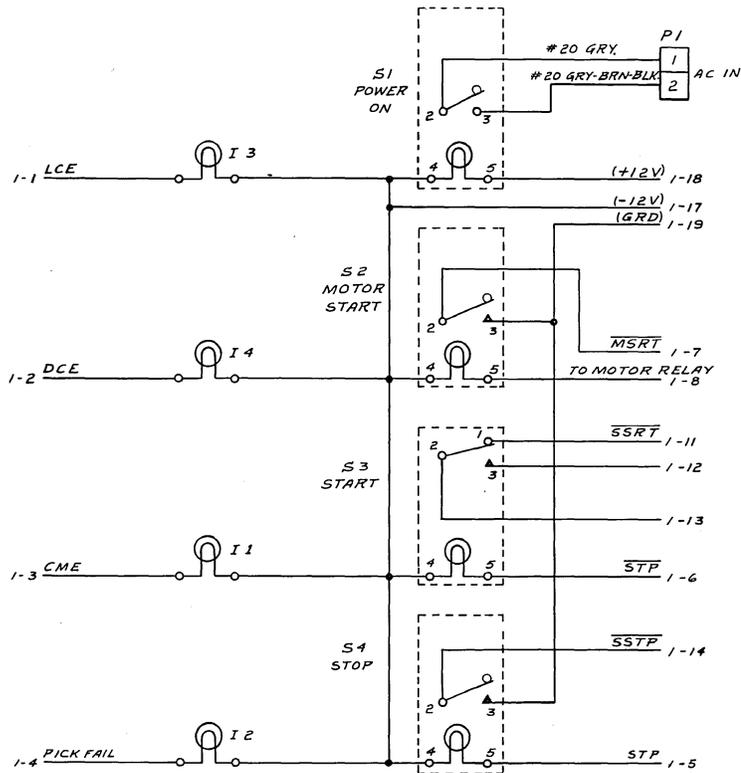
 MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE MODULE LAYOUT SCCR		
DATE	REV.	DRAWING NO. 111052300



FIND NO.	PART NO.	DESCRIPTION
C1	134005405	Cap. 1 uf, 35VDC
R1	387212005	Resistor 4ohms, 5W
P4	145002001	Connector
P6,P7	420006401	Receptacles
P5	145002001	Connector
P2	145002003	Connector
J1	146000201	Sockets
P1,P2,P3	146000101	Pins
P3	145002002	Connector
	416002101	Switch, Interlock S3
	111011900	Fiber Optic Assy.

LOCATION		
 MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE		
SCHEMATIC, CHASSIS WIRING, SCCR		
DATE	REV.	DRAWING NO
3/17/71	G	1101517

NOTES:
 ⚠ J-2[Ⓢ] CONNECTOR MATES WITH SOLENOID ON PICKER ASSEMBLY. (SEE SHT. 1)
 2. REF. CONNECTION NO. 5 COINCIDE WITH SHEET 1.
 4 HOLE POSITIONS (ON CARD ASSY.) FOR CABLE.
 3. ALL UNMARKED WIRES ARE # 24 WHITE.



FIND NO.	PART NO.	DESCRIPTION
2	416004901	Switch
3	416004902	Switch
4	416004903	Switch
5	302001105	Ind Lamp
6	146000101	Pins

LOCATION

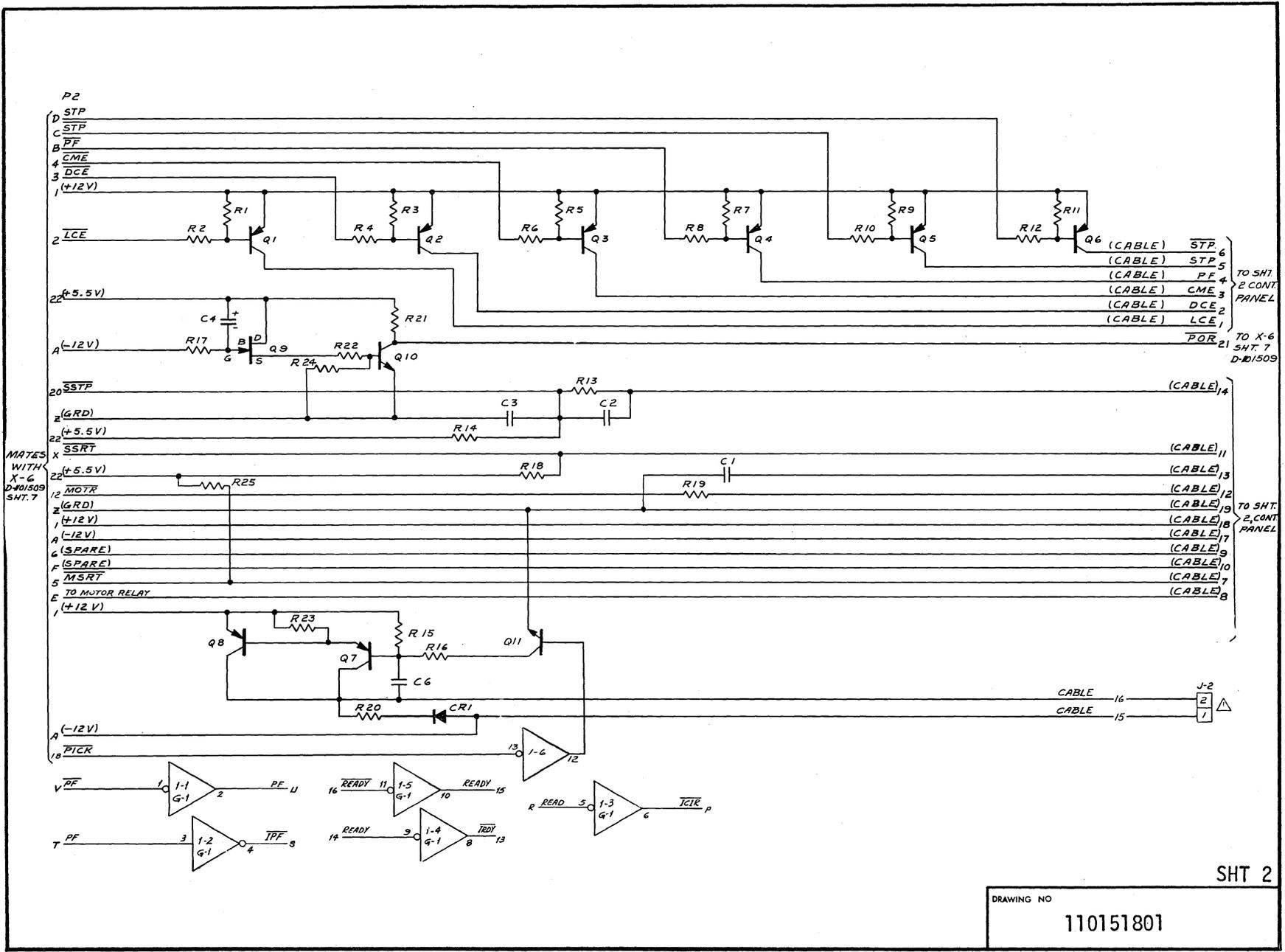
MS MOHAWK DATA SCIENCES CORP.
 HERKIMER N.Y.

TITLE SCHEMATIC, CONTROL PANEL
 CURRENT DRIVER BOARD

DATE
 9/9/68

REV.
 B

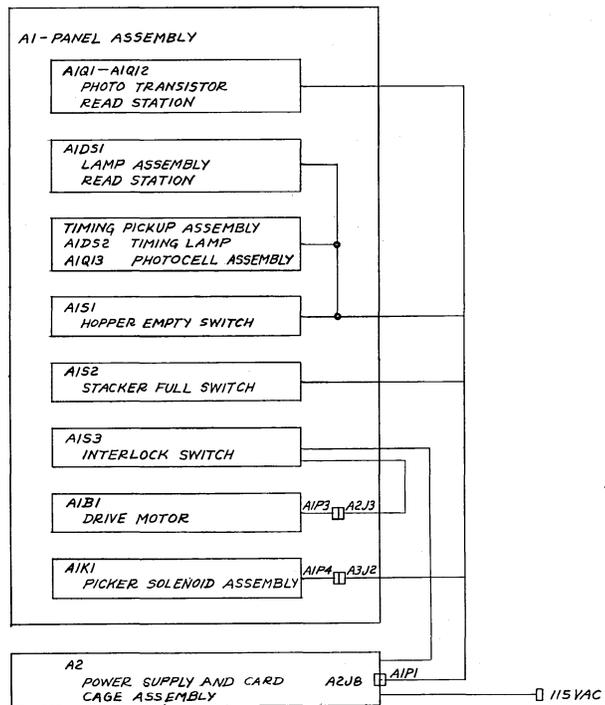
DRAWING NO
 110151801



SHT 2

DRAWING NO

110151801



C-102290 (225 CPM)
 C-102291 (400 CPM)
 C-102292 (600 CPM)

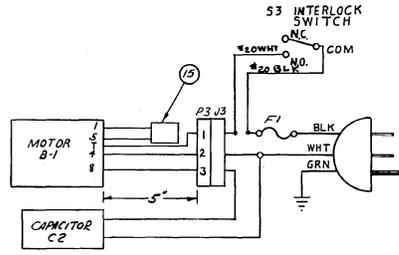
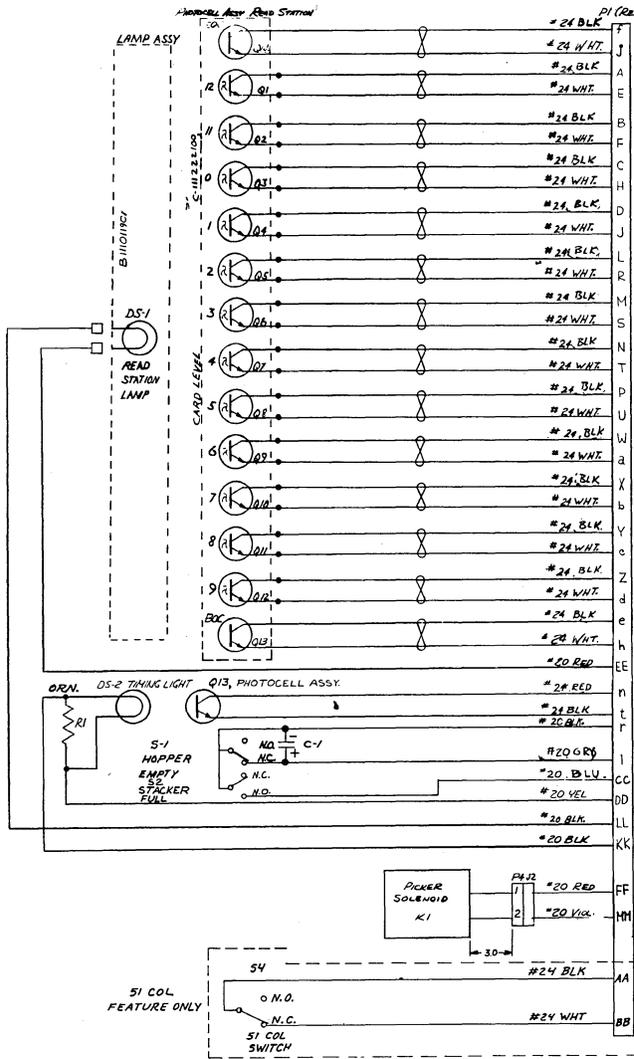
E-102287 MECHANICAL ASSEMBLY

E-102294 PANEL ASSEMBLY

D-102295 POWER SUPPLY & CARD CAGE ASSEMBLY

D-102289 SCHEMATIC, CHASSIS HARNESS

LOCATION		
 MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE		
BLOCK DIAGRAM W/O CIRCUITS		
DATE	REV.	DRAWING NO
		111160900



FIND NO.	PART NO.	DESCRIPTION
Q13	110176901	Photocell Assy.
C1	134202029	Capacitor 1uf, 35 VDC
C2	134005404	Capacitor
DS-2	302000101	Timing Light
P3	145002002	Connector
P3,P4	146000101	Pins
P4	145002001	Connector
J2	146000201	Sockets
J3	145002102	Connectors
J3	146000202	Contact Socket

LOCATION		
MOHAWK DATA SCIENCES CORP. HERKIMER N.Y.		
TITLE SCHEMATIC CHASSIS WIRING W/O CIRCUITS		
DATE	REV.	DRAWING NO 110228900

SECTION VII ILLUSTRATED PARTS BREAKDOWN

7.1 GENERAL

7.1.1 The illustrated parts breakdown contains illustrations and descriptions of assemblies, components and parts for the Card Reader. This illustrated parts breakdown is used for requisitioning, storing, issuing and identifying the parts. A list of recommended spares is also included in this section.

7.2 ILLUSTRATIONS

7.2.1 The illustrations in this section show each assembly and related parts. The illustrations are numbered consecutively, the hardware is listed separately.

7.3 FIGURE AND INDEX COLUMN

7.3.1 Numbers preceding the hyphen refer to the figure in which a part or assembly is illustrated. The digits following the hyphen are the index numbers in that particular illustration.

7.4 DESCRIPTION COLUMN

7.4.1 This column list each assembly, its attaching parts and components of the assembly.

7.5 USABLE ON CODE

7.5.1 The usable on code pertains to the particular card reader this part is used on. In this manual the alpha digits A, B, C, D are used. They stand for A-6001; B-6001A; C-6002; D-6002A.

7.6 RECOMMENDED SPARES

- 7.6.1 To minimize the length of down time, a list of parts, recommended for storing are identified, and may be requisitioned from Mohawk Data Sciences Corp.

NOTES

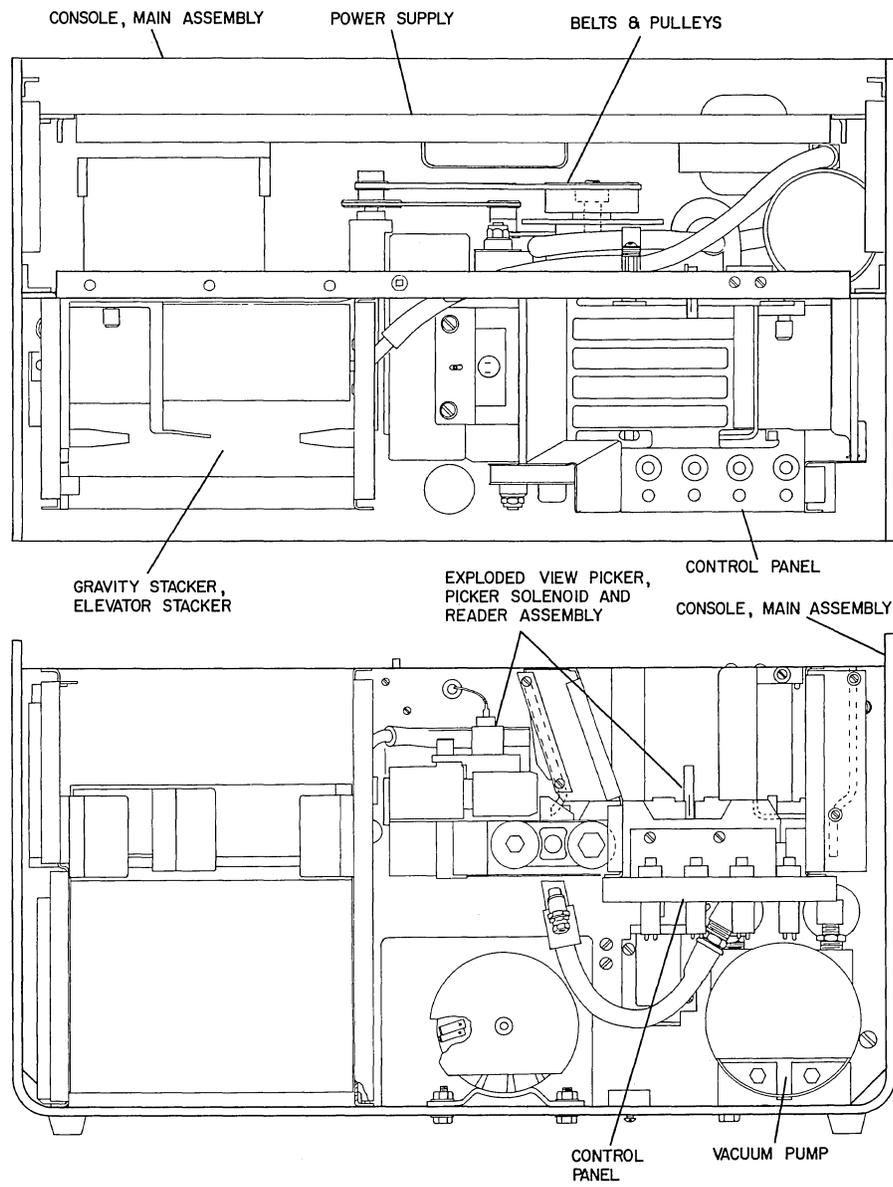


FIGURE	DESCRIPTION	PAGE
7-1	Console, Main Assembly	7-3
7-2	Exploded View Picker, Picker Solenoid, and Reader Assembly	7-4
7-3	Control Panel and Hopper Empty Switch	7-7
7-4	Vacuum Pump	7-8
7-5	Gravity Stacker	7-9
7-6	Elevator Stacker Assembly	7-10
7-6A	Elevator Stacker Assembly	7-12
7-7	Power Supply	7-14
7-7A	Power Supply	7-16
7-8	Belts and Pulleys	7-18

FIGURE 7-1 CONSOLE, MAIN ASSEMBLY

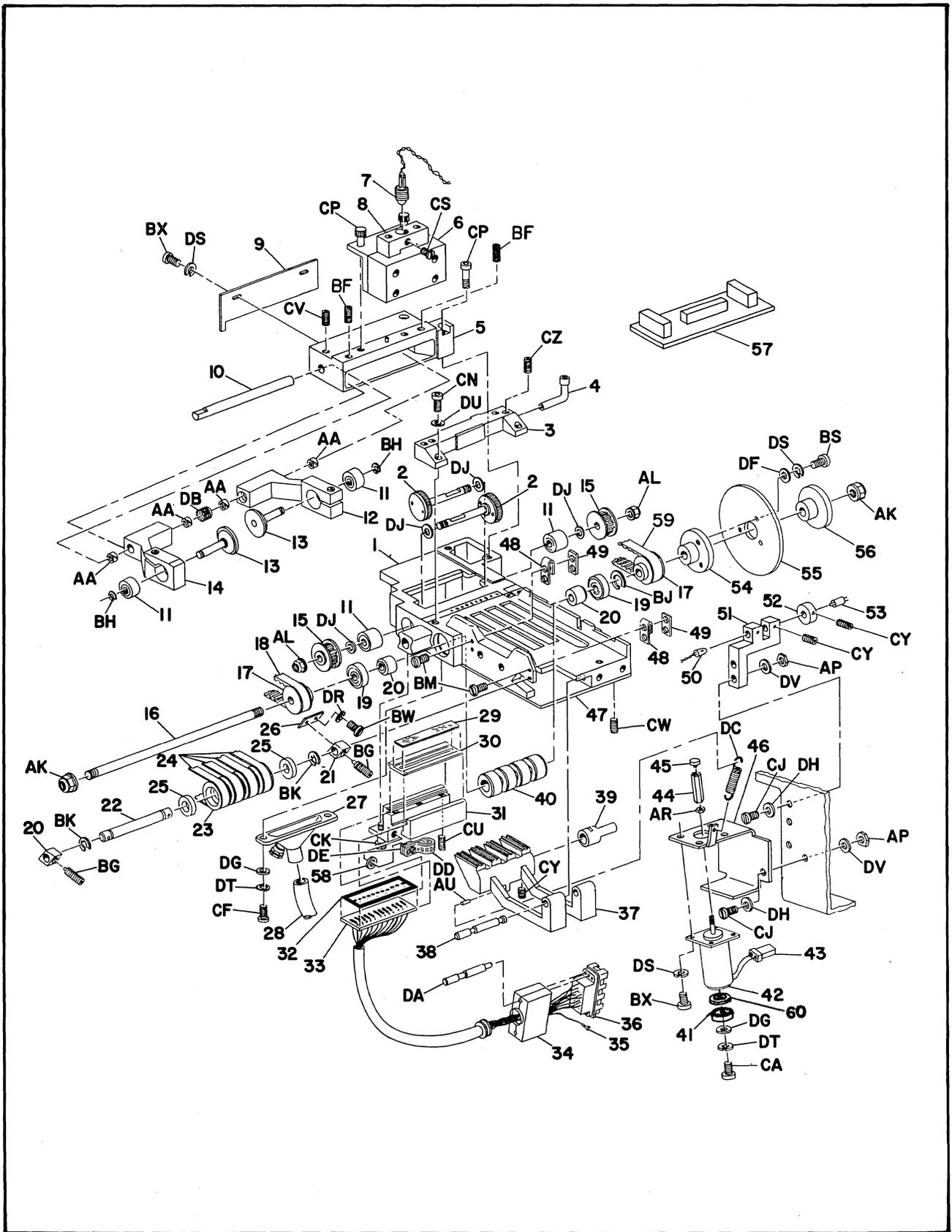
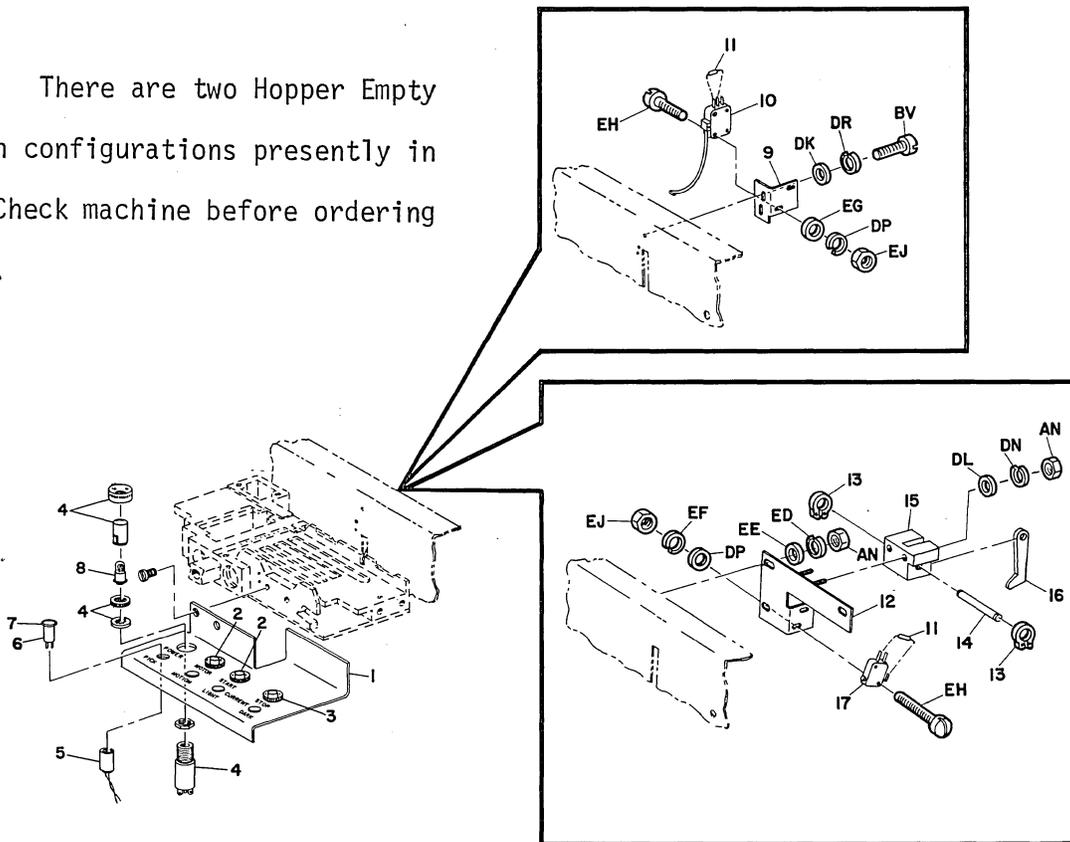


FIGURE 7-2 EXPLODED VIEW PICKER, PICKER SOLENOID AND READER ASSEMBLY

FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
REF	110202901	Picker/Reader Assembly	C,D
REF	110229301	Picker/Reader Assembly	A,B
7-2-1	110234301	Picker Frame	A,B,C,D
-2	110219200	Metering Capstans	A,B,C,D
-3	002611401	Throat Block Assembly	A,B,C,D
-4	111020900	Tube Assembly, Throat Air	A,B,C,D
REF	111023200	Idler Roller Assembly & Support Light Station (Includes 7-2-5, -10 -11, -12, -13, -14)	A,B,C,D
-5	110500500	Support, Light Station & Idler	A,B,C,D
REF	111011900	Fiber Optic Light Assembly	A,B,C,D
-6	110140701	Carrier, Fiber Optic Light	A,B,C,D
-7	302000401	Lamp, Fiber Optics	A,B,C,D
-8	110140901	Block, Lamp Mounting	A,B,C,D
-9	111055500	Card Guide	A,B,C,D
-10	111050160	Pivot Shaft, Idler Arm	A,B,C,D
-11	525003001	Bearing	A,B,C,D
-12	111023100	Idler Arm, Inboard	A,B,C,D
-13	110500201	Idler Roller Assembly	A,B,C,D
-14	111022900	Idler Arm, Outboard	A,B,C,D
-15	807000535	Pulley	A,B,C,D
-16	110025204	Shaft, Drive	A,B,C,D
-17	807000507	Pulley	A,B,C,D
-18	530120013	Belt 70 XL-037	A,B,C,D
-19	525004001	Bearing, Ball	A,B,C,D
-20	110025402	Spacer	A,B,C,D
-21	110500800	Slider	A,B,C,D
-22	110500900	Shaft, Idler	A,B,C,D
-23	110501000	Pulley, Idler	A,B,C,D
-24	110500300	Belt, Set, Picker (4 matched)	A,B,C,D
-25	525003301	Bearing, Ball	A,B,C,D
-26	110502000	Plate, Positioning	A,B,C,D
-27	111028400	Air Transition, Tube Assembly	A,B,C,D
-28	111030101	Throat Hose Assembly	A,B,C,D
REF	110233701	Photocell Assembly (Includes 7-2-29 thru 7-2-32)	A,B,C,D
-29	110501301	Cover Glass	A,B,C,D
-30	110141601	Divider, Light	A,B,C,D
-31	110141101	Photocell Holder	A,B,C,D
-32	110141401	Insulator	A,B,C,D
	110181501	Gasket	A,B,C,D
-33	110234501	P.C. Board Assembly	C,D
	110234801	P.C. Board Assembly	A,B
-34	571001201	Connector Shield	C,D
-35	146000002	Contact Connector	A,B
	146110001	Contact Connector	A,B
-36	145000701	Connector	C,D
-37	110172000	Pusher, Belt	A,B,C,D
-38	110501502	Pivot Shaft	A,B,C,D
-39	110657601	Tube Vacuum, Belt Pusher	A,B,C,D
-40	110500700	Pulley, Drive	A,B,C,D

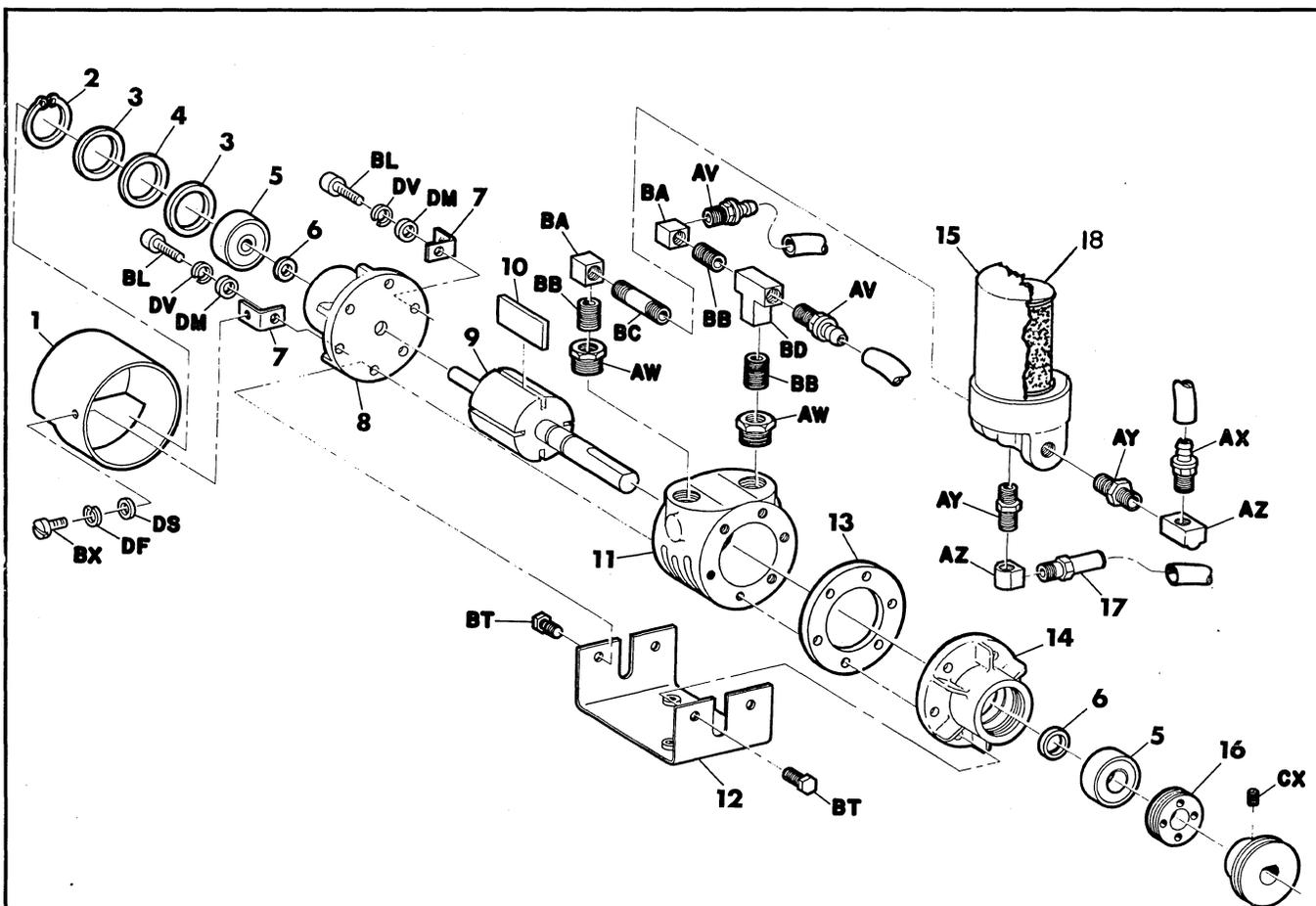
FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
REF	110153801	Picker Solenoid Assembly (Includes 7-2-41 thru 7-2-46)	A,B,C,D
-41	111017601	Solenoid Stop	A,B,C,D
-42	002849101	Solenoid Assembly	A,B,C,D
-43	145002001	Connector	A,B,C,D
	146000101	Pin	A,B,C,D
-44	111017800	Plunger	A,B,C,D
-45	548000102	Bumper	A,B,C,D
-46	110194801	Bracket	A,B,C,D
-47	111033600	Shield, Heat	A,B,C,D
-48	110500401	Spring, Edge Guide	A,B,C,D
-49	110500601	Nut Plate	A,B,C,D
REF	110171901	Timing Pick-up Assembly (Includes 7-2-50 thru 7-2-53)	A,B,C,D
-50	302000101	Lamp, Timing Assembly	A,B,C,D
-51	110150601	Bracket, Timing Assembly	A,B,C,D
-52	110207901	Set Collar	A,B,C,D
-53	110176901	Photocell Assembly	A,B,C,D
REF	110179201	Timing Disk Assembly (Includes 7-2-54, -55)	A,B,C,D
-54	110207801	Hub	A,B,C,D
-55	111016601	Timing Disk	A,B,C,D
-56	Fig. 7-8	Pulley Drive	A,B,C,D
-57	111096400	Card Weight 80 Col.	A,B,C,D
	111096500	Card Weight 51 Col.	A,B,C,D
-58	110141501	Spacer	A,B,C,D
-59	530120014	Belt 80 XL-037 (Back)	A,B,C,D
-60	110536582	Shim .005	A,B,C,D
	110536583	Shim .010	A,B,C,D

NOTE: There are two Hopper Empty Switch configurations presently in use. Check machine before ordering parts.

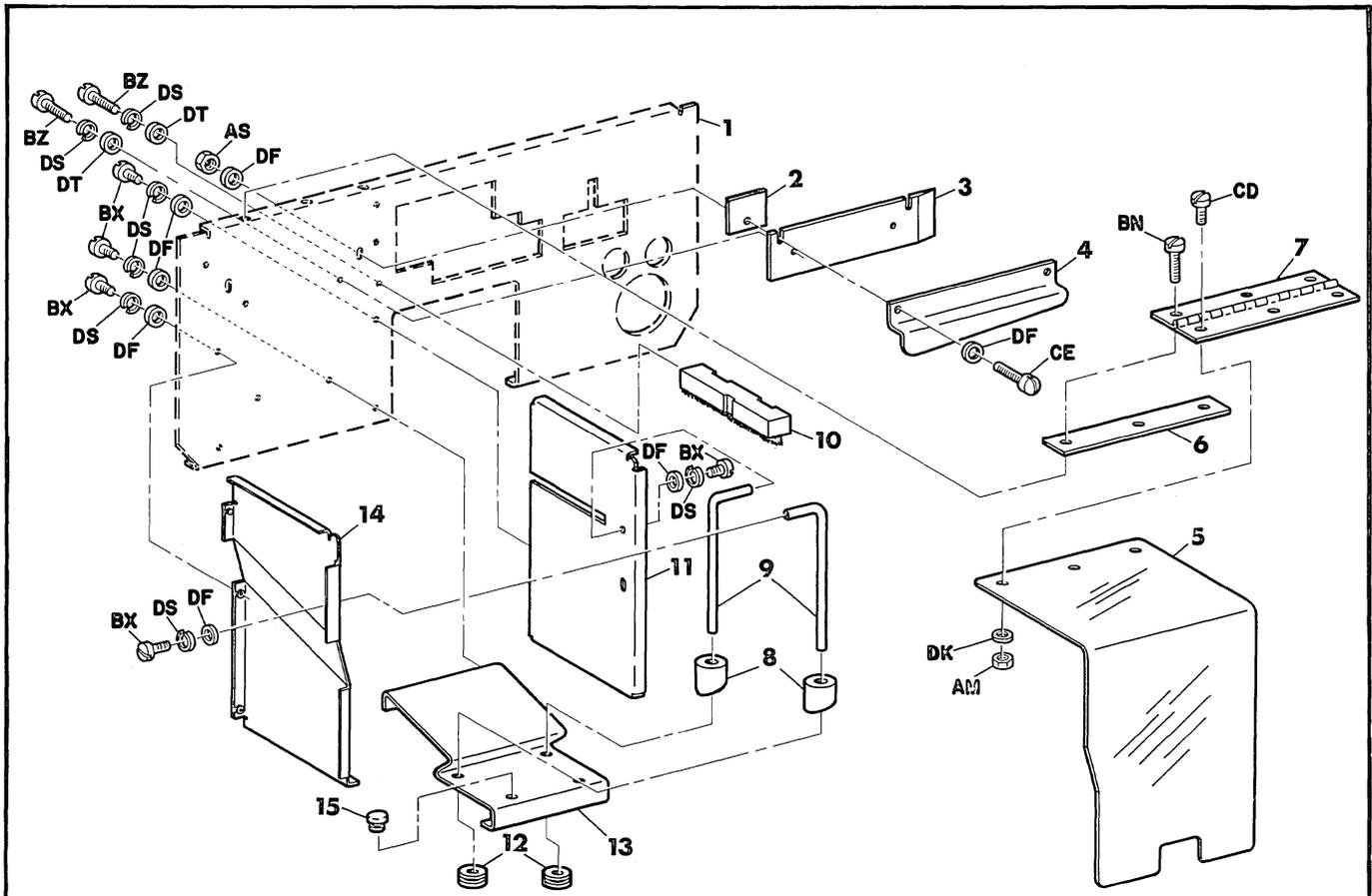


FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
REF	111052400	Control Panel	A,B,C,D
7-3-1	110131301	Panel, Mounting	A,B,C,D
-2	416004902	Switch, Push, Momentary (A3S2, S3)	A,B,C,D
-3	416004901	Switch, Push, Alternate (A3S1)	A,B,C,D
-4	416004903	Switch, Push, Momentary (A3S4)	A,B,C,D
-5	302001801	Socket	A,B,C,D
-6	302001105	Lamp, Indicator	A,B,C,D
-7	142000401	Retainer	A,B,C,D
-8	302104001	Lamp	A,B,C,D
-9	002470301	Bracket, Switch	A,B,C,D
-10	002487901	Switch, Hopper Empty	A,B,C,D
-11	134202029	Capacitor, Fixed .1 MFD 35V	A,B,C,D
-12	004099101	Bracket Switch	A,B,C,D
-13	829107008	Ring, Retaining	A,B,C,D
-14	004099201	Pin, Mounting Block	A,B,C,D
-15	004099001	Block, Mounting	A,B,C,D
-16	004099101	Arm, Hopper Empty	A,B,C,D
-17	002258300	Switch, Hopper Empty	A,B,C,D

FIGURE 7-3 CONTROL PANEL AND HOPPER EMPTY SWITCH

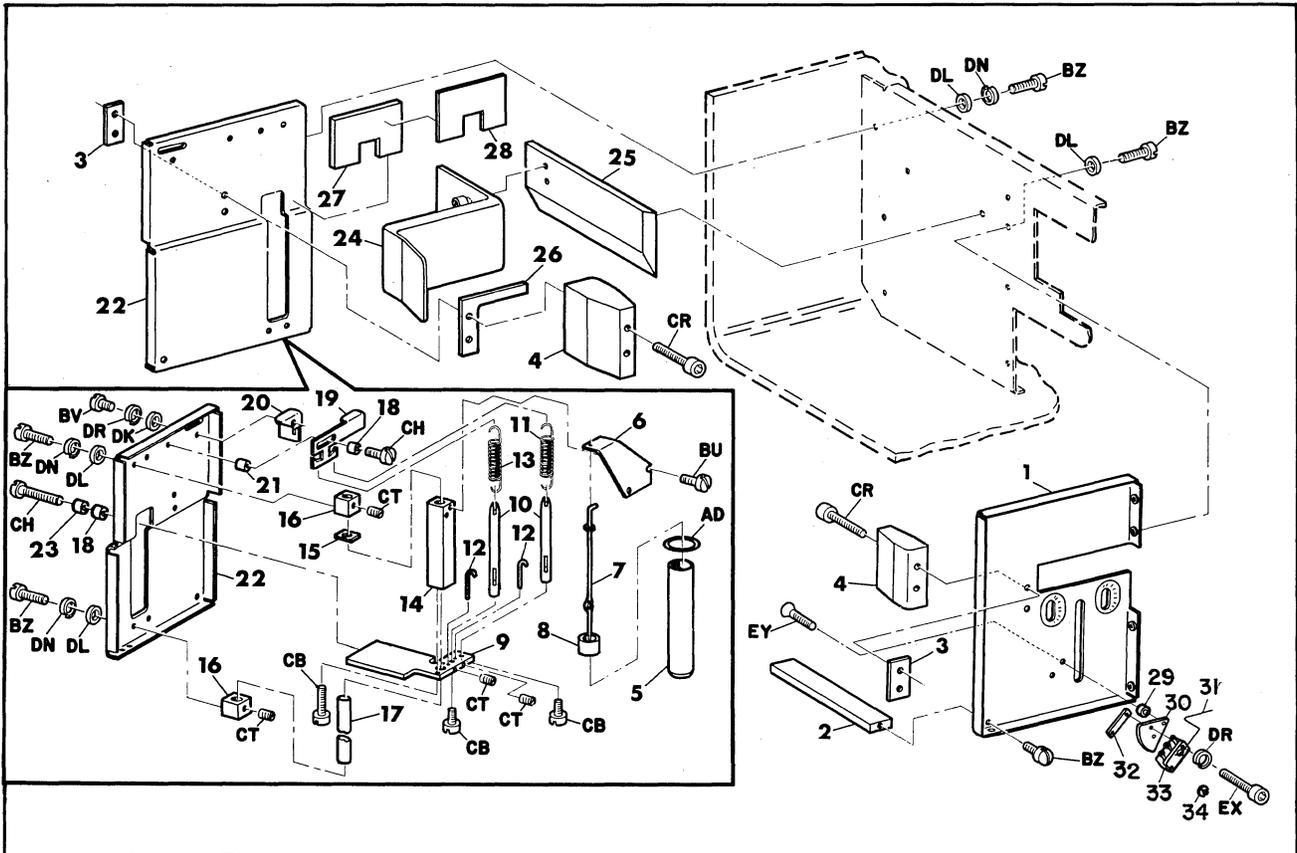


FIND NO.	PART NO.	DESCRIPTION	USEABLE ON CODE
REF	111030701	Vacuum Pump Assembly	A,B,C,D
7-4-1	111058500	Shroud Fan	A,B,C,D
-2	808000119	Retaining Ring	A,B,C,D
-3	808000118	Belleville Spring	A,B,C,D
-4	808000120	Washer	A,B,C,D
-6	808000116	Deflector	A,B,C,D
-7	111044700	Bracket	A,B,C,D
-8	808000113	End Plate, Dead	A,B,C,D
-9	808000114	Rotor Assembly, Clockwise	A,B,C,D
-10	808000115	Vane, Carbon	A,B,C,D
-11	808000111	Body	A,B,C,D
-12	110129801	Bracket, Pump	A,B,C,D
-13	808000122	Body Spacer Gasket	A,B,C,D
-14	808000112	End Plate, Drive	A,B,C,D
-15	111235901	Muffler Assembly	A,B,C,D
-16	808000121	End Cap	A,B,C,D
REF	Figure 7	Pulley	A,B,C,D
-17	110659601	Airfitting	A,B,C,D
-18	637000601	Filter, Felt	A,B,C,D



FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
7-5-1	110701601	Panel	A,C
-2	111044900	Shim	A,C
-3	111072600	Spacer, Card Guide	A,C
-4	110136801	Card Guide, Upper	A,C
-5	111035801	Cover, Stacker	A,C
-6	111080000	Spacer, Stacker Cover	A,C
-7	111058100	Hinge	A,C
-8	111033900	Shim, Stacker	A,C
-9	110176801	Retainer, Stacker Cover	A,C
-10	111091800	Static Eliminator	A,C
-11	110128901	Stacker, Right Side	A,C
-12	625101028	Rubber Grommet	A,C
-13	110150401	Stacker, Bottom	A,C
-14	110137001	Stacker, Left Side	A,C
-15	544000201	Bumper	A,C

FIGURE 7-5 GRAVITY STACKER

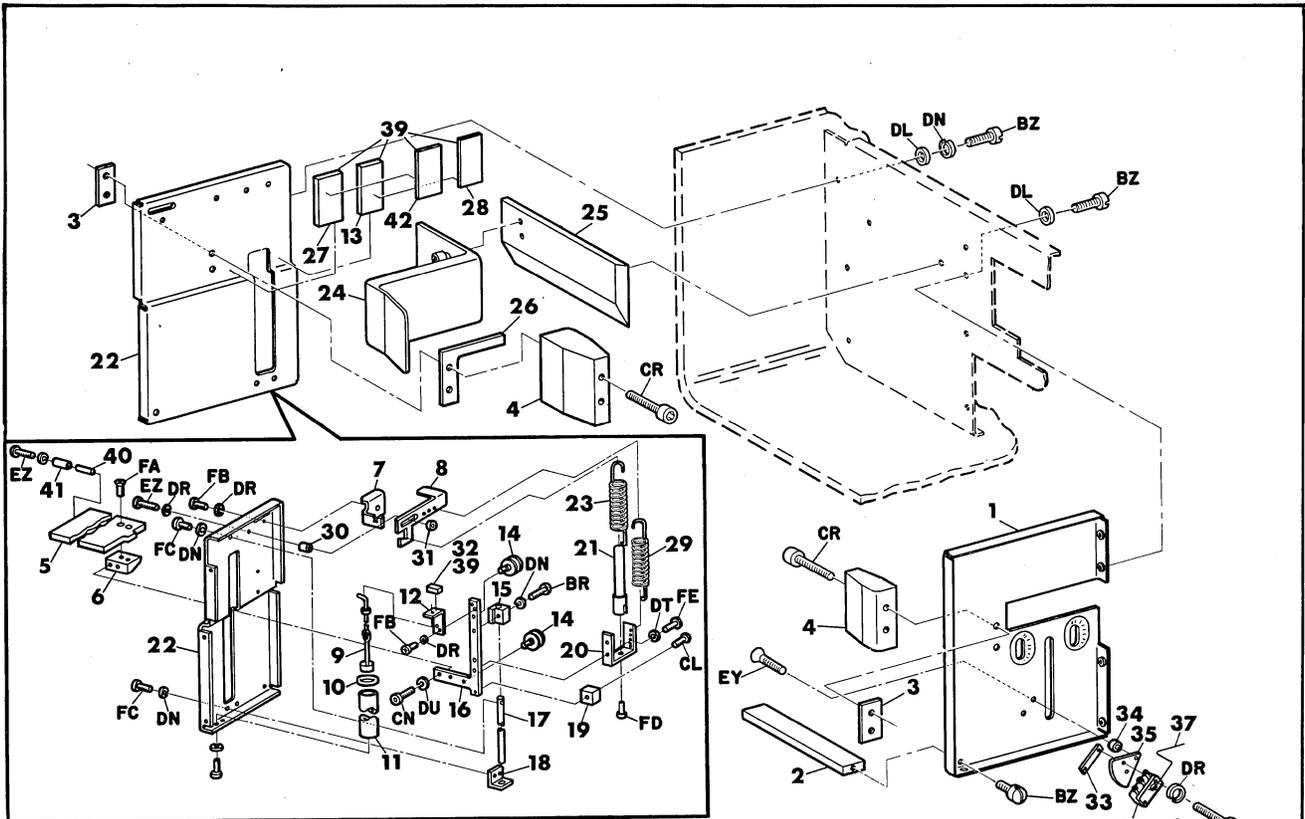


NOTE: There are two Elevator Stacker configurations in use. Check machine before ordering parts.

FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
7-6-1	111206301	Plate, Right Side Stacker	B,D
-2	111209001	Spacer Bar	B,D
-3	111206801	Plate Nut	B,D
-4	111206701	Card Guide	B,D
REF	111208101	Cylinder Assembly	B,D
-5	111208201	Cylinder	B,D
-6	111207701	BKT, Dashpot MTG	B,D
REF	111207801	Piston Assembly (Includes 7-6-7, -8)	B,D
-7	111208001	Connecting Rod Assembly	B,D
-8	111207901	Piston	B,D
-9	111207601	Plate, Card	B,D
-10	111209401	Support Spring (used on 80/51 col. only).	B,D
-11	111209301	Spring, Stacker (used on 80/51 col. only).	B,D

FIGURE 7-6 ELEVATOR STACKER ASSEMBLY

FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
-12	111208901	Hook, Spring	B,D
-13	111209201	Spring, Stacker (used on 80 col. only)	B,D
-14	111207301	Housing Assembly	B,D
-15	111207501	Pad, Rubber	B,D
-16	111207102	Block MTG	B,D
-17	111207201	Shaft	B,D
-18	110609202	Sleeve (used on 80/51 col. only)	B,D
-19	111209501	Slide, Anchor (used on 80/51 col. only)	B,D
-20	111210201	BKT, Legend (used on 80/51 col. only)	B,D
-21	111209601	Spacer (used on 80/51 col. only)	B,D
-22	111206901	Plate, Left Side	B,D
-23	111208801	Roller	B,D
-24	111209801	Card Stop Assembly	B,D
-25	111209101	Plate, Card Edge	B,D
-26	111208401	Spacer	B,D
-27	111208501	Pad, Rebound	B,D
-28	111208601	Cover, Rebound Pad	B,D
-29	867000201	Spacer	B,D
-30	004265701	Plate, Adjustment	B,D
-31	416004303	Wire, Actuator Switch 004297901	B,D
-32	004265801	Nut, Plate	B,D
-33	004297901	Switch	B,D
-34	416004305	Ring, Grip	B,D



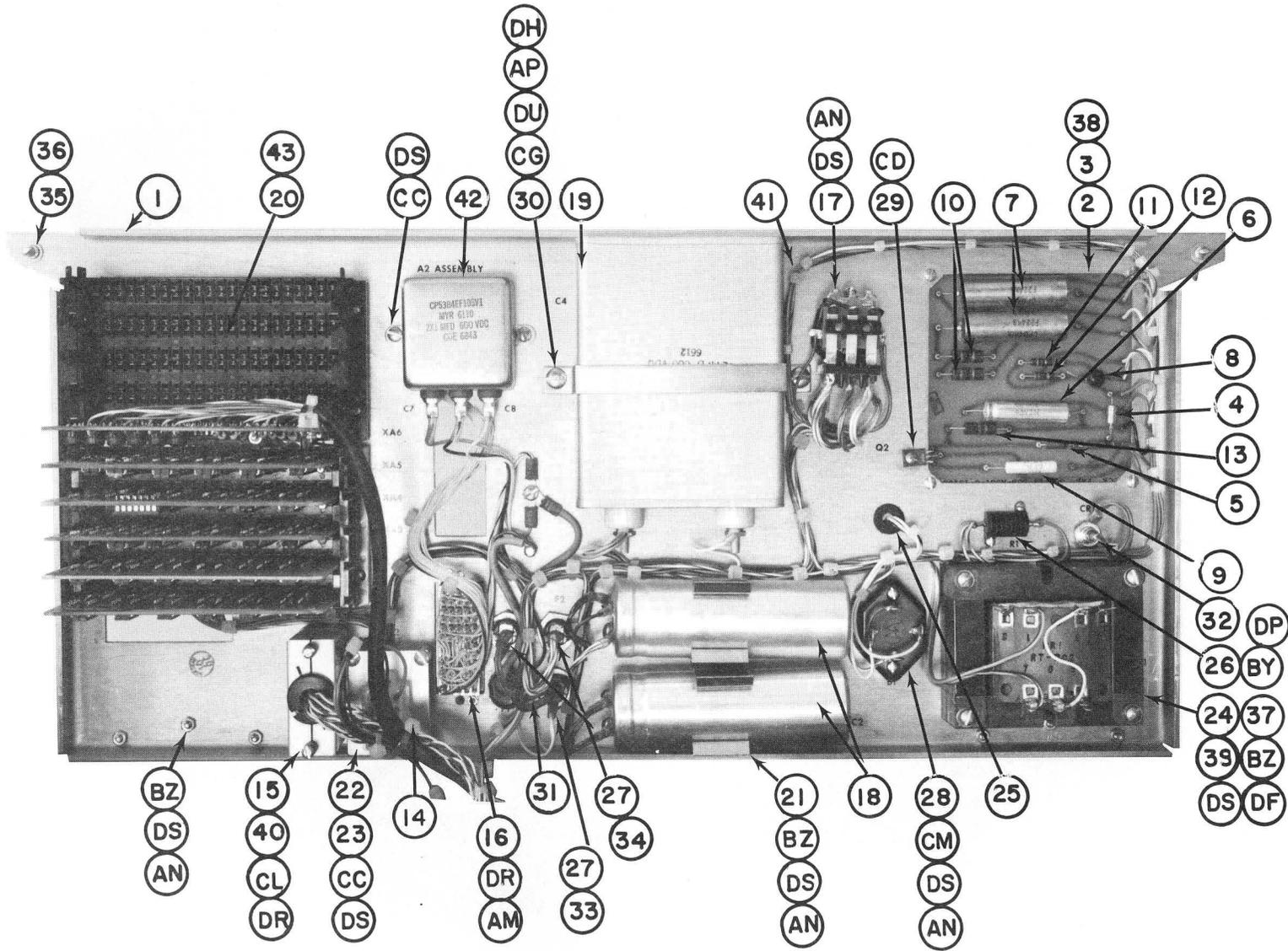
NOTE: There are two Elevator Stacker Configurations in use. Check machine before ordering parts.

FIND	PART NO.	DESCRIPTION	USEABLE ON CODE
7-6-1	111206301	Plate, Right Side Stacker	A,B
-2	111209001	Spacer Bar	A,B
-3	111206801	Plate, Nut	A,B
-4	111206701	Card Guide	A,B
-5	004245401	Plate, Card	A,B
-6	004245601	Block Mt	A,B
-7	111210201	Bracket, Legend	A,B
-8	111209501	Slide Anchor	A,B
-9	111207801	Piston ASM	A,B
-10	652000111	O Ring	A,B
-11	111208101	Cylinder, AMS	A,B
-12	004246201	Bracket, Dash Pot Mtg.	A,B
-13	004542701	Pad, Rebound	A,B
-14	004245601	Roller Asm.	A,B
-15	004542101	Block, Upper Guide	A,B

FIGURE 7-6A ELEVATOR STACKER ASSEMBLY

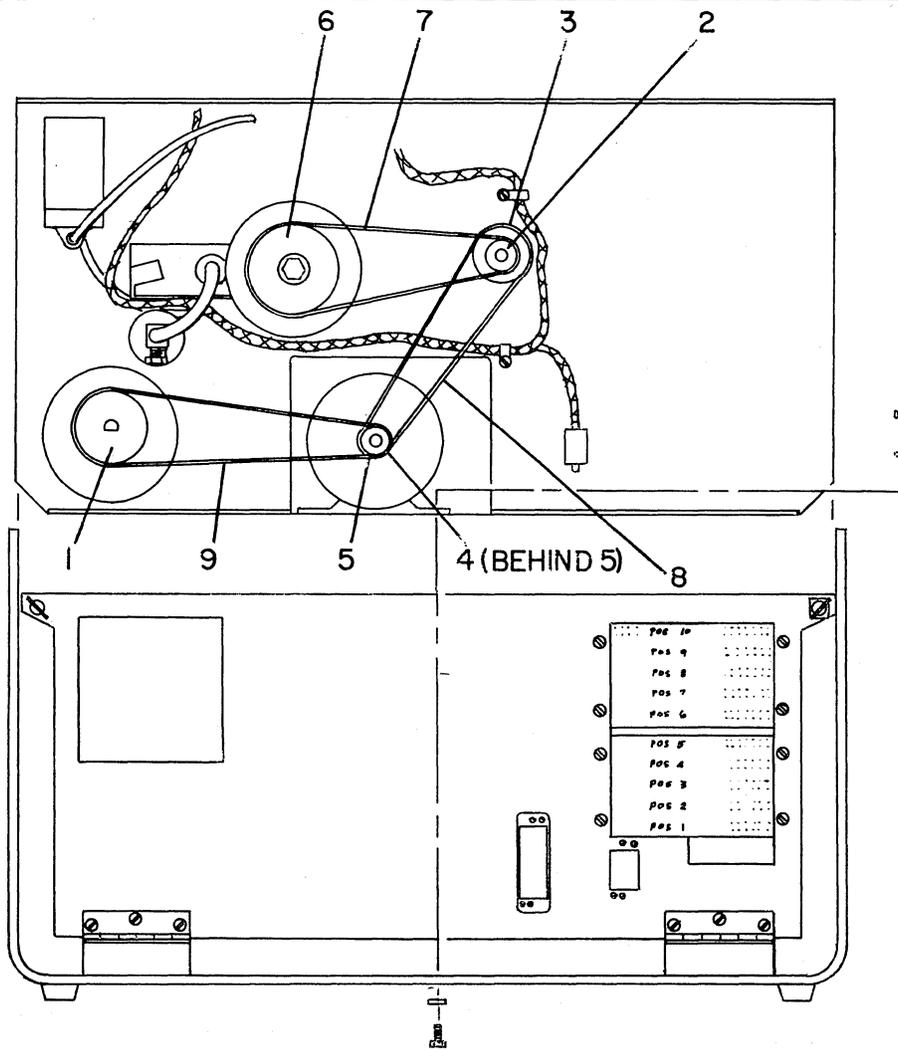
FIND	ORDER	DESCRIPTION	USEABLE ON CODE
-16	004245501	Plate, Mtg. Stacker	A,B
-17	004541901	Shaft	A,B
-18	004542001	Angle Mtg. Lower	A,B
-19	004245801	Block Shaft Guide	A,B
-20	004542301	Bracket, Spring Mtg.	A,B
-21	004542201	Guide Spring	A,B
-22	004541801	Plate, Left Side	A,B
-23	004542401	Spring Stacker (51/80)	A,B
-24	111206702	Card Guide	A,B
-25	111209101	Plate, Card Edge	A,B
-26	004542601	Spacer	A,B
-27	004542702	Pad, Rebound	A,B
-28	004542801	Cover Rebound Pad	A,B
-29	004542501	Spring, Stacker (51 Col)	A,B
-30	111209601	Spacer	A,B
-31	110609202	Sleeve	A,B
-32	004542703	Pad, Rebound	A,B
-33	004265801	Nut, Plate	A,B
-34	867000201	Spacer	A,B
-35	004265701	Plate Adjustment	A,B
-36	004297901	Switch	A,B
-37	416004303	Wire, Actuator Switch 004297901	A,B
-38	416004305	Ring Grip(Part of Switch 004297901)	A,B
-39	504101001	Adhesive 3M	A,B
-40	111208701	Spacer, Roller	A,B
-41	111208801	Roller	A,B
-42	004542802	Cover, Rebound Pad	A,B

FIGURE 7-7 POWER SUPPLY



FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
7-7-1	110163601	Chassis	A,B,C,D
-2	110168001	Circuit Card Assembly	C,D
-3	110167901	Printed Wiring Board	C,D
-4	167000901	Diode, Semiconductor (A2 CR2)	C,D
-5	169001301	Diode Stabistor (A2CR3, CR4)	C,D
-6	134103115	Capacitor, 100 MFD, 25V (A2C3)	C,D
-7	134004801	Capacitor 0.22 MFD, 600V (A2C5,C6)	C,D
-8	436404001	Transistor (A2 Q1)	C,D
-9	387212076	Resistor, 2.7 ohm, 5W (A2R2)	C,D
-10	387111031	Resistor, 18 ohm, 1W, 5% (A2R3, R4)	C,D
-11	387110067	Resistor, 560 ohm, 1/2W 5% (A2R5)	C,D
-12	387110093	Resistor, 6800 ohm, 1/2W, 5% (A2R6)	C,D
-13	387000057	Resistor, 220 ohm, 1W, 5% (A2R7)	C,D
-14	145002103	Connector (part of 110184601) A2J2	C,D
-15	145000702	Connector (A2J8)	C,D
-16	145000703	Connector, (AMP) A2J7	C,D
	146002601	Pins for Connector A2J7	C,D
	145000704	Mating Connector for A2J7	C,D
	146000002	Pins for Mating Connector	C,D
	571001201	Shield for Mating Connector	C,D
	848000101	Jack Screws for Mating Connector	C,D
	145001001	Connector (ELCO), A2J7	C,D
	146110001	Pins for Connector and Mating Connector	C,D
	145000801	Mating Connector (Elco), for A2J7	C,D
-17	384105013	Relay (A2K1)	C,D
-18	134002801	Capacitor, 13,000 MFD, 15V (A2C1, C2)	C,D
-19	134005404	Capacitor, 12 MFD, 600V (A2C4)	A,B,C,D
-20	145008701	Connector, (A2XA1-5, 6-10)	C,D
-21	142000020	Clip, Mounting	C,D
-22	110194001	Plate, Connector Mounting	C,D
-23	874000106	Spacer, Standoff	C,D
-24	434000903	Transformer, Power (A2T1)	C,D
-25	662101028	Grommet, Rubber	C,D
-26	387513036	Resistor, 10 ohm, 1W (A2R1)	C,D
-27	203000201	Fuseholder, (A2XF1, 2, 3)	A,B,C,D
-28	381116001	Bridge, Rectifier (A2B1)	C,D
-29	436001401	Transistor (A2Q2)	C,D
-30	110704301	Mounting Strap	A,B,C,D
-31	465001201	AC Power Cord (A2P1)	A,B,C,D
-32	169000903	Diode (A2CR1)	C,D
-33	203115401	Fuse, 3 AMP, 125V Time Lag (A2F1)	A,B,C,D
-34	203102016	Fuse, 2 AMP, 250V Normal (A2F2, F3)	C,D
-35	632132001	Retainer, Stud	A,B,C,D
-36	632133011	Stud, Fastener	A,B,C,D
-37	110194201	Shield, Transformer	C,D
-38	110194101	Shield, Circuit Card	C,D
-39	874000104	Spacer, Standoff	C,D
-40	110548101	Spacer	C,D
-41	110184601	Power Supply Harness Assembly	C,D
	145002101	Connector (A2J1)	C,D
	145002102	Connector (A2J3)	C,D
	146000201	Contact Connector	C,D
-42	134005201	Capacitor 1 MFD, 600V (A2C7-8)	C,D
-43	134005809	Capacitor, 0.015 MFD, 100V (A2C9)	C,D

FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
7-7-19	110194001	Plate, Connector Mtg.	A,B,C,D
-20	874000106	Spacer, Standoff	A,B,C,D
-21	434000903	Transformer, Power (A2T1)	A,B,C,D
-22	662101028	Grommet Rubber	A,B,C,D
-23	387513036	Resistor, 10 ohm 10W (A2R1)	A,B,C,D
-24	203000502	Fuseholder	A,B,C,D
-25	381116001	Bridge Rectifier	A,B,C,D
-26	436004903	Transistor A2Q2	A,B,C,D
-27	110704301	Mounting Strap	A,B,C,D
-28	465001201	AC Power Cord (A2P1)	A,B,C,D
-29	169000903	Diode (A2CR1)	A,B,C,D
-30	203115401	Fuse 3 Amp 125 V Time Lag (A2F1)	A,B,C,D
-31	203102016	Fuse 2 Amp 250 V Normal (A2F2, F3)	A,B,C,D
-32	632132001	Retainer Stud	A,B,C,D
-33	632133011	Stud, Fastener	A,B,C,D
-34	110194201	Shield, Transformer	A,B,C,D
-35	110194101	Shield, Circuit Card	A,B,C,D
-36	874000104	Spacer, Standoff	A,B,C,D
-37	110548101	Spacer	A,B,C,D
-38	004290801	Power Supply Harness Assembly	A,B,C,D
	145002101	Connector (A2J1)	A,B,C,D
	145002103	Connector (A2J2)	A,B,C,D
	145002102	Connector (A2J2)	A,B,C,D
	146000201	Connector Contact	A,B,C,D
-39	134007613	Capacitor	A,B,C,D
-40	387000032	Resistor 1K 1/4 Watt	A,B,C,D
-41	110130601	Hinge	A,B,C,D
-42	110130701	Hinge, Block	A,B,C,D
-43	420127002	Terminal	A,B,C,D
-44	146002601	Crimp Pin (Contact for AMP Connector)	A,B,C,D
	146110001	Crimp Pin (Contact for ELCO Connector)	A,B,C,D
-45	662000903	Bushing, Strain Relief	A,B,C,D
-46	420152005	Lug, Fastener	A,B,C,D



FIND NO.	PART NO.	DESCRIPTION	USABLE ON CODE
7-8-1	110199010	Pulley, Pump 225/400 CPM, 60 HZ	A,B,C,D
	110199012	Pulley, Pump 225/400 CPM, 50 HZ	A,B,C,D
-2	110199002	Pulley, Idler-Picker, 225 CPM 50/60 HZ	A,B,C,D
	110199004	Pulley, Idler-Picker 400 CPM 50/60 HZ	A,B,C,D
-3	808001704	Pulley, Idler-Motor- 225/400 CPM, 60 HZ	A,B,C,D
	110199008	Pulley, Idler-Motor 225/400 CPM, 50 HZ	A,B,C,D
-4	807001702	Pulley, Motor Pump 225/400 CPM, 50/60 HZ	A,B,C,D
-5	110199009	Pulley, Motor-Idler 225/400 CPM 60 HZ	A,B,C,D
	110199011	Pulley, Motor-Idler 225/400 CPM 50 HZ	A,B,C,D
-6	110203201	Pulley, Picker 225 CPM 50/60 HZ	A,B,C,D
	110203202	Pulley, Picker 400 CPM 50/60 HZ	A,B,C,D
-7	530000603	Belt, Idler-Picker 225/400 CPM, 50/60 HZ	A,B,C,D
-8	530000602	Belt, Motor-Idler 225/400 CPM, 60 HZ	A,B,C,D
	530000601	Belt, Motor-Idler 225/400 CPM, 50 HZ	A,B,C,D
-9	530000605	Belt, Motor-Pump 225/400 CPM, 50/60 HZ	A,B,C,D

FIGURE 7-8 BELTS AND PULLEYS

TABLE 7-1 HARDWARE LIST

FIND NO.	PART NO.	Description
AA	546104004	Bearing, Bushing
AB	571002702	Connector
AC	632001901	Screw, Turn 10C
AD	652000111	O-Ring
AE	662101028	Grommet, Rubber
AG	697000304	Insert, 10-32 x .300
AH	697000505	Pem Nut, 6-32
AJ	697000601	Insert, 10-32 x .375
AK	776000201	Nut, Self Locking 7/16 - 20
AL	776000801	Nut, Self Locking 5/16 - 24
AM	776001204	Nut, Hex 4-40
AN	776001207	Nut, Hex 6-32
AP	776001213	Nut, Hex 10-32
AR	776107012	Nut, Hex 5-40
AS	776001303	Nut, 10-32
AT	795000403	Roll Pin .094 x .500
AU	795323002	Pin, Drive Loc.
AV	796000501	Barb Male, 1/4 NPT
AW	796000502	Reducer 3/8, 1/4 NPT
AX	796000504	Adapter, Pipe Hose 5/16 I.D.
AY	796000801	Bushing
AZ	796001201	Elbow
BA	796001203	Ell, Street 1/4 NPT
BB	796001504	Nipple, Close, 1/4 NPT
BC	796001506	Nipple, 1/4 x 2
BD	796001801	Tee, 1/4 NPT
BE	796002802	Relief Valve
BF	799000102	Vlier Plunger
BG	799000203	Vlier Plunger
BH	829000901	Retaining Ring
BJ	829001701	Retaining Ring
BK	829113009	Retaining Ring
BL	842000218	Screw, Lg. Soc. Hd. 1/4 - 28 x 5/8
BM	842004105	Screw, Flat Hd. 4-40 x 5/16
BN	842004107	Screw, Flat Hd. 4-40 x 1/2
BP	842000904	Screw, Machine 6-32 x 1/4
BR	842003827	Screw, Pan Hd. 6-32 x 5/8
BS	842101020	Screw, BHMS 6-32 x 3/8
BT	842103025	Screw, BHMS 1/4 - 28 x 3/4
BU	842107001	Screw, BHMS 2-56 x 3/16
BV	842003902	Screw, BHMS 4-40 x 3/16
BW	842003903	Screw, BHMS 4-40 x 1/4
BX	842003907	Screw, BHMS 6-32 x 5/16
BY	842004901	Screw, BHMS 2-56 x 3/8
BZ	842003920	Screw, BHMS 6-32 x 3/8
CA	842003924	Screw, BHMS 8-32 x 3/8
CB	842107026	Screw, BHMS 4-40 x 7/16
CC	842107027	Screw, BHMS 6-32 x 7/16
CD	842107033	Screw, BHMS 4-40 x 1/2
CE	842003921	Screw, BHMS 6-32 x 1/2
CF	842003911	Screw, BHMS 8-32 x 1/2
CG	842003927	Screw, BHMS 10-32 x 1/2

FIND NO.	PART NO.	Description
CH	842107050	Screw, BHMS 4-40 x 3/4
CJ	842003912	Screw, BHMS 10-32 x 3/4
CK	842003916	Screw, BHMS 10-32 x 7/8
CL	842003709	Screw, Soc. Hd. Cap. 4-40 x 5/8
CM	842003718	Screw, Soc. Hd. Cap. 6-32 x 7/8
CN	842003734	Screw, Soc. Hd. Cap. 10-32 x 1/2
CP	842003737	Screw, Soc. Hd. Cap. 10-32 x .875
CR	842122407	Screw, Soc. Hd. Cap. 4-40 x 1 5/8
CS	842130043	Screw, Nylon 6-32 x 3/8
CT	845000108	Set Screw 4-40 x 1/8
CU	842000111	Set Screw 4-40 x 1/2
CV	845000312	Set Screw 8-32 x 3/16
CW	845001003	Set Screw 8-32 x 3/16
CX	845001517	Set Screw 10-32 x 1/4
CY	845003302	Set Screw 6-32 x 3/16
CZ	845101053	Set Screw 6-32 x 1/4
DA	848000101	Jackscrew
DB	870105410	Spring
DC	870201321	Spring
DD	881104001	Tie Strap
DE	881000401	Tie Clamp
DF	932000905	Washer, Plain #6
DG	932000906	Washer, Plain #8
DH	932000907	Washer, Flat #10
DJ	932000310	Washer, Flat #5/16
DK	932000201	Washer, Flat #4
DL	932000905	Washer, Flat #6
DM	932000909	Washer, Flat #1/4
DN	933001305	Washer, Lock #6
DP	933001301	Washer, Lock #2
DR	933001303	Washer, Lock #4
DS	933001305	Washer, Lock #6
DT	933001306	Washer, Lock #8
DU	933001307	Washer, Lock #10
DV	933001309	Washer, Lock #1/4
DW	776111009	Nut, Hex 2-56
DX	932000302	Washer, Flat #2
DY	842107099	Screw 4-40 x 9/16
DZ	933001005	Starlock #6
EA	420110206	Ring Lug #10
EB	842003707	Screw 4-40 x 7/16 Socket Head
EC	842003706	Screw 4-40 x 3/8 Socket Head
ED	933113005	Washer, Lock #6
EE	933000306	Washer, Flat #6
EF	932000301	Washer, Lock #2
EG	932000901	Washer, Flat #6
EH	842003862	Screw 2-56 x 1/4, Phillips Head
EJ	776001201	Nut, Hex 5-56

TABLE 7-2 RECOMMENDED SPARES

Category	Part Number	Description	Ref. Fig.
C	110100001	Circuit Board FF12	6-4
C	110110200	Circuit Board, and-invert-12	6-3
C	110117900	Circuit Board, Counter	6-6
C	110124900	Circuit Board, Reader Control	6-8
C	110176900	PhotoCell Assy. Timing	7-2-53
C	004297901	Switch, Push	7-6-36
B	110234501	PhotoCell Assy. (C,D only)	7-2-33
C	110500200	Idler Roller Assy.	7-2-13
C	110500300	Belt Set, Picker	7-2-24
A	110500401	Spring, Edge Guide	7-2-48
B	111016601	Disc, Timing	7-2-55
A	111030900	Throat Block Assy.	7-2-4
C	111037300	Circuit Board, Current Driver	6-9
B	111044000	Pump, Modified	6-7
C	111091800	Static Eliminator Assy.	7-5-10
B	110234801	PhotoCell Assy. (A,B only)	7-2-33
C	169000903	Diode	
C	203115401	Fuse, (MDX3) 3 AMP, 125V	7-7-33
C	203115305	Fuse, (MDL2) 2 AMP, 250V	7-7-34
C	302000401	Lamp	7-2-7
C	302001105	Lamp, Indicator	7-3-6
C	302104001	Lamp	7-3-8
A	327000001	Motor, A/C, 60/50 HZ, 115V, 3200/2700 RPM	Ref.
C	384105013	Relay	7-7-17
A	407001601	Solenoid	
C	416004901	Switch, Push, Alternate Action	7-3-3
C	416004902	Switch, Push, Momentary Action	7-3-2
C	436001401	Transistor (2N5190)	7-7-29
C	436404001	Transistor (2N3644)	7-7-8
C	530000602	V-Belt	7-8-8
C	530000603	Drive Belt	7-8-7
C	530000605	V-Belt	7-8-9
C	530120013	Belt, Positive Drive (70XL037)	7-2-18
C	530120014	Belt, Positive Drive (80XL037)	7-2-59
C	799000203	Plunger, Spring	BG
C	829000901	Ring, Retaining	BH
C	302000101	Timing Lamp Assy.	7-2-50
C	637000601	Filter, Felt	7-4-18

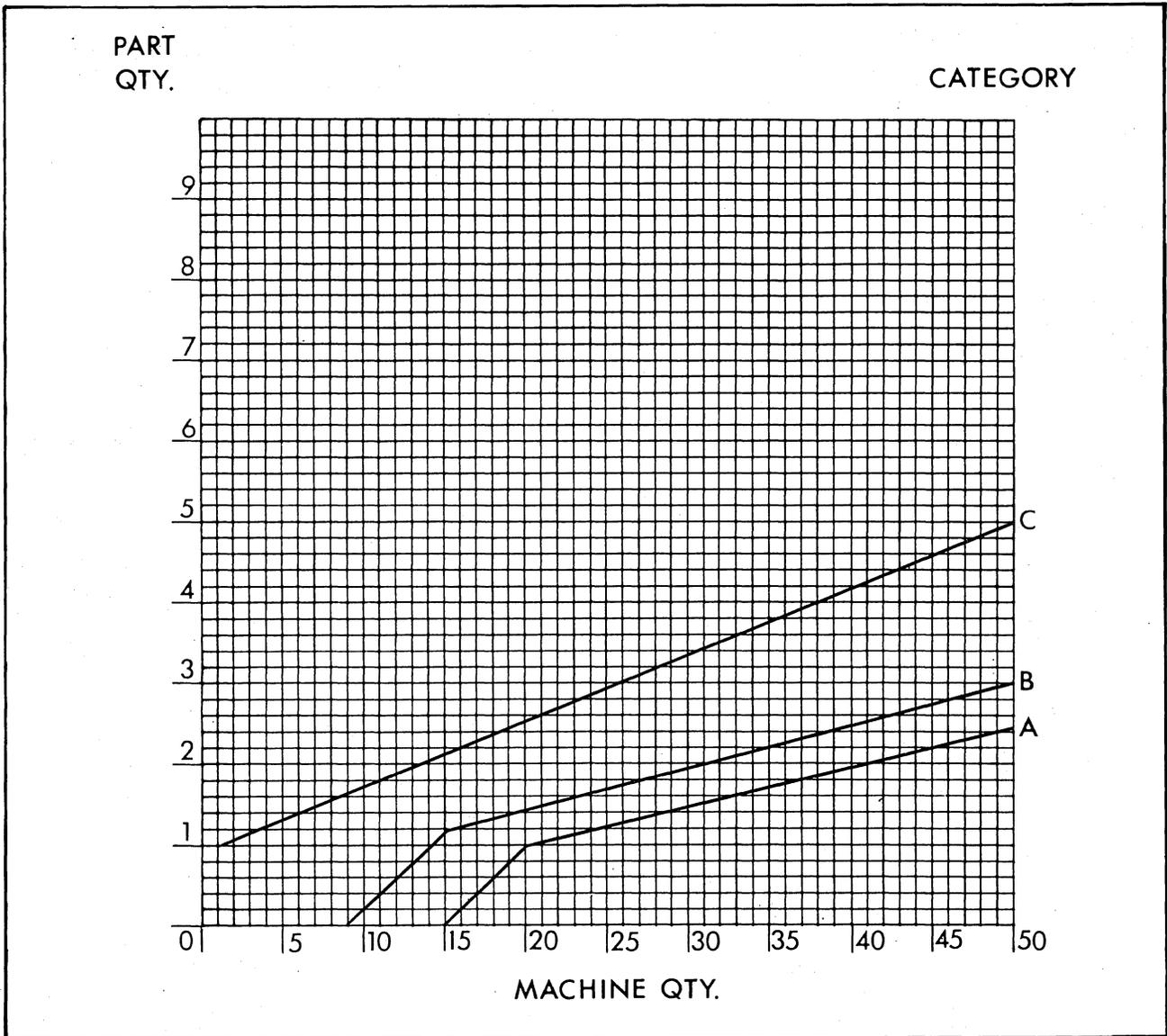


FIGURE 7-9 RECOMMEND SPARES