



III.H.9M-2

CUSTOMER ENGINEERING

**PRODUCT MAINTENANCE MANUAL
(NEW PRODUCT PHASE)**

2244V CARD READER

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**WANG
SUPPLE-
MENT**

WANG SUPPLEMENT

SCOPE

The features of the Wang Laboratories, Incorporated (WLI) 2244V Card Reader, WLI part number (P/N) 177-7068 are summarized below.

The 2244V Card Reader is manufactured by Peripheral Dynamics, Incorporated (PDI); its PDI designation is 3155H/MTX. The 2244V Card Reader operates as part of a VS punched card reader subsystem. For information on the subsystem, refer to the New Products Phase Manual VS Punched Card Reader Subsystem, WLI part number 729-0943.

The publication contains three original equipment manufacturer (OEM) manuals. Since PDI has no manual covering the 2244V (3155H/MTX) Card Reader exclusively, coverage is provided by reprints of the three PDI OEM manuals. The manuals are contained in parts I through III as follows:

1. Part I -- 3155H Series Card Reader,
2. Part II -- 3055M Series Mark Sense Card Reader, and
3. Part III -- PDI Asynchronous RS232-C Serial Interface.

Part I is a manual, and parts II and III are supplementary manuals.

PRINTED CIRCUIT BOARD COMPLEMENT

Parts I, II, and III together, provide coverage for all printed circuit boards (PCBs) contained in the 2244V Card Reader. Because parts I and II were originally written for maintenance of other card reader configurations, they document PCBs not contained in the 2244V Card Reader as well as ones that are. Two examples of equipment documented, but not installed, are the read check board described in part I, paragraph 4.3.5.5, and the interface paddle connector shown in part I, figure 5-1. The PCB complement of the 2244V configuration, and the Wang Laboratories, Incorporated (WLI) part number of each PCB, is summarized below.

<u>WLI PART NUMBER</u>	<u>DESCRIPTION</u>
726-1400	Logic Board Assembly
(TBD)	Mark-Sense Amplifier PCB
726-1425	Asynchronous RS232-C Interface PCB
726-1423	Hollerith-To-ASCII Buffer PCB
726-1404	Voltage Regulator PCB (Power Supply Regulator Board)
726-1424	Power Supply, +, -12V
726-1405	Infra Red Light Source PCB (part of Read Station)
726-1401	Sensor/Light Source PCB (part of Read Station)

WIRE LISTS

Available wire list data for the 2244V Card Reader is summarized on the following pages.

Logic Board Assembly Wire List

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J1</u>			
1	HALT/READY switch, and input and output hopper switches	2	J4-X/J1-16
3	GND	4 through 15	Not used
16*	J1-2/J7-3	17	Not used
18	J4-22	19	J4-8
20 through 22	Not used	A and B	Not used
C	TB2-1	D	Not used
E	TB2-3	F	J4-S
H	Not used	J	Not used
K through M	Not used	N	J4-17/J11-1
P	J8-6	R	Not used
S	J7-Z	T	J7-9
U	J8-4	V	Not used
W	J4-7	X through Z	Not used

* Tie point, no internal connection to PCB

Logic Board Assembly Wire List (Continued)

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J2</u>			
1	GND	2	J2-13/J8-7
3	J4-14	4	J11-18
5 through 7	Not used	8	J11-U
9	J4-10	10	J4-9
11	J11-V	12	J4-6
13	J2-2/J4-15	14	+5V
15	J11-X	16*	J4-4
17*	J11-16	18	Not used
19	RESET switch	20	RESET switch
21	Not used	22	RESET lamp
A	GND	B	J4-20
C	J11-19	D	J4-13
E	J11-20	F	J4-12
H	J11-Y	J	J4-11
K through M	Not used	N	J11-T
P	J4-18	R	Not used
S	J4-5	T	J11-W
U	J4-3	V	J4-16

* Tie point, no internal connection to PCB

Logic Board Assembly Wire List (Continued)

PIN NO.	DESTINATION	PIN NO.	DESTINATION
------------	-------------	------------	-------------

Connector J2 (Continued)

W	J11-21	X	J4-2
Y	J4-1	Z	J11-22

Connector J15

1	Strobe pickup (white)	2	Strobe pickup (black)
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Interface Connector J3** Wire List

PIN NO.	DESTINATION	PIN NO.	DESTINATION
1	Not used	2	J8-E
3	J7-12	4	J8-M
5	J7-10	6	Not used
7	GND	8	J7-L
9 through 19	Not used	20	J8-J
21 through 25	Not used		

** Located at corner of card reader under rear cover.

Mark-Sense Amplifier PCB Wire List

PIN NO.	DESTINATION	PIN NO.	DESTINATION
		<u>Connector J4</u>	
1	J2-Y	2	J2-X
3	J2-U	4	J2-16
5	J2-S	6	J2-12
7	J1-W	8	J1-19
9	J2-10	10	J2-9
11	J2-J	12	J2-F
13	J2-D	14	J2-3
15	J2-13 and MARKS/PUNCH switch	16	J2-V
17	J1-N	18	J2-P
19	40/80 COL switch	20	J2-B
21	MARKS/PUNCH switch	22	J1-18
A	GND	B	GND
C through F	Not used	H	Not used
J through N	not used	P	GND
R	Not used	S	J1-F
T	Not used	U	MARKS/PUNCH switch
V	MARKS/PUNCH switch	W	Unregulated power supply
X	J1-2	Y	Not used
Z	J7-R		

Mark-Sense Amplifier PCB Wire List (Continued)

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J14</u>			
1	P14-1***	3	P14-3
5	P14-5	6	P14-6
8	P14-8	9	P14-9
10	P14-10	11	P14-11
12	P14-12	13	P14-13
14	P14-14	15	P14-15
16	P14-16		

*** Connector P14 is part of the read station, which includes both the infra red light source PCB and the sensor/light source PCB.

Asynchronous RS232-C Interface PCB Wire List

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J7</u>			
1 and 2	Not used	3	J1-16
4	ON LINE/OFF LINE switch	5	ON LINE/OFF LINE switch
6	Not used	7	J11-2
8	J11-4	9	J1-T
10	J3-5	11	Not used
12	J3-3	13 through 22	Not used

Asynchronous RS232-C Interface PCB Wire List (Continued)

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J7 (Continued)</u>			
A	J11-L	B	J11-K
C	J11-12	D	J11-F
E	J11-B	F	J11-A
H	J11-C	J	J11-E
K	J8-L/J11-17	L	J3-8
M and N	Not used	P	Not used
R	J4-Z	S	J11-5
T	Not used	U	J11-11
V through Y	Not used	Z	J1-S

<u>Connector J8</u>			
1 through 3	Not used	4	J1-U
5	Not used	6	J1-P
7	J2-2/J11-7	8	GND
9	GND	10 through 19	Not used
20	J11-6	21	Not used
22	J11-3	A through D	Not used

Asynchronous RS232-C Interface PCB Wire List (Continued)

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J8 (Continued)</u>			
E	J3-2	F and H	Not used
J	J3-20	K	J11-Z/+12V
L	J7-K/-12V	M	J3-4
N and P	Not used	R	READY LAMP
S through V	Not used	W	J11-J
X	J11-H	Y	J11-15
Z	Not used		

Hollerith-To-ASCII Buffer PCB Wire List

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J11</u>			
1	J1-N	2	J7-7
3	J8-22	4	J7-8
5	J7-S	6	J8-20
7	J8-7	8	J11-9/GND
9	J11-8/J3-7	10	Not used
11	J7-U	12	J7-C

Hollerith-To-ASCII Buffer PCB Wire List (Continued)

PIN NO.	DESTINATION	PIN NO.	DESTINATION
<u>Connector J11 (Continued)</u>			
13 and 14	Not used	15	J8-Y
16	J2-17	17	J7-K
18	J2-4	19	J2-C
20	J2-E	21	J2-W
22	J2-Z	A	J7-F
B	J7-E	C	J7-H
D	Not used	E	J7-J
F	J7-D	H	J8-X
J	J8-W	K	J7-B
L	J7-A	M and N	Not used
P	Not used	R and S	Not used
T	J2-N	U	J2-8
V	J2-11	W	J2-T
X	J2-15	Y	J2-H
Z	J8-K		

PART

1

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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SECTION

1

INTRO-

DUCTION

SECTION 1
INTRODUCTION

1.1 SCOPE

This manual contains specifications, installation requirements, operator instructions, principles of operation, and maintenance information for the PDI 3155H Series Card Readers. The manual also contains complete circuit schematics and logic diagrams.

1.2 GENERAL DESCRIPTION

The PDI 3155H Series Card Readers, hereinafter referred to as Card Reader(s), are self-contained units capable of reading standard 80-column cards at a maximum rate of 300 cards per minute. Cards may be picked automatically at this rate, or on an individual basis up to the maximum rate.

Two card reader models are available in this series: the model 3155HT and the model 3155HR. The 3155HT Card Reader is designed for table-top operation, whereas the 3155HR is designed for mounting into a standard 19-inch relay rack or cabinet. Both models, the 3155HT and 3155HR are equally suited for use in an office environment or as an integral part of an industrial data processing system.

The 3155HT and 3155HR Card Readers which are front loaded and unloaded, accept cards punched in any format, reading the data column by column. Data is detected photoelectrically, converted as read to logic levels, and presented on output lines. Sufficient control lines are provided so that the card readers can operate, via a suitable set of control electronics, with a general-purpose computer or remote terminal.

1.3 DESIGN FEATURES

The 3155H Series Card Readers have been designed to meet the most demanding requirements of the modern data processing industry. The readers are rugged, reliable, quiet, simple to operate, and easy to maintain.

Standard features include dust-proof read station, solid state light source, high quality ball bearing construction, thermally protected motor, and universal power supply.

The readers have card feed stop and motor shutdown for input hopper empty, output hopper full, three successive pick failures, or card jam conditions.

1.4 SPECIFICATIONS

Speed and Data Detection

- Speed is 300 cards per minute.
- Data is detected column-at-a-time and presented to the output lines without modification or encoding.
- Data timing is electronically resynchronized for each column containing data in any of the four central rows.

Hoppers

- Input hopper capacity is 500 cards.
- Output hopper capacity is 500 cards.
- Unloading on-the-fly is permissible. Loading on-the-fly is permissible as long as there are approximately 100 cards or more in the input hopper. The input hopper is shaped to indicate the safe level for on-the-fly loading.
- Detection of input-hopper-empty and output-hopper-full are basic features.

Operator Controls and Indicators

The operator controls and indicators consist of three pushbutton switch indicators as follows:

- POWER switch - alternate action - with a white light.
- RESET switch - momentary action - with split indicator.
The top half has a white indicator labelled RESET and the lower half has a red indicator labelled READ ERROR. The reset light indicates a hold condition requiring normal operator attention. When the reset light is on, card feeding is stopped and the motor is not running. The read error light indicates possible failure of one or more of the LED light sources or sensors in the read station.
- HALT switch - momentary action - with a white unlit indicator.
Operation of this switch halts card feed and shuts down the motor.

Power Requirements

Power requirements are 115 VAC $\pm 10\%$, 48 to 66 Hz, 175 watts maximum. Card feed rate is proportional to frequency; i.e., feed rate at 50Hz is 250 CPM.

Dimensions

- PDI 3155HT Card Reader (table model)
 - 11-3/4 in. high to cabinet top, 13-1/2 in. high overall, 14-3/4 in. deep, and 19-1/4 in. wide.
 - 35 lbs. weight.
- PDI 3155HR Card Reader (rack-mounted model)
 - 14 in. high, 6-1/8 in. forward projection, 12-5/8 in. deep overall (including forward projection), and 19 in. wide.
 - 30 lbs. weight.

- In both models, space has been provided for additional printed circuit cards for possible customer applications.

Environmental Conditions

- Ambient operating temperature range is 50°F to 95°F (10°C to 35°C).
- Relative humidity range is 20% to 80%.
- Continuous operation is permissible at the combined extremes of both ranges.
- Ambient storage temperature range is -40°F to 140°F (-40°C to 60°C).

1.5 OPTIONS

The following options are available:

- Modification to operate on-line voltages of 100 VAC +10%, 200 VAC +10%, or 230 VAC +10%.
- Modification to maintain 300 CPM speed at 50 Hz.
- Modification to feed cards at the maximum rate of 500 CPM at 60 Hz, or 400 CPM at 50 Hz.
- Modification to provide five pick tries before sensing mispick.
- Handling of 51 column cards - 500 CPM feed rate (500 CPM at 60 Hz or 400 CPM at 50 Hz) provided with this option.
- Communications type interfaces - a complete line of RS232-C bit serial type interfaces are available for these readers.

SECTION

2

INSTAL-

LATION

SECTION 2
INSTALLATION

2.1 GENERAL

This section of the manual covers unpacking, handling and installation of both the 3155HT (table-top unit) and 3155HR (rack-mounted unit) Card Readers.

2.2 UNPACKING AND HANDLING

The Card Reader is shipped in a container, which is a double-thick corrugated carton, with custom-designed packing material to provide maximum support for the unit.

With the carton in the upright position, as indicated on the carton, open the carton with reasonable care. Carefully remove the unit from the carton, saving the carton, packing materials, and packing instructions leaflet (which is attached to the power cord).

IMPORTANT: If for some reason it becomes necessary to ship a unit, repack into original carton with all packing inserts, following the packing instructions mentioned above. This point cannot be overstressed--the card reader must be properly packed to avoid damage in shipment.

The Card Reader does not require special conditioning or adjustments prior to operation. It is recommended, however, that in case of shipment during adverse weather conditions, sufficient time be allowed for the unit to stabilize at room temperature prior to operation.

The Card Reader is now ready for operational checks as described in paragraph 2.3.

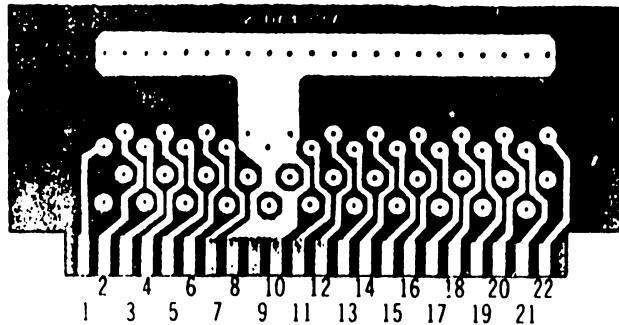
2.3 OPERATIONAL CHECKS

Although each Card Reader is thoroughly tested at PDI before shipment, it is recommended that the unit be checked out following the unpacking, to make sure that no damage has been incurred in shipment. The following checks should be made with both front and rear covers removed. Remove the front cover by grasping on each side, and with the thumbs against the front panel to provide leverage, withdraw the cover. Remove the rear cover in similar fashion. It may be found helpful in removing the rear cover to first separate the two bottom latches and then separate the two top latches.

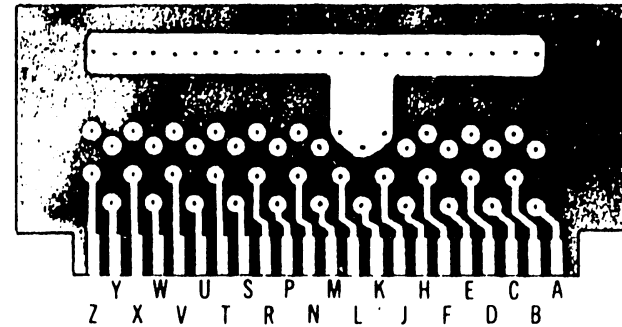
- a. Inspect reader to make sure that the circuit boards are properly seated in their connectors and that the various connectors are fully mated.
- b. Inspect strobe wheel and magnetic pickup to ensure magnetic pickup and strobe wheel have correct clearance (.004 to .006 in.).
- c. Plug line cord into A-C receptacle of the proper voltage (see nameplate on rear chassis apron of card reader).
- d. Operate POWER switch: POWER and RESET lamps should light.
- e. Hold input hopper switch down with finger, and operate RESET switch: motor should run; RESET lamp should extinguish. Release input hopper switch: motor should stop running; RESET lamp should light.

- f. Hold input hopper switch down with finger and operate RESET switch again: with motor running, operate output hopper switch by gently raising output hopper card follower (hinged flipper) to end of its travel with other hand; motor should stop running and RESET lamp should again light.
- g. Turn off power and ground PICK line (pin 6 of J3) with temporary lead. Note: This can be done simply by connecting pin 6 to pin 8, 9 or 10 of the paddle connector (see Figure 2-1) and inserting paddle into J3. (J3 is the 44-pin connector closest to the back of the equipment.) Hold input hopper switch down as before and operate POWER switch: Motor should run and unit should attempt to pick three times and stop; similarly, the motor should start and the unit should attempt to pick three times and stop each time the RESET switch is operated. The RESET lamp should extinguish during time picking is attempted.
- h. With power on and PICK line still grounded, load deck of cards into input hopper and place card follower on top of cards. Operate RESET switch: unit should pick and stack deck of cards. When input hopper empties, unit should stop picking, motor should stop and RESET lamp should light.
- i. Restack cards into input hopper and operate RESET switch. With unit feeding cards, operate HALT switch: unit should stop picking, motor should stop and RESET lamp should light.

THIS SIDE FACES REAR OF READER



THIS SIDE FACES FRONT OF READER



PIN DESIGNATIONS

	PIN	FUNCTION	PIN	FUNCTION
INPUTS:	6	PICK		
	A	MOTOR DISABLE		
OUTPUTS:	1	CARD IN STATION	16	BIT 3
	2	DATA AVAILABLE	17	BIT 4
	3	CHECK CONDITIONS	18	BIT 5
	4	INTERLOCK	19	BIT 6
	5	READ CHECK	20	BIT 7
	7	+5V (interface options only)	21	BIT 8
	8	GROUND	22	BIT 9
	9		F	DATA STROBE (interface options only)
	10		R	EXT. SW.
	11	BIT 12	T	PICK FAILURE
	12	BIT 11	U	
	13	BIT 0	V	
	14	BIT 1	W	
	15	BIT 2	Z	MOTOR STATUS

FIGURE 2-1 INTERFACE PADDLE CONNECTOR

- j. Operate RESET switch: motor should start, RESET lamp should extinguish, and unit should resume picking until input hopper empties. The motor should stop and the RESET lamp should light as before.
- k. Turn off power to the Card Reader, remove ground jumper from PICK line, and replace front or front and rear covers, as required.

2.4 INSTALLATION REQUIREMENTS

2.4.1 Physical Dimensions

The PDI Model 3155HT Card Reader is designed for table-top operation. The overall dimensions of this model are shown in Figure 2-2a. A table height of about 30 inches is recommended for this Card Reader.

The PDI Model 3155HR Card Reader is designed for mounting into a standard 19-inch relay rack or cabinet. The overall dimensions and mounting details are given in Figure 2-2b. It is recommended that this Card Reader be mounted so that the top of the front panel is about 48 inches above the floor.

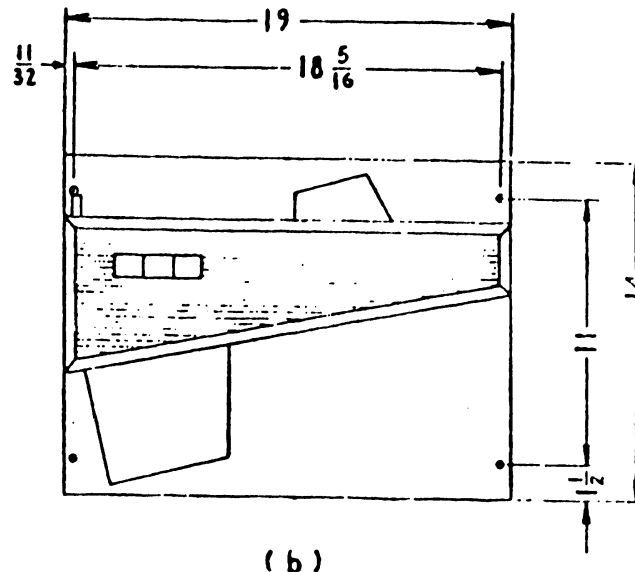
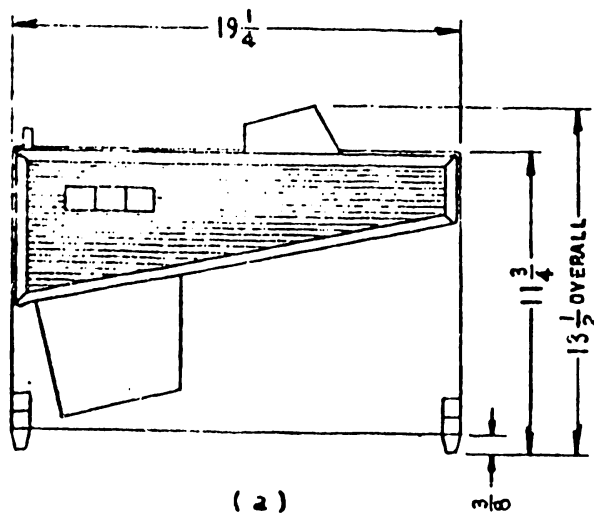
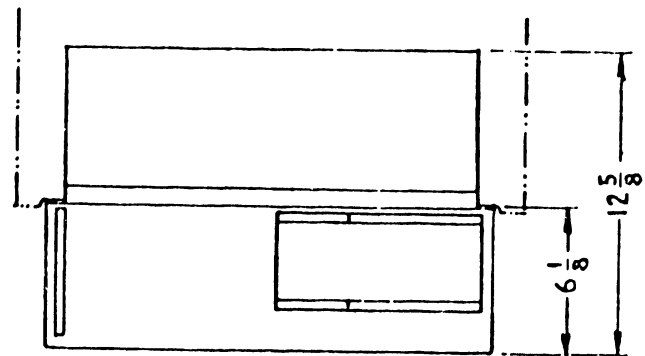
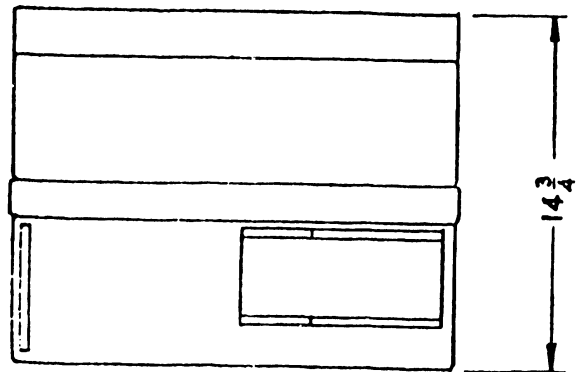
2.4.2 Power Requirements

Each Card Reader requires a source of 115 volts, 50-60 Hz AC power, at 175 watts maximum. A power line cord and plug is provided as an integral part of the Card Reader.

2.4.3 Data Controller Requirements

2.4.3.1 General

The PDI 3155H Series Automatic Card Readers require a Data Controller capable of interfacing the Card Reader with the computer system.



(a)

(b)

MODEL 3155HT TABLE UNIT

MODEL 3155HR RACK UNIT

Figure 2-2 3155 SERIES AUTOMATIC CARD READER DIMENSIONS

The arrangement of the Data Controller in regards to the computer interface will necessarily be dictated by the computer requirements. However, the Data Controller must be capable of issuing commands to, and responding to status conditions and data from, the Card Reader. The nature of these signals is described in the following paragraphs.

2.4.3.2 Card Reader Interface Signals

Interface levels are standard +5-volt TTL logic levels. Interface line drivers and receivers are 7400-series TTL logic gates, which are compatible with most other forms of current-sinking logic. The interface is arranged so that the signal sense is "ground true" on the interconnecting cable. This precludes the entry of data to the Data Controller if a cable should open or be accidentally pulled loose. (With current-sinking logic such as TTL, an open input is interpreted as a high level.)

2.4.3.3 Card Reader Operating Modes

The Card Reader may be operated in either of two modes: single-pick-on-command at rates up to 300 cards per minute, or pick-continuously at a maximum rate (300 CPM). The mode of operation will depend on how the pick command signal is issued. For the single pick mode, the Data Controller must generate a pick command (a zero-going pulse on the PICK input line) for each card to be read. The pick command should be issued only when the INTERLOCK output line is low. The width of the pick command pulse is not critical and pulse widths ranging from 1 usec to 70 milliseconds are acceptable.

If, instead of applying individual pulses to the PICK input line, this line is held to a steady-state ground, the unit will continuously cycle, picking one card after another at maximum rate, until the input hopper runs out of cards. When the input hopper empties, the CHECK CONDITIONS output line will go high, and the PICK input line should be allowed to go high until the input hopper is reloaded and it is desired to start running the next deck. If the pick order is not cleared, the Card Reader will commence picking as soon as it is placed in the ready condition (by operating the RESET button).

If it is desired to operate the Card Reader in such a manner that a long period of time is involved in reading a complete deck of cards; for example, if several cards are read at a time with long intervals of waiting until the next several cards are to be read, it may be desirable to shut down the motor remotely for the waiting periods. In this card, the card reader is kept in the "on line" condition and the shutdown of the motor is controlled remotely by the Data Controller. A motor shutdown line is provided at the card reader interface for this purpose. A high level (or no connection) on this line will permit normal motor operation; conversely, a ground level on this line will inhibit motor operation.

The motor shutdown line must not be brought to ground unless the interlock line is low. To shut down the motor externally, then, the Data Controller must first make sure the interlock line is low before grounding the motor shutdown line. To restart the motor, the motor shutdown line is brought to the high-level and the motor will start. A 300-millisecond timeout period is built into the card reader to prevent the processing of pick orders until the motor is up to speed.

2.4.3.4 Signal Interface Input and Output Lines

A tabulation of the 23 signal interface lines and their functions is presented in Table 2-1.

TABLE 2-1. CARD READER INTERFACE LINES

No. of Lines	Name of Line	Function
1	PICK	<p>Input line: Ground true pulse of 1 usec minimum duration required to effect card pick. Should be sent when INTERLOCK line is low to effect pick.</p> <p>A ground true pick signal that is continuous is acceptable and will result in continuous card picks as described in paragraph 2.4.3.3.</p>
1	MOTOR DISABLE	<p>Input line: Ground true level disables motor. High level or no connection allows normal motor operation. This line should not be grounded unless INTERLOCK line is low.</p>
12	DATA (Labeled BIT 12, BIT 11, BIT 0, BIT 1, BIT 2, BIT 3, BIT 4, BIT 5, BIT 6, BIT 7, BIT 8, and BIT 9)	<p>Output lines: Ground true pulse when data hole is present. Data can be accepted when DATA AVAILABLE line is low.</p>
1	DATA AVAILABLE	<p>Output line: Eighty 2 usec wide ground true pulses for each card read. Data is "good" during times when this line is low. Pulse occurs during last 2 usec of DATA STROBE signal.</p>
1	DATA STROBE (not required for normal interface)	<p>Output line: 120 usec wide ground true pulse every 960 usec. Occurs at approximately center of hole when data is being read, but is also present when data is not being read. (Used for interface options only.)</p>
1	CARD IN STATION	<p>Output line: Ground true signal when card is in read station.</p>

TABLE 2-1 (Cont'd)

No. of Lines	Name of Line	Function
1	CHECK CONDITIONS	Output line: Ground true signal when the following conditions are all true: power on, input hopper not empty, output hopper not full, not more than three successive pick failures, and HALT switch not operated since last RESET switch operation. Motor is shut down internally if this line goes high. Requires normal operation intervention when line goes high (HOLD condition).
1	INTERLOCK	Output line: Ground true signal when check conditions are true and card is not being transported. Controller should generate pick command when this line is low.
1	MOTOR STATUS	Output line: Ground true signal when motor is running and is up to speed.
1	PICK FAILURE	Output line: Ground true signal when check conditions false signal is due to three successive pick failures.
1	EXTERNAL SWITCH	Output line: Ground true signal when check conditions false signal is due to input hopper empty or output hopper full. Also goes to ground momentarily when HALT switch is operated. NOTE: This line may require buffering to eliminate the effects of switch contact bounce.
1	READ CHECK	Output line: Ground true signal when check conditions false signal is due to a light/dark check failure. Reset by operating RESET switch.

2.4.4 Interface Wiring

All data and control line interconnections are made through a paddle connector, J3, which plugs into the 44-pin connector closest to the rear of the unit. It is recommended that all interconnections between the Data Controller and this paddle connector be made with 26 AWG twisted-pair wire, the total cable length to be as short as possible, and in no case to exceed 30 feet. If longer interface lines are required, up to 100 feet of twisted-pair wire may be used if a 560 ohm pull-up resistor to +5 volts is used at the receiving end of each line. For runs in excess of 100 feet, it is recommended that special line driver and receiver interface circuits be used.

The paddle connector layout and pin designations are given in Figure 2-1. It will be noted that there are 21 output lines from the Card Reader and two input lines. A separate twisted pair should be used for each line. The ground lead from each twisted pair should be connected to the grounding strip on the paddle, adjacent to the pin used. The paddle connector should be installed with the part number side facing the rear of the equipment.

2.5 INSTALLATION CHECKS

2.5.1 Procedure

The following procedure is presented as a guide to check out the operation of the Card Reader after installation. The checkout is discussed in a general manner to illustrate typical operating conditions.

- a. Initial conditions: no cards in hoppers and read station clear.

- b. Operate POWER switch: POWER lamp should light; RESET lamp should light; CHECK CONDITIONS line should be high; INTERLOCK line should be high; and DATA AVAILABLE line should be high.
- c. Load cards into input hopper and then operate RESET switch: motor should run; RESET lamp should go out; CHECK CONDITIONS line should go low; and INTERLOCK line should go low. Unit is now under control of the Data Controller.
- (1) When INTERLOCK line is low, Data Controller may issue a pick command, which should be a zero-going pulse, typically of one to two microseconds duration, on the PICK input line to the Card Reader.
 - (2) When the pick command is received, the INTERLOCK line will go high, indicating receipt and initiation of the order. The INTERLOCK line will remain high during the time the card is in transit. When the card is stacked, the INTERLOCK line will again go low to indicate that the unit is available to receive the next pick command. In the event of a misspick, the INTERLOCK line will remain high and the unit will attempt to repick up to two times. If one of these attempts is successful, the INTERLOCK line will go low when the card is stacked, to indicate that the unit is available to receive the next pick command. If the second repick attempt is not successful, the INTERLOCK line will remain high and the CHECK CONDITIONS line will go high indicating that operator

intervention is required. At the same time, the motor will shut down, the RESET lamp will light to indicate that the unit is in the HOLD condition, and the PICK FAILURE line will go to ground level. When the card problem is corrected, operation can be resumed by operating the RESET switch, which resets the logic and returns control to the Data Controller.

(3) During the time a card is being read, 80 zero-going pulses, each typically of two microseconds duration and spaced approximately every 960 microseconds, will appear on the DATA AVAILABLE line to the Data Controller. Data bits may be transferred during the times when this line is low (during each two usec period).

(4) If, for some reason, the operator wishes to halt operation of the Card Reader during the time it is under control of the Data Controller, he may operate the HALT switch. The HALT switch is a momentary action type, and will place the unit in a hold condition, and shut down the motor. If a card is in the process of being read when the HALT switch is operated, reading will be completed and the card will be stacked before the motor shutdown occurs. To restart the unit, the operator merely operates the RESET switch; the motor will start and the Card Reader will resume operation under control of the Data Controller.

d. In the event that faulty cards cause a card jam to develop, the condition will be sensed and power will be removed from the drive motor.

e. If during operation, the motor shuts down and both RESET and READ ERROR indicators light, it is an indication that the last card read has failed to pass either the light or dark checks of the read check cycle. This could indicate a failure of either the light source or the sense head and the data on the last card in the stacker may be questionable. The last card in the stacker should be examined and if nothing can be found wrong with it, it should be reloaded to the bottom of the deck in the input hopper, and the RESET button operated to continue reading the deck. If READ ERROR indications persist, the reader may require servicing to correct the problem. The read check system is described in detail in section 4.3.5.5 of this manual.

2.5.2 Functional Summary

A functional summary of the Card Reader operation is presented in Table 2-2.

TABLE 2-2 CARD READER FUNCTIONAL SUMMARY

CONDITIONS	POWER LIGHT (white)	RESET LIGHT (white)	INTERLOCK LINE	CHECK CONDITIONS LINE	MOTOR
1. POWER FIRST TURNED ON; NO CARDS IN INPUT HOPPER OR READ STATION; CHECK CONDITIONS FALSE.	ON	ON	HIGH	HIGH	STOPPED
2. CARDS PLACED IN INPUT HOPPER; POWER IS TURNED ON, OR RESET SWITCH OPERATED; CHECK CONDITIONS TRUE.	ON	OFF	LOW CONTROLLER INITIATES PICKS WITH ZERO GOING PULSE; HIGH WHILE CARD IS BEING TRANSPORTED. LOW WHEN CARD IS STACKED.	LOW	RUNNING
3. CHECK CONDITIONS TRUE; 1 OR 2 FALSE PICKS.	ON	OFF	HIGH	LOW	RUNNING
4. TRUE PICK OCCURS BEFORE 3RD FALSE PICK.	ON	OFF	LOW WHEN CARD IS STACKED	LOW	RUNNING
5. THIRD FALSE PICK - CHECK CONDITIONS GO FALSE. RETURN TO 2. AFTER OPERATOR INTERVENTION	ON	ON	HIGH	HIGH	STOPPED
6. CARDS RUN OUT OF INPUT HOPPER OR OVERLOAD OUTPUT HOPPER - CHECK CONDITIONS GO FALSE. RETURN TO 2. AFTER OPERATOR INTERVENTION.	ON	ON	HIGH	HIGH	STOPPED
7. CARD JAM. RETURN TO 2. AFTER OPERATOR INTERVENTION.	ON	OFF	LOW	LOW	STOPPED
8. HALT SWITCH OPERATED - CHECK CONDITIONS GO FALSE.	ON	ON	HIGH - AFTER CARD IS STACKED	HIGH-AFTER CARD IS STACKED	STOPPED-AFTER CARD IS STACKED
9. RESET SWITCH OPERATED-CHECK CONDITIONS GO TRUE	ON	OFF	LOW - HIGH WHILE CARD IS BEING TRANSPORTED FOR EACH PICK ORDER.	LOW	RUNNING
10. POWER LOST OR TURNED OFF.	OFF	OFF	EQUIV. HIGH CONDITION	EQUIV. HIGH CONDITION	STOPPED

CHECK CONDITIONS TRUE: POWER ON; HOPPERS OK; NOT 3 SUCCESSIVE PICK FAILURES; HALT SWITCH NOT OPERATED SINCE LAST RESET SWITCH OPERATION.

INTERLOCK TRUE: CARD NOT BEING TRANSPORTED AND CHECK CONDITIONS TRUE.

SECTION

3

OPERA-

TION

SECTION 3

OPERATION

3.1 GENERAL

This section contains a description of the operating controls and a discussion of normal operating procedures.

3.2 OPERATING CONTROLS AND INDICATORS

All the operating controls and indicators for the Card Reader are located on the upper left-hand corner of the front panel of the unit. These controls consist of three pushbutton switch indicators which function as follows:

- a. POWER - An alternate-action pushbutton switch indicator that turns power on and off to the unit. This switch has a white indicator panel that is illuminated when power is on.
- b. RESET - A momentary-action pushbutton switch indicator that is used to reset the logic functions. This switch has a split indicator; the top half is illuminated white for RESET (a "hold" condition, when the check conditions are not satisfied), and the bottom half is illuminated red for READ ERROR.
- c. HALT - A momentary-action pushbutton switch used to place the Card Reader in the "hold" condition and turns off the motor. This switch has a white panel that is not illuminated.

3.3 OPERATING INSTRUCTIONS

3.3.1 Normal Operation

- a. After ascertaining that there are no cards in the hoppers, operate POWER switch. The POWER indicator switch should light,

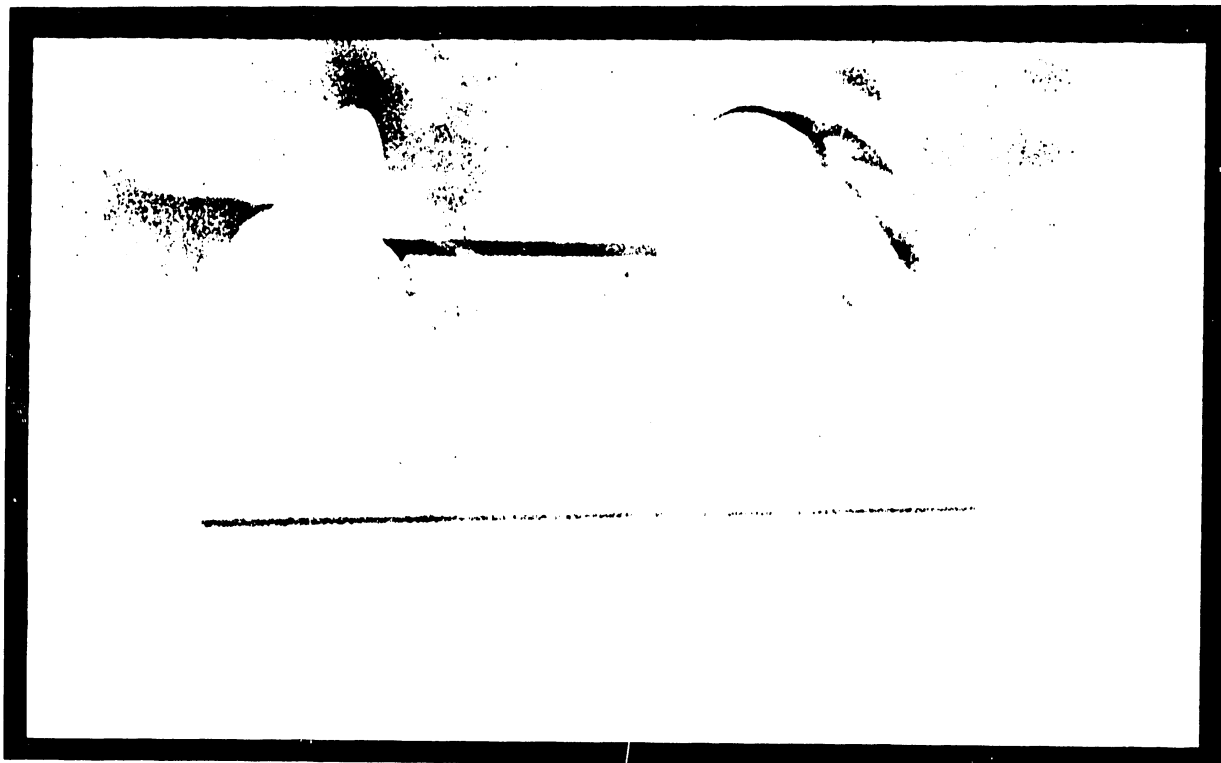
denoting that power is on. The RESET indicator should light, denoting, in this case, that the input hopper is empty.

Operate the RESET switch. The lower half of the RESET switch indicator, which is labeled READ ERROR should light read, thereby checking the lamp.

- b. Remove card follower from input hopper. The deck of cards to be read should first be jogged on the left top surface of the machine (see Figure 3-1a). The cards are then loaded into the input hopper, with column 1 to the left and row 12 toward front of machine, and the card follower is placed on top of the cards. It is sometimes helpful to riffle the cards slightly, see Figure 3-1b, as they are placed into the input hopper.
- c. Operate the RESET switch. The RESET indicator lamp should go out, indicating that the check conditions have been satisfied and that the unit is now "on line". The Data Controller can now commence to pick cards. The motor may start immediately, or just prior to picking cards, depending upon the Data Controller programming.
- d. When the input hopper runs out of cards, the motor will stop and the RESET indicator will again light, denoting that the input hopper is empty and that the Card Reader is in the hold condition ("off line").
- e. Remove cards from the output hopper, and if no more cards are to be run, turn off power to the unit by operating the POWER switch.

3.3.2 Mispicks

If, in the course of reading a deck of cards, the Card Reader has difficulty picking a card, the standard unit will attempt to repick up to two additional times. If unsuccessful, the unit will stop picking, the motor will shut down, and the RESET indicator will light. The bottom card



a



b

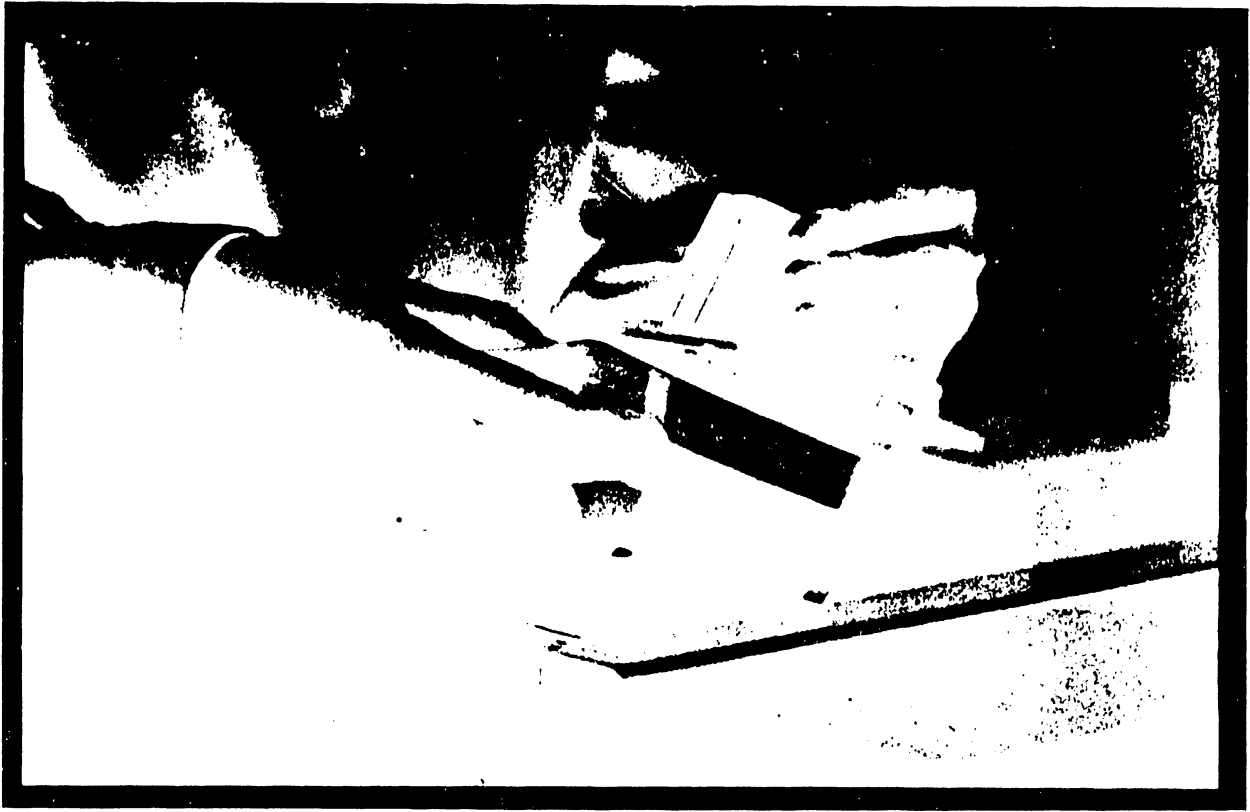
FIGURE 3-1 LOADING CARDS

of the stack in the input hopper will be the defective card. If not too damaged, the card edge may be flattened out sufficiently to run by drawing the damaged edge of the card between the thumb and forefinger of one hand. After replacing the damaged card on the bottom of the remainder of the deck and jogging them again, replace the deck in the input hopper with the card follower on top. Operation of the RESET button will restart the motor, reset the logic, and allow the unit to complete the reading of the deck.

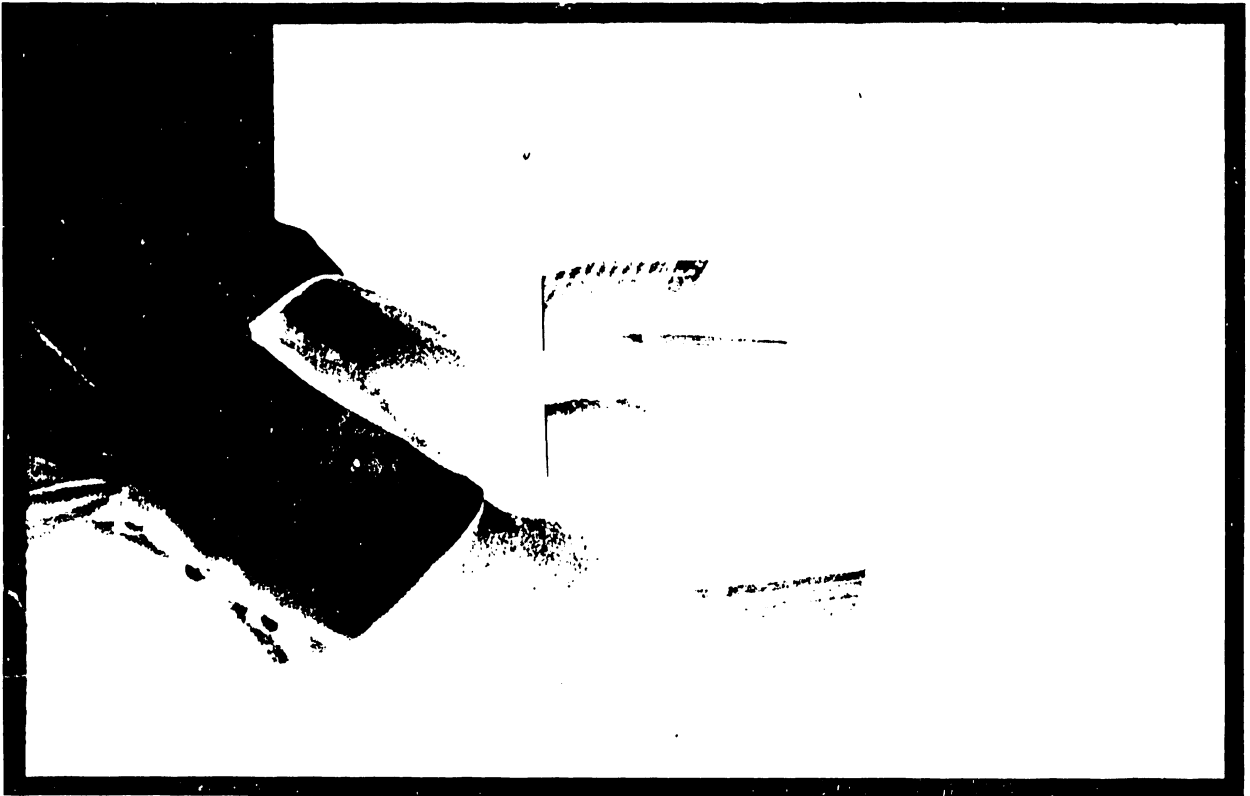
3.3.3 Loading and Unloading On-the-Fly

Loading and unloading on-the-fly is permissible and should offer no problems if a few simple rules are followed:

- a. First, since the card follower must be lifted when loading on-the-fly, the level of the cards in the input hopper must not be allowed to get below 100 cards to ensure reliable picking. Refer to Figure 3-2a. A convenient gauge for this is the outermost corner on the "tails" of the input hopper, which are about 3/4" above the card bed. In other words, do not let the card stack in the input hopper get lower than about 3/4" in thickness.
- b. Secondly, use two hands to unload the output hopper. The procedure that works best is to hold up the cards coming into the hopper with the index finger of the left hand while removing the stack of cards from beneath this finger with the right hand. Refer to Figure 3-2b. In removing cards from the output hopper in this fashion, it is recommended that the stack of cards taken at a time be not thicker than about two inches for ease of removal.



a



b

FIGURE 3-2 LOADING AND UNLOADING ON-THE-FLY

SECTION

4

**PRINCIPLES OF
OPERATION**

SECTION 4

PRINCIPLES OF OPERATION

4.1 GENERAL

This section is divided into two parts: Principles of Mechanical Operation, which contains all major mechanical considerations; and the Principles of Electrical Operation, which first discusses all major electrical considerations on the basis of simplified block diagrams, and concludes with a detailed description of the various printed circuit (PC) boards.

4.2 PRINCIPLES OF MECHANICAL OPERATION

As can be seen in Figure 4-1, the Card Reader consists of an input module assembly and an output hopper assembly. The input module assembly contains the input hopper, the picker roller, a gauged throat, a pair of drive rollers, and their opposing pinch rollers. The cards are moved from the input hopper by the picker roller, which is a friction roller in intimate contact with the bottom card of the stack. This roller is rotated (by motor power) on command by a magnetically operated clutch. This action feeds a card through the throat, which is gauged to permit only one card at a time to pass through. The picker roller continues to drive until the leading edge of the card is sensed, at which time it is already captured by the first drive roller, and the accompanying set of pinch rollers of the transport system. An inertia damper is employed on the picker roller shaft to prevent overtravel of the picker roller after the captured card loses contact with it.

4-2

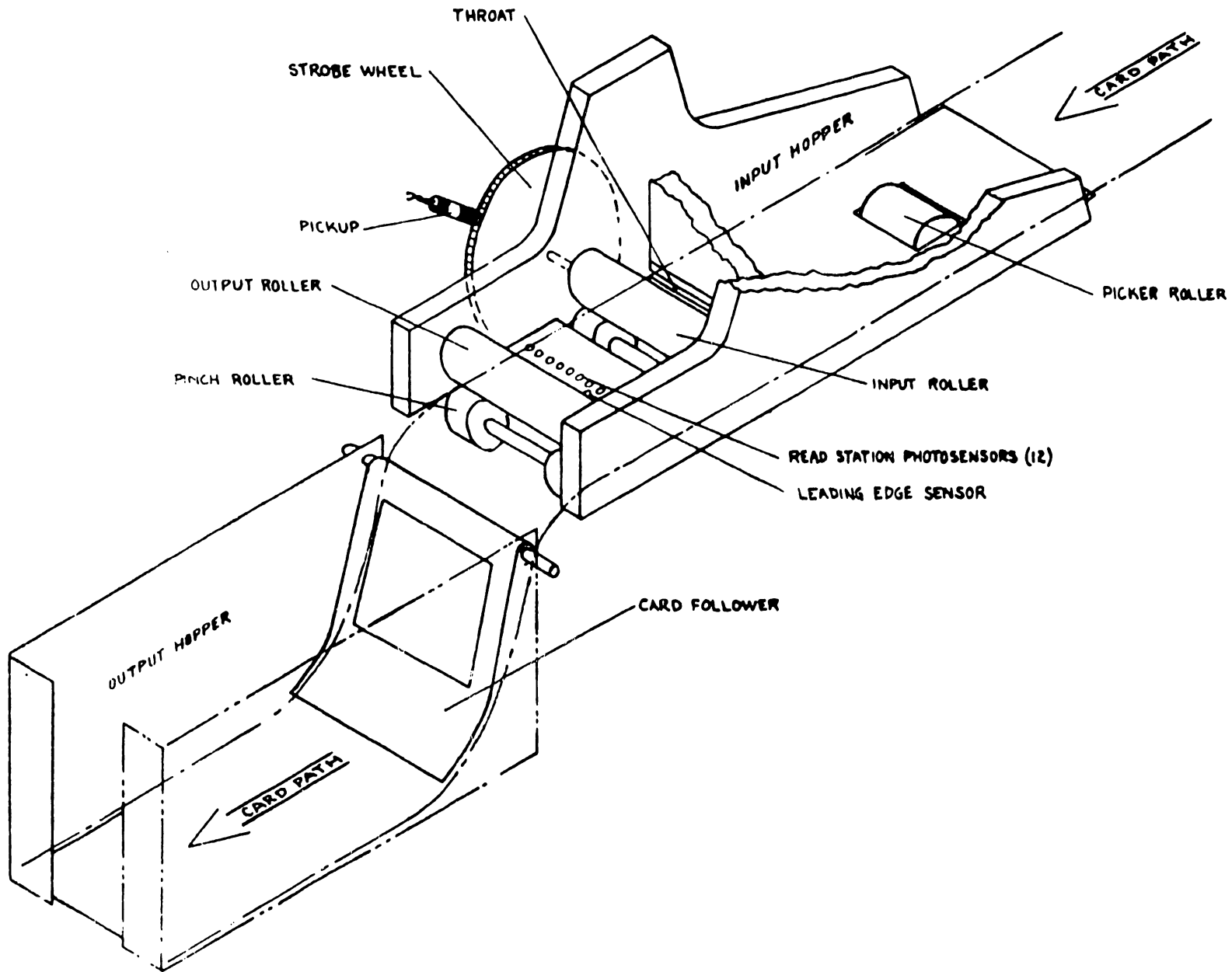


FIGURE 4-1 CARD READER INPUT MODULE AND OUTPUT HOPPER ASSEMBLIES

Upon entering the transport system, the matched drive rollers maintain positive control of the card during the entire reading operation. The read station, consisting of an array of infrared light emitting diodes (LED's) and an array of photosensors, mounted in opposition, is located between these two drive rollers. Timing is taken from the first drive roller by means of the strobe wheel, and is, therefore, in unison with the card being driven. The second drive roller also functions as a positive drive to deposit the card into the output hopper. The cards are ramped downward into the input hopper over a variable angle which is a function of the number of cards in the output hopper. A hinged follower in the output hopper assembly guides the buildup of cards in the hopper and ensures positive stacking action. The shape of this follower has been designed to meet this requirement and should not be modified.

4.3 PRINCIPLES OF ELECTRICAL OPERATION

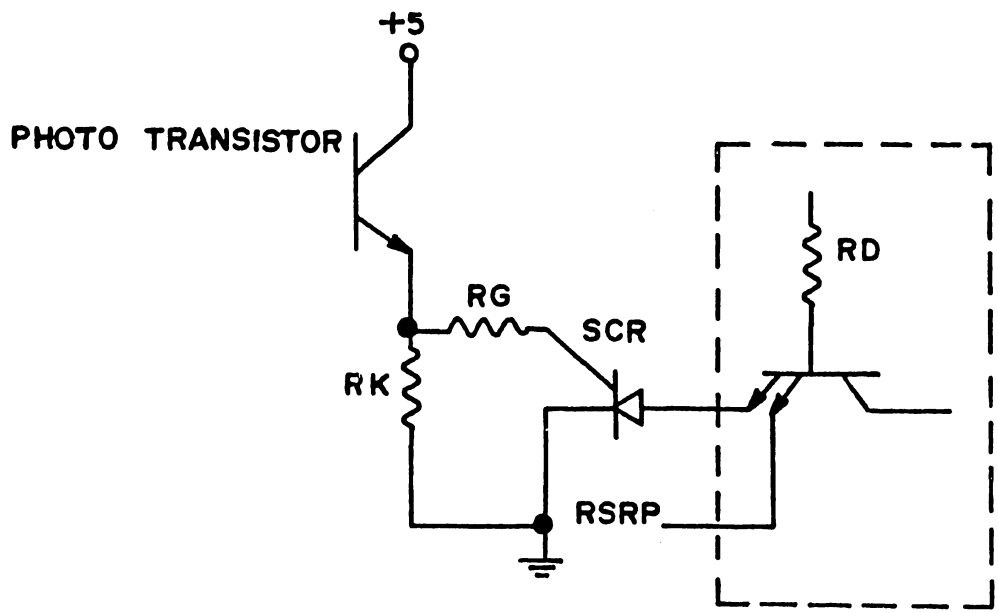
4.3.1 Data Circuits

The card reader data circuitry employs photo-transistors to sense data, and SCR's to latch the data. Both photo-transistors and data latches are physically contained on the read head p-c board. The photo-transistors have a lens which focuses incident light on the semiconductor chip. When light energy strikes them, as through the holes in the card, the transistors turn on; in the absence of light, they turn off. The circuitry is arranged so that when light strikes the photo-transistor, its associated SCR is turned on. The SCR's, once triggered, will remain on, until they are electrically turned off. The SCR's are turned off by reducing the anode current below the holding current value required to maintain conduction in the latched condition. In the off condition, the SCR's have an impedance of several megohms; in the on condition, they have an impedance of less than

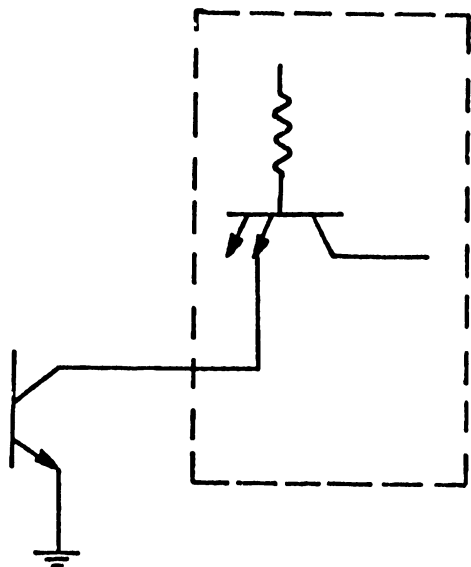
10 ohms, and hence can work directly into the logic gates.

The data sensors are arranged as shown in Figure 4-2a, which typifies one bit of the read station. The collector of the photo-transistor is connected to the +5-volt supply, and the emitter is d-c coupled to the gate of the SCR data latch. The logic-node load resistor (R_D) which is contained in the integrated circuit (IC) package, is also the anode load resistor for the SCR. When the SCR turns on, it pulls current from the logic gate input and turns off the logic gate, so that its output goes high. Read station reset pulses (\overline{RSRP}) are applied to the other input of the logic gate. When light strikes the photo-transistor, it conducts, turning on the SCR data latch which pulls current from one input of the logic gate causing its output to go high. When the zero-going reset pulse occurs (\overline{RSRP}), the output of the logic gate remains high, but the current from R_D is diverted from the SCR to the reset input, turning off the SCR. The read station is reset during the time between data bits (during the web time), and after termination of the reset pulse, if no light is detected (no hole for the next data bit) the SCR remains off and the logic gate output goes low. If, on the other hand, a hole is present for the next bit, light striking the photo-transistor again resets the SCR and the logic gate output will remain high.

The leading edge sensor is also a photo-transistor, and is arranged as shown in Figure 4-2b. Light energy striking the photo-transistor causes it to turn on, sinking current from the logic gate input, causing the logic gate to turn off and its output to go high. When this light energy is cut off, as it would be when a card passes between the light source and the sensor, the photo-transistor ceases to conduct and the output of the logic gate goes low until the sensor is again uncovered.



A. READ STATION SENSOR



B. LEADING EDGE SENSOR

FIGURE 4-2 DATA AND LEADING EDGE PHOTODIODE CIRCUITS.

4.3.2 Control Circuits

A simplified block diagram of the control circuitry is shown in Figure 4-3. Control timing is developed from a strobe wheel which is affixed to the first drive roller shaft. A magnetic pickup senses teeth on this strobe wheel and indexes a mod 8 counter; the strobe wheel has eight teeth per data column, and the mod 8 counter cycles once per data column. Refer to the timing diagram shown in Figure 4-4b. The leading edge detector, a photosensitive device, synchronizes the mod 8 counter at the same time the leading edge of a card is detected via the leading edge single shot. The mod 8 counter is decoded to provide data strobe pulses and read station reset pulses. The latter pulses are also used to index the main counter at the column rate.

The main counter is normally "hung up" (prevented from counting) by the count gate which is controlled by the last state of that counter. When a pick command is received, the main counter is set to its starting count whereupon the count gate allows the counter to index at the column rate until the leading edge is sensed. Upon sensing the leading edge, the main counter is again set to its starting count. When the counter reaches the last state, further counting is inhibited by the count gate and the counter is hung up. The main counter, therefore, is normally partially cycled first, and then completely cycled once per card, and all timings are derived from decoded states of this counter. Approximate timings for two different modes of picking are shown in Figure 4-4a.

A lockup flip-flop is employed to allow only one pick command at a time to be given to the control circuits. When the main counter is hung, the lockup flip-flop is in the unlocked (or reset) state, enabling the lockup gate. The pick command sets the lock flip-flop, which in turn,

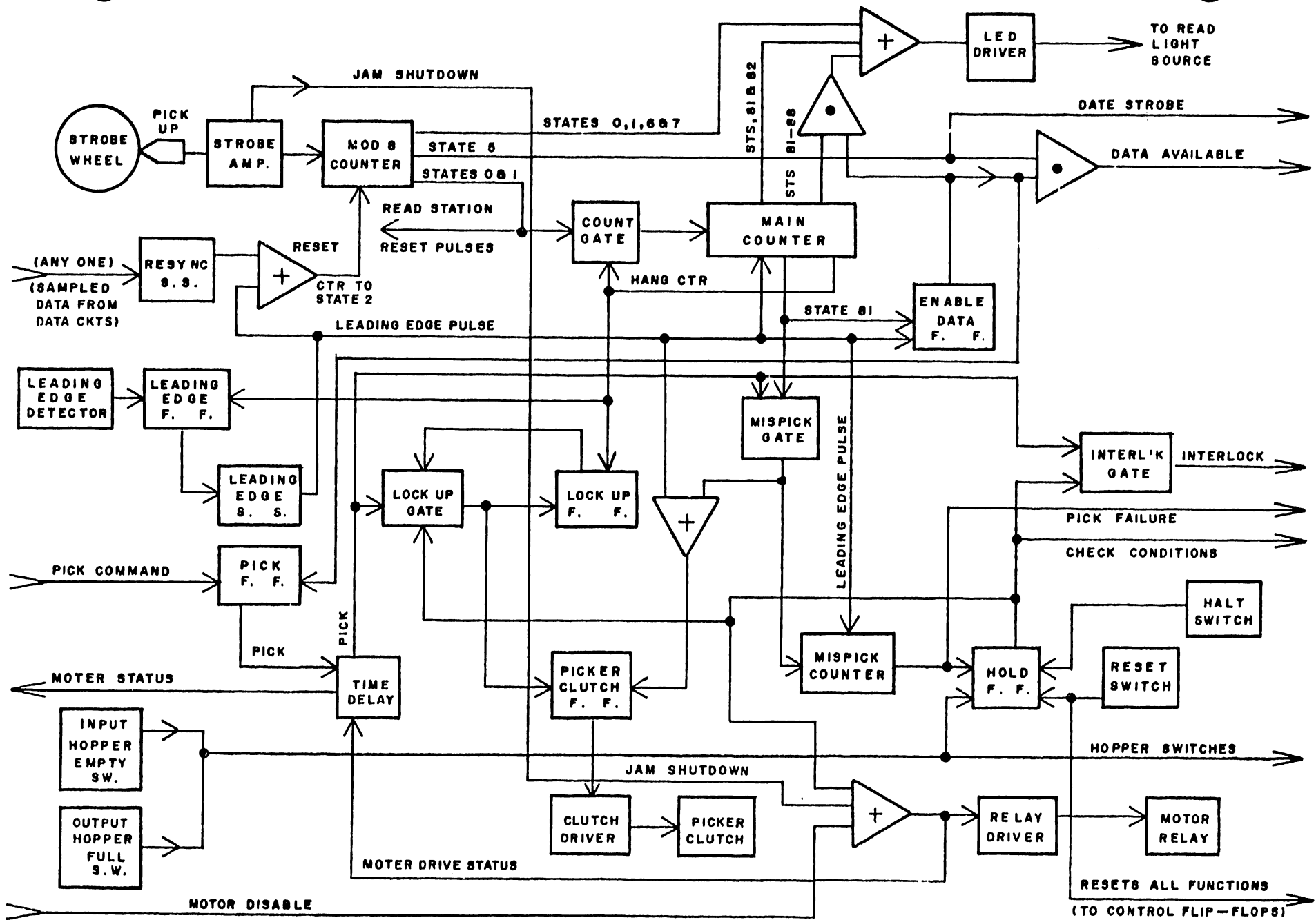
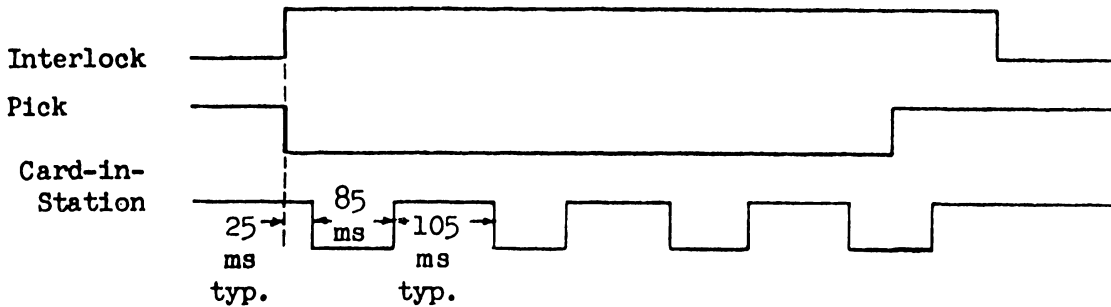
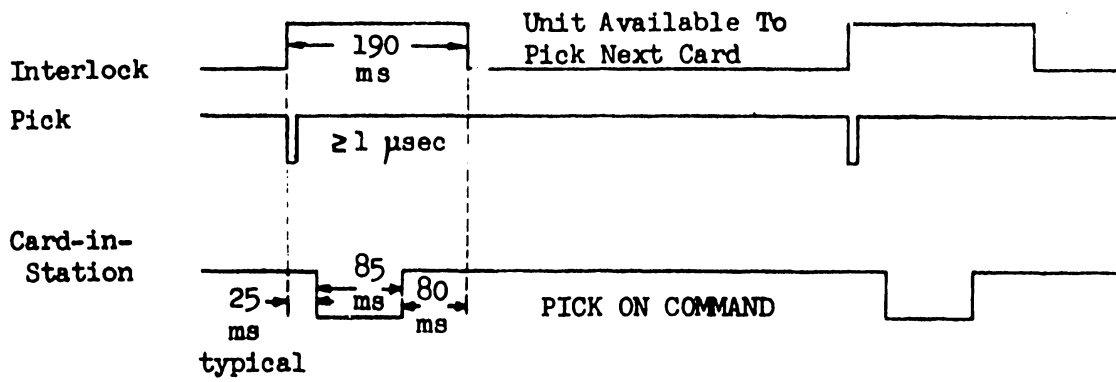
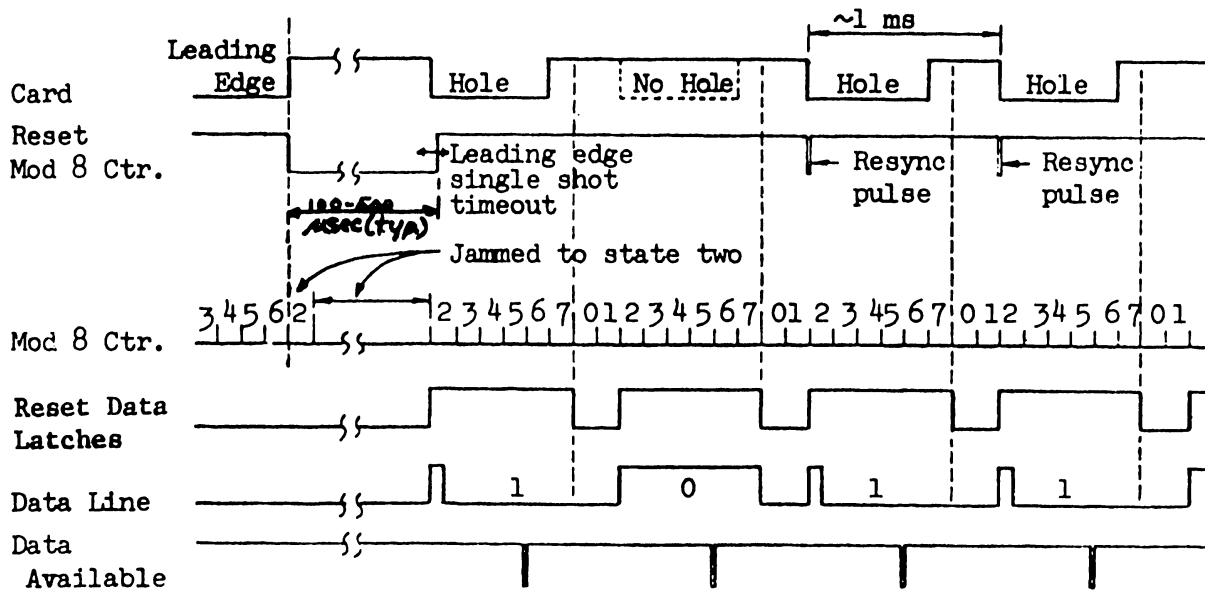


FIGURE 4-3 CARD READER CONTROL CIRCUITS, SIMPLIFIED BLOCK DIAGRAM



CONTINUOUS PICK

A. Card Timing



B. Data Timing

Figure 4.4 SIGNAL INTERFACE TIMING DIAGRAM - 300 CPM READER

through the lockup gate, sets the picker clutch flip-flop, the lockup flip-flop, and also the main counter to its starting count. The setting of the lockup flip-flop inhibits the lockup gate until the main counter cycles out.

Setting of the picker clutch flip-flop causes the picker clutch coil to be energized via the clutch driver, and allows the motor to drive the picker roller through the clutch. The picker clutch flip-flop is normally reset when the leading edge of the card is sensed, terminating the picker clutch signal.

If a leading edge has not been sensed, the picker clutch flip-flop is reset when the main counter reaches state 81. In other words, the picker clutch is energized for as long as it takes to get a card into the read station (a minimum time of about 27 milliseconds), up to a maximum time of about 80 milliseconds.

When the leading edge of the card is sensed by the leading edge detector, the leading edge flip-flop is set, causing the mod 8 counter to be set to state 2 for synchronization, the main counter to be set to its starting count (allowing it to index), and the enable data flip-flop to be set to enable data strobe pulses (decoded from the now synchronized mod 8 counter) to appear on the data available line. The enable data flip-flop is reset 80 columns later by decoding the 81st state of the main counter. In this manner, exactly 80 data available pulses are transmitted for each card that is read. Synchronization of the mod 8 counter from the leading edge of the card ensures that each of the data available pulses occurs when the data in each of the columns is good. As an adjunct to this, to allow greater freedom for the reading of poorly registered cards or to correct for any card slippage during transport, the mod 8 counter is resynchronized each time light is first detected in any of the center four rows of the card (bits 2 through 5).

The mispick circuitry allows for three tries (or optionally, five tries) to pick a card for a given pick command. When a card is picked, it normally takes about 27 milliseconds to reach the leading edge sensor. Since the pick flip-flop is set by the pick command and reset during the time the card is in the read station, this flip-flop normally stores the pick command for about 27 milliseconds; if a pick attempt is unsuccessful, the pick flip-flop remains set for a re-try. The 81st state of the main counter is used to interrogate the pick flip-flop (about 80 milliseconds after the pick command) via the mispick gate. If the pick flip-flop has been reset (indicating a valid pick), the mispick counter will not be advanced. If, however, this flip-flop remains set (indicating a mispick), the mispick counter will be advanced one count. Meanwhile, since a leading edge was not sensed, the pick flip-flop will continue to store the pick command for another try after the main counter has cycled out. If the second try is unsuccessful, the mispick counter is advanced to its third state and the process is repeated. If the third try is also unsuccessful, the mispick counter is advanced to its fourth state, which sets the hold flip-flop to create a HOLD condition requiring operator intervention (to remove the defective card). If, on the other hand, the second or third try is successful, the leading edge of the card would be sensed. This, in turn, would clear the pick flip-flop and the mispick counter, allowing normal procedure to be resumed. The mispick counter may be optionally connected to provide for five pick attempts if desired. This is accomplished through a strapping option on the logic board. An interface line is brought out to the interface from the mispick counter to indicate PICK FAILURE.

The input hopper "empty" and the output hopper "full" switches also set the hold flip-flop for these two situations, creating a HOLD condition

requiring operator intervention. The hold flip-flop communicates this status to the Data Controller via the CHECK CONDITIONS line and indicates by means of the INTERLOCK line that no further pick orders should be generated. The HOPPER SWITCHES line is brought out to the interface to indicate that the input hopper is empty or that the output hopper is full.

A RESET switch is provided so that the operator can reset all the control functions after attending to the problem. Resetting of the hold flip-flop will then cause the check conditions and interlock lines to return to their ready condition and the motor to start.

When the card reader goes into the HOLD condition, power is removed from the motor. The motor is again energized when the condition causing the HOLD (either three successive misspicks, empty input hopper, full output hopper, or HALT switch operated) is corrected, and the RESET switch is again operated. This feature prevents unnecessary wear on the motor and drive system when the Card Reader is not actually reading cards. Provision is made to externally control motor shutdown (and reactivate the motor if the card reader is not in a HOLD condition) by means of an extra input line from the interface.

The strobe amplifier in addition to conditioning the strobe pickup signals for operation of the logic, also detects the loss of strobe pulses which occurs in case of a card jam. A jam-shutdown line from the amplifier causes the motor to be de-energized during a card jam.

A blinker system is incorporated into the card reader circuitry to blink the LED's in the read station light source. The circuit is arranged so that the LED's are only on for the times when the reader is actually looking for data holes, which is basically during counts 2, 3, 4, and 5 of the mod 8 counter for columns 1 through 80 of the card. This is done to extend the lifetimes of the LED's, since degradation of the LED's is directly related to their "on" times.

The LED's are turned on and off by the LED driver circuit which is enabled from column 1 through column 80 time by the enable data flip-flop, and extended from column 81 through column 88 time by decoded states from the main counter. The enable time is extended to accomodate the read check circuitry by allowing a light check to be taken off the trailing edge of the card, when the read station can see light on all of the twelve rows. The light source is turned off during columns 81 and 82, by decoded states from the main counter, to allow a dark check to be taken by the read check circuitry. The light source is also turned off by states 0, 1, 6, and 7 of the mod 8 counter, to "blink" the LED's during the web times of the cards.

4.3.3 Read Check Feature

The read check feature is a systematic method for testing the read station and LED light source for proper operation. The tests consist basically of sampling the output of each of the twelve data bits at a time when all the cells are dark (column 81 time), and at a time when all the cells are illuminated (after the trailing edge of the card has cleared the read station). If the circuits are reading "zeros" at the dark check time and "ones" at the light check time, on a card-by-card basis, the test is considered successful and operation of the card reader proceeds normally. If, however, one of the tests is unsuccessful, the circuitry generates a read check failure condition which halts card reader operation, lights the RESET lamp, lights the READ ERROR lamp, and causes the read check output line to the interface to go to "zero". If this condition occurs, the data read from the last card in the output hopper is questionable.

A functional block diagram of the read check feature is shown in Figure 4-5. The twelve data lines are "OR'd" together on the logic board, and the "all ones" line from the logic board is a "one" when all data bits are "ones".

4-13

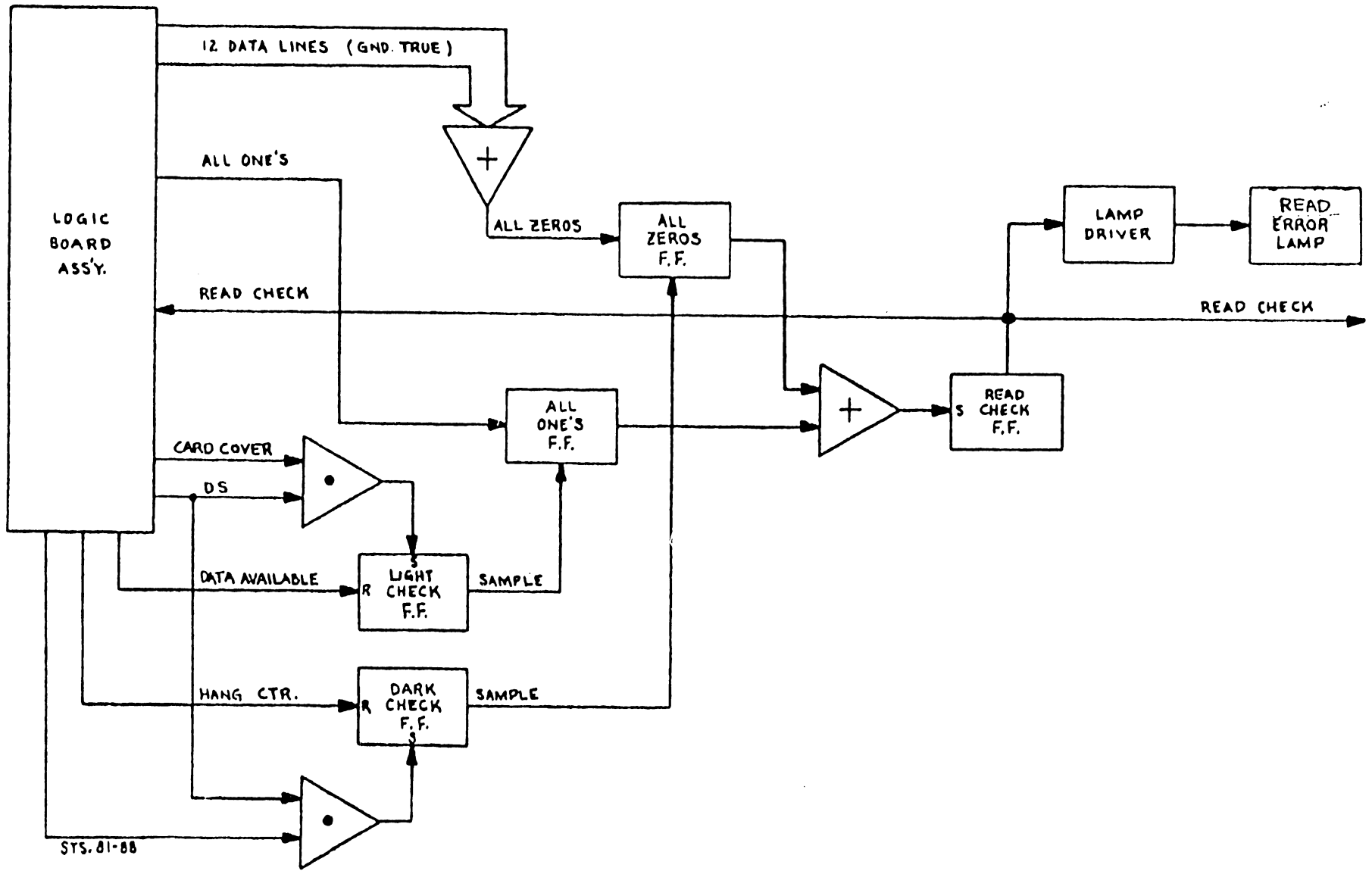


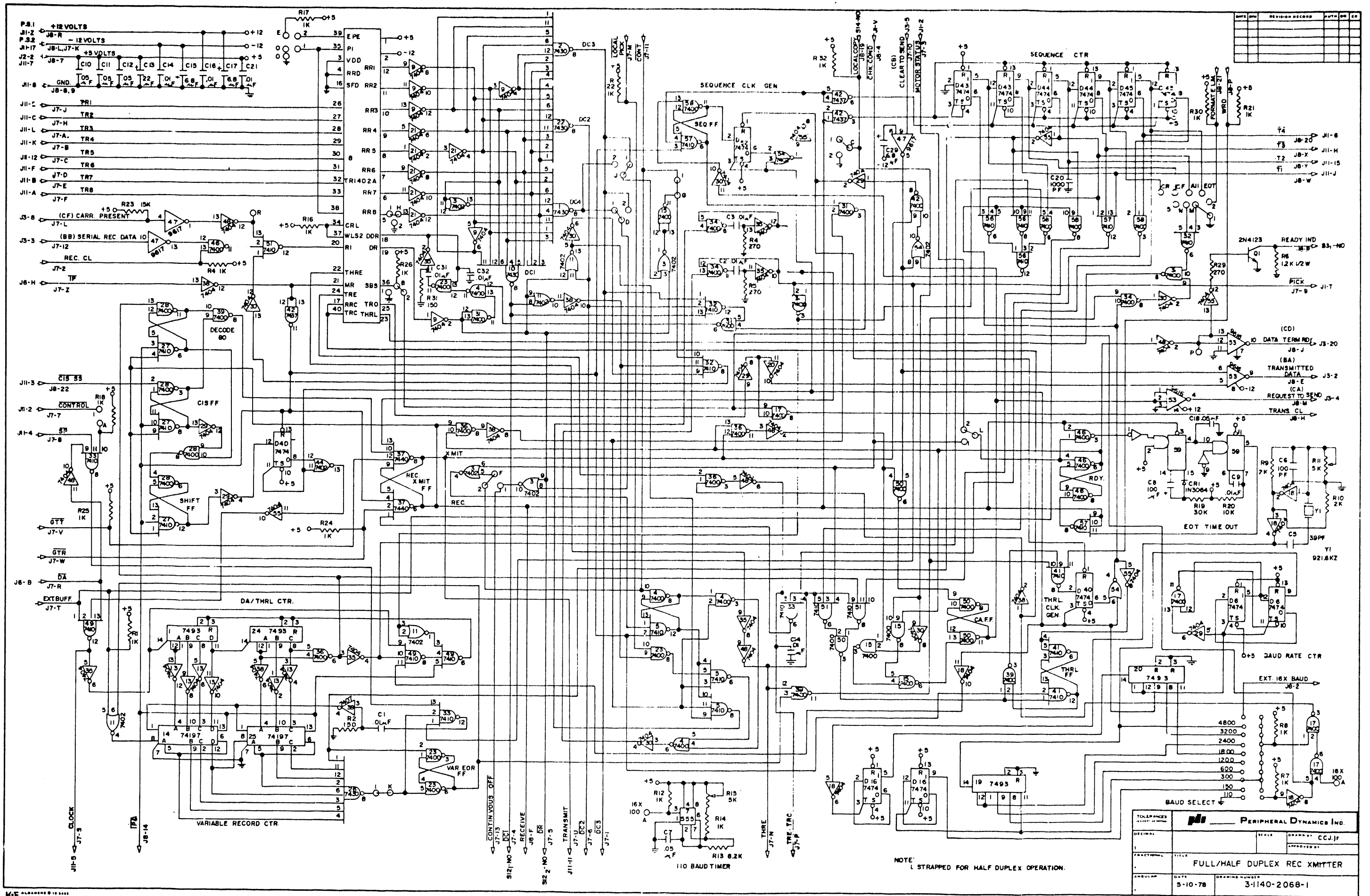
FIGURE 4-5 READ CHECK FEATURE, FUNCTIONAL BLOCK DIAGRAM

Similarly, a twelve-wide OR gate on the read check board generates a "one" when all twelve bits are "zeros". These two lines are sampled into their respective flip-flops at the appropriate times as follows: The all zeros flip-flop is clocked from the dark check flip-flop which is set at the data strobe time for the 81st column and reset at hang-counter-time. The all zeros flip-flop samples the all zeros line at the transition time when the dark check flip-flop is set. The all ones flip-flop is clocked from the light check flip-flop which is set at the first data strobe time after the trailing edge of the card clears the leading edge sensor, and is reset by the first data available pulse of a succeeding card. The all ones flip-flop samples the all ones line at the transition time when the light check flip-flop is set. The sampling of the improper condition into either the all zeros flip-flop or the all-ones flip-flop, or both, sets the read check flip-flop causing a hold condition in the card reader with the appropriate indications of read check failure. Following a read check failure, the circuitry must be reset by depressing the RESET button.

4.3.4 Power Supply

The power supply used in the Card Reader consists of a dual unregulated power supply, one portion of which supplies power for the motor relay, picker clutch, and front panel lamps; the other portion supplies power for the logic voltage regulator. The voltage regulator portion is contained on a separate PC board and is discussed separately in Paragraph 4.3.5.2.

The unregulated power supply consists of a power transformer, two fullwave bridge rectifiers, two filter capacitors, two bleeder resistors and appropriate fusing. A schematic of the unregulated power supply is shown in Figure 4-6. The supply can furnish up to four amperes at 12 volts and up to one ampere at 25 volts with 50-60 Hz AC input; at nominal input voltages of 100 volts, 115 volts, 200 volts, or 230 volts, depending upon which transformer taps are wired.



REV	DESCRIPTION	DATE	BY	CHKD

TOLERANCES		PERIPHERAL DYNAMICS INC.	
DECIMAL		SCALE	
FRACTIONAL		DRAWN BY	CCJ/JF
FULL/HALF DUPLEX REC XMITTER			
DATE	5-10-78	DRAWING NUMBER	3-1140-2068-1

K&E ALUMINUM & 10 3443 ENGINEERING STANDARDS FORM

4.3.5 Description of PC Boards

A detailed description of each of the PC boards used in the Card Reader is presented in the following paragraphs.

4.3.5.1 Read Station Board

The read station board contains all the electronic components required at the read station (refer to Figure 4-6). These consist of the 12 data phototransistors, the 12 data latch SCR's, their bias resistors, and the leading edge phototransistor. The 13 output lines, +5-volts and ground, are cabled to a paddle connector that plugs into J4, which is located adjacent to the read station.

4.3.5.2 Voltage Regulator Board

The voltage regulator board contains an integrated circuit voltage regulator and associated discrete resistors and capacitors (refer to Figure 4-6). Power from the 12-volt unregulated power supply is applied to the input terminal for the logic voltage regulator, J12-6. This regulator is comprised of integrated circuit regulator V1 and transistor Q1, in conjunction with series passing transistor Q2. All 5-volt power for the logic circuits is provided from this regulator, which is short-circuit protected, and can supply up to about 2.5 amperes of load current.

4.3.5.3 LED Assembly

The LED assembly contains 13 infrared light emitting diodes and their associated current limiting resistors. Twelve of these LED's illuminate the 12 data bit sensors of the read station and the thirteenth illuminates the leading edge sensor (refer to Figure 4-6). The LED's are selected and matched, and are precision mounted to the PC board. If an LED should become defective, it is recommended that the LED assembly be returned to the factory for repair.

4.3.5.4 Logic Board

All of the logic for the Card Reader is contained on a single double-sided PC board approximately 7 inches high by 10 inches wide, and having two 44-pin connector tangs. The logic functions are implemented with type 7400-series TTL integrated logic modules. The board also contains several discrete-component circuits.

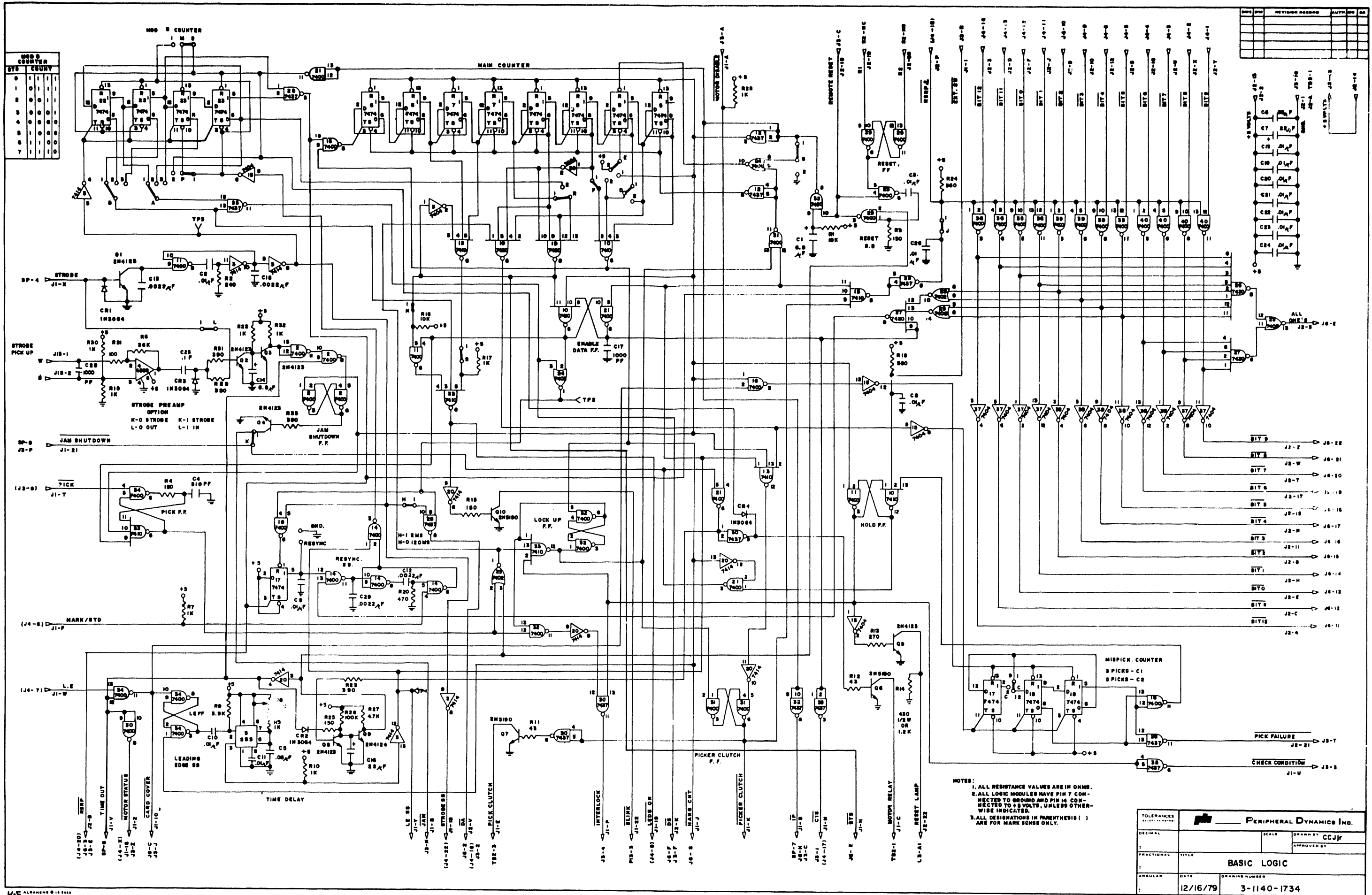
A schematic of the logic board is shown in Figure 4-7, and a truth table for the main counter is shown in Figure 4-8. Figure 4-8, while not specifically referred to in the text, should serve as a useful reference toward the complete understanding of the operational details.

MIL-standard 806B logic symbols are used in the logic diagram. The logic circuits are represented in standard POSITIVE LOGIC using the logical elements and definitions given in Figure 4-9.

Throughout the following discussion, refer to the Logic Board Schematic shown in Figure 4-7. In referring to this schematic, the following convention will be used to identify specific logic elements contained within a given module.

For combinational logic, the output pin will be added to the module number with a hyphen, e.g., 4-6 refers to the portion of module 4 whose output is taken from pin 6, 4-11 refers to the portion of module 4 whose output is taken from pin 11; 4-8 and 4-3 refer to those portions of module 4 whose output pins are 8 and 3 respectively. In the case of the flip-flops, the output pin for the "true" side of the flip-flop will be specified; for example, 1-9 and 1-5 identify the two flip-flops contained in module 1.

The circuitry can be broken down into six general categories: read circuits, strobe conditioning circuits, mod 8 counter and strobe circuit, main counter, control flip-flops, and LED blinker circuits.



REV	DATE	REVISION	DESIGNED	AUTH	CHK

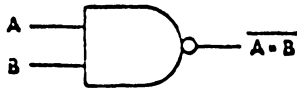
NOTES:
 1. ALL RESISTANCE VALUES ARE IN OHMS.
 2. ALL LOGIC MODULES HAVE PIN 7 CON-
 NECTED TO GROUND AND PIN 14 CON-
 NECTED TO +5 VOLTS, UNLESS OTHER-
 WISE INDICATED.
 3. ALL DESIGNATIONS IN PARENTHESES ()
 ARE FOR MARK SENSE ONLY.

TOLERANCES		PERIPHERAL DYNAMICS INC.	
DECIMAL		SCALE	DRAWN BY CCJF
FRACTIONAL		TITLE	APPROVED BY
ANGULAR		DATE	
		DRAWING NUMBER	
		12/16/79	3-1140-1734

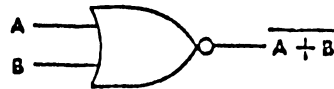
<u>State</u>	<u>Counter Stages</u> A B C D E F G H	<u>State</u>	<u>Counter Stages</u> A B C D E F G H	<u>State</u>	<u>Counter Stages</u> A B C D E F G H
1	1 1 1 1 1 1 0 1	55	1 0 0 1 0 0 0 1	109	1 1 0 0 1 0 1 0
2	0 1 1 1 1 1 0 1	56	0 0 0 1 0 0 0 1	110	0 1 0 0 1 0 1 0
3	1 0 1 1 1 1 0 1	57	1 1 1 0 0 0 0 1	111	1 0 0 0 1 0 1 0
4	0 0 1 1 1 1 0 1	58	0 1 1 0 0 0 0 1	112	0 0 0 0 1 0 1 0
5	1 1 0 1 1 1 0 1	59	1 0 1 0 0 0 0 1	113	1 1 1 1 0 0 1 0
6	0 1 0 1 1 1 0 1	60	0 0 1 0 0 0 0 1	114	0 1 1 1 0 0 1 0
7	1 0 0 1 1 1 0 1	61	1 1 0 0 0 0 0 1	115	1 0 1 1 0 0 1 0
8	0 0 0 1 1 1 0 1	62	0 1 0 0 0 0 0 1	116	0 0 1 1 0 0 1 0
9	1 1 1 0 1 1 0 1	63	1 0 0 0 0 0 0 1	117	1 1 0 1 0 0 1 0
10	0 1 1 0 1 1 0 1	64	0 0 0 0 0 0 0 1	118	0 1 0 1 0 0 1 0
11	1 0 1 0 1 1 0 1	65	1 1 1 1 1 1 1 0	119	1 0 0 1 0 0 1 0
12	0 0 1 0 1 1 0 1	66	0 1 1 1 1 1 1 0	120	0 0 0 1 0 0 1 0
13	1 1 0 0 1 1 0 1	67	1 0 1 1 1 1 1 0	121	1 1 1 0 0 0 1 0
14	0 1 0 0 1 1 0 1	68	0 0 1 1 1 1 1 0	122	0 1 1 0 0 0 1 0
15	1 0 0 0 1 1 0 1	69	1 1 0 1 1 1 1 0	123	1 0 1 0 0 0 1 0
16	0 0 0 0 1 1 0 1	70	0 1 0 1 1 1 1 0	124	0 0 1 0 0 0 1 0
17	1 1 1 1 0 1 0 1	71	1 0 0 1 1 1 1 0	125	1 1 0 0 0 0 1 0
18	0 1 1 1 0 1 0 1	72	0 0 0 1 1 1 1 0	126	0 1 0 0 0 0 1 0
19	1 0 1 1 0 1 0 1	73	1 1 1 0 1 1 1 0	127	1 0 0 0 0 0 1 0
20	0 0 1 1 0 1 0 1	74	0 1 1 0 1 1 1 0	128	0 0 0 0 0 0 1 0
21	1 1 0 1 0 1 0 1	75	1 0 1 0 1 1 1 0	129	1 1 1 1 1 1 0 0
22	0 1 0 1 0 1 0 1	76	0 0 1 0 1 1 1 0	130	0 1 1 1 1 1 0 0
23	1 0 0 1 0 1 0 1	77	1 1 0 0 1 1 1 0	131	1 0 1 1 1 1 0 0
24	0 0 0 1 0 1 0 1	78	0 1 0 0 1 1 1 0	132	0 0 1 1 1 1 0 0
25	1 1 1 0 0 1 0 1	79	1 0 0 0 1 1 1 0	133	1 1 0 1 1 1 0 0
26	0 1 1 0 0 1 0 1	80	0 0 0 0 1 1 1 0	134	0 1 0 1 1 1 0 0
27	1 0 1 0 0 1 0 1	81	1 1 1 1 0 1 1 0	135	1 0 0 1 1 1 0 0
28	0 0 1 0 0 1 0 1	82	0 1 1 1 0 1 1 0	136	0 0 0 1 1 1 0 0
29	1 1 0 0 0 1 0 1	83	1 0 1 1 0 1 1 0	137	1 1 1 0 1 1 0 0
30	0 1 0 0 0 1 0 1	84	0 0 1 1 0 1 1 0	138	0 1 1 0 1 1 0 0
31	1 0 0 0 0 1 0 1	85	1 1 0 1 0 1 1 0	139	1 0 1 0 1 1 0 0
32	0 0 0 0 0 1 0 1	86	0 1 0 1 0 1 1 0	140	0 0 1 0 1 1 0 0
33	1 1 1 1 1 0 0 1	87	1 0 0 1 0 1 1 0	141	1 1 0 0 1 1 0 0
34	0 1 1 1 1 0 0 1	88	0 0 0 1 0 1 1 0	142	0 1 0 0 1 1 0 0
35	1 0 1 1 1 0 0 1	89	1 1 1 0 0 1 1 0	143	1 0 0 0 1 1 0 0
36	0 0 1 1 1 0 0 1	90	0 1 1 0 0 1 1 0	144	0 0 0 0 1 1 0 0
37	1 1 0 1 1 0 0 1	91	1 0 1 0 0 1 1 0	145	1 1 1 1 0 1 0 0
38	0 1 0 1 1 0 0 1	92	0 0 1 0 0 1 1 0	146	0 1 1 1 0 1 0 0
39	1 0 0 1 1 0 0 1	93	1 1 0 0 0 1 1 0	147	1 0 1 1 0 1 0 0
40	0 0 0 1 1 0 0 1	94	0 1 0 0 0 1 1 0	148	0 0 1 1 0 1 0 0
41	1 1 1 0 1 0 0 1	95	1 0 0 0 0 1 1 0	149	1 1 0 1 0 1 0 0
42	0 1 1 0 1 0 0 1	96	0 0 0 0 0 1 1 0	150	0 1 0 1 0 1 0 0
43	1 0 1 0 1 0 0 1	97	1 1 1 1 1 0 1 0	151	1 0 0 1 0 1 0 0
44	0 0 1 0 1 0 0 1	98	0 1 1 1 1 0 1 0	152	0 0 0 1 0 1 0 0
45	1 1 0 0 1 0 0 1	99	1 0 1 1 1 0 1 0	153	1 1 1 0 0 1 0 0
46	0 1 0 0 1 0 0 1	100	0 0 1 1 1 0 1 0	154	0 1 1 0 0 1 0 0
47	1 0 0 0 1 0 0 1	101	1 1 0 1 1 0 1 0	155	1 0 1 0 0 1 0 0
48	0 0 0 0 1 0 0 1	102	0 1 0 1 1 0 1 0	156	0 0 1 0 0 1 0 0
49	1 1 1 1 0 0 0 1	103	1 0 0 1 1 0 1 0	157	1 1 0 0 0 1 0 0
50	0 1 1 1 0 0 0 1	104	0 0 0 1 1 0 1 0	158	0 1 0 0 0 1 0 0
51	1 0 1 1 0 0 0 1	105	1 1 1 0 1 0 1 0	159	1 0 0 0 0 1 0 0
52	0 0 1 1 0 0 0 1	106	0 1 1 0 1 0 1 0	160	0 0 0 0 0 1 0 0
53	1 1 0 1 0 0 0 1	107	1 0 1 0 1 0 1 0	161	1 1 1 1 1 0 0 0
54	0 1 0 1 0 0 0 1	108	0 0 1 0 1 0 1 0		

FIGURE 4-8 TRUTH TABLE, MAIN COUNTER

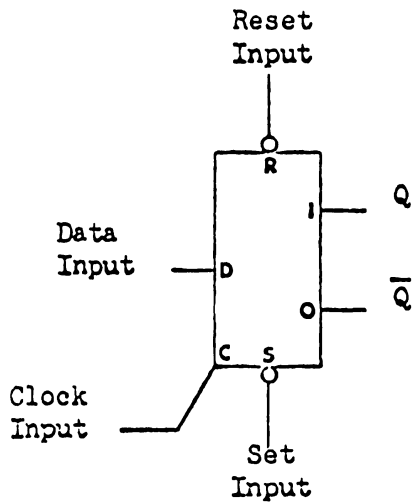
LOW VOLTAGE - LOGICAL 0
HIGH VOLTAGE - LOGICAL 1



NAND GATE



NOR GATE



TYPE D FLIP-FLOP

1. Information is transferred from D input to Q output on positive edge of clock pulse.
2. Direct set and reset inputs are independent of clock.

FIGURE 4-9 LOGIC ELEMENT REPRESENTATION AND DEFINITIONS

4.3.5.4.1 Read Circuits - The read circuits consist simply of logic gates and inverters 36 through 40. Typical of each of the 12 data lines is the gate and inverter combination 36-3 and 37-4 (bit 12). The anode of the bit 12 SCR is connected to pin 2 of 36-3. Zero-going read station reset pulses are applied to pin 1 of 36-3. 36-3 is always a "one" during the reset pulse interval; however, during the data sensing interval, this point will be a "one" if a hole is sensed and a "zero" if no hole is sensed. The inverted output appearing at 37-4 is then BIT 12.

Modules 26-8, 27-6 and 25-13 comprise an AND gate, the output of which is a "one" if "one's" are sensed simultaneously in every data bit. This ALL ONE's output is used only in performing a Read Check.

Modules 25-10, 25-4 and 27-8 comprise an OR gate, the output of which is a "one" if a "one" is sensed in any of the data bits 2, 3, 4, or 5. This signal is used to resync the mod 8 counter and is applied to pin 13 of 14-11 in the resync portion of the circuitry.

4.3.5.4.2 Strobe Conditioning Circuits - The strobe conditioning circuitry contains an amplifier circuit for increasing the sensitivity of the strobe pickup, and some additional circuitry for detection of the presence or absence of strobe pulses. The latter feature is employed as a protection device to remove power from the drive motor if a card jam should develop which would slow down or stop the motor drive.

The strobe pickup magnetically senses the teeth on the strobe wheel which rotates with the read station drive rollers. The strobe wheel has eight teeth per data column of card travel. The strobe amplifier is comprised of module 4-1 (an operational amplifier) and some associated discrete components. The output strobe signal which is essentially a square wave at the standard logic levels, is coupled through R29 and strap L-1 to the input of Q1. The strobe signal is also applied through R31 to a pulse omission detector,

comprised of Q2, Q3, R22, R32, and C14. The time constant of this circuit is about 900 usec, and with a normal strobe signal (120 μ sec per strobe cycle), the voltage across C14 is maintained very close to ground level. Transistor Q3 is therefore held in the off condition, and its collector is normally high. This signal is inverted by 2-11 and applied to one input of 2-8. The other input of 2-8 is held at a high level by the time-out signal from 20-4. The jam shutdown flip-flop (2-3 and 2-6) is initially reset by either the initialize pulse or the reset pulse generated by operating the RESET switch, causing the output of 2-6 to be low and remain low as long as normal strobe operation maintains a low condition at pin 10 of 2-8. With 2-6 low, transistor Q4 is held in the off state, and through strap K-1, the motor is allowed to run. If a card should jam in the card drive mechanism, Q2 allows C14 to charge through R22, turning on transistor Q3. Pin 10 of 2-8 goes high and the output of 2-8 goes to ground, setting the jam shutdown flip-flop. 2-6 goes high, turning on Q4 and grounding the jam shutdown line through strap K-1. Grounding of this line removes power from the drive motor through 21-6, 30-3 and Q6. It also resets the time delay circuit, Q8 and Q9, through 21-6, making the time-out line into pin 9 of 2-8 go low.

When the jam is corrected and the motor is restarted (by operation of the RESET switch), the time-out line will stay low for approximately 300 milliseconds, and then go high. This line being low for the time-out period allows the jam shutdown flip-flop to be reset and the motor to come up to speed before "allowing" gate 2-8 to again sense for loss of strobes.

4.3.5.4.3 Mod 8 Counter and Strobe Circuit - The mod 8 counter is comprised of four flip-flops, modules 22 and 23, arranged as a ring counter. This counter is used to develop the read station reset and data strobe timings on a column-by-column basis. Strobe pulses from the magnetic pickup and

following strobe amplifier (eight pulses per column) are applied through a buffer transistor, Q1, to the input of a single shot, 11-8 and 3-10. This single shot standardizes the input pulses and provides sharp rise and fall times required for clean operation of the counter. The strobe single shot provides zero-going pulses approximately 2 μ sec wide. The trailing edge of these pulses indexes the mod 8 counter. The counter states are shown in Figure 4-7, in the table adjacent to the mod 8 counter. The fifth state of the counter, which is subsequently used to develop the data available pulses, is decoded by 35-11. The first two states of the counter (states 0 and 1) are decoded by the 28-3 to provide 240 usec wide reset pulses for the read station.

When the power is first turned on, the mod 8 counter is initially set to state 6 by means of the network R1, C1. This network keeps pin 9 of module 32-8 at ground for a sufficient time to guarantee that the mod 8 counter and other circuitry all come on in the proper states. The mod 8 counter is also set to state 6 by operation of the RESET switch, acting through the reset flip-flop, 29-8 and 29-11, and the reset single shot, 29-6 and 29-3.

In the course of reading a card, the mod 8 counter is set to state 2 for initial synchronization when the leading edge of the card is detected. Detection of the leading edge sets the leading edge flip-flop (34-8 and 34-3), and causes the leading edge single shot (5-3) to fire. The resultant zero-going pulse at 3-12 (TP1) sets and holds the mod 8 counter to state 2 (via 14-3 and 15-6) for the duration of the leading edge single shot pulse, which nominally terminates at the beginning of the first card column. This initially synchronizes the mod 8 counter to strobe for the first data hole (when state 5 is reached). The mod 8 counter is also set to state 2 by the resynchronization circuitry, which is discussed at a later point in this text.

4.3.5.4.4 Main Counter - The main counter is an eight-stage decrementing binary counter in which the starting count is fixed and the ending count may be selected by strapping features on the logic board. The main counter is initialized to the ending count, which is decoded by 10-6 and used to block count gate 16-8. The initialization is accomplished by means of the network, R1, C1, when power is first turned on, or by the operation of the RESET switch. In the initialized condition, the counter is hung (prevented from counting). When required, this counter is set to its starting count, whereupon it indexes at the column rate and counts down to the ending count. When the ending count is reached, the counter is again hung and stops counting.

The counter consists of modules 6 through 9, 6-5 being the least significant bit and 9-9 being the most significant bit. The starting count is 11111101 (least significant bit to the left). As the counter cycles, states 81 through 96 are decoded to check for a mispick condition (via 19-6), while states 81-88 are decoded by 19-8 to reset the enable data flip-flop if a card has been read. The counter continues to decrement to the ending count (hang counter), which is decoded by 10-6. For 300 cpm operation of the card reader from a 60 Hz power source, or 250 cpm operation of the card reader from a 50 Hz power source (since the motor speed is proportional to the power frequency), the ending count is state 161 (11111000). For 300 cpm operation of the card reader from a 50 Hz power source, the ending count is state 129 (11111100). For 500 cpm operation of the card reader from a 60 Hz power source (or 400 cpm operation from a 50 Hz power source), the ending count is state 97 (11111010).

4.3.5.4.5 Control Flip-Flops - The reset flip-flop (29-8 and 29-11) is used to buffer the RESET switch, to eliminate the effects of contact bounce. The switch contacts are connected to the R1 and R2 lines entering the board on pins J2-19 and J2-20, respectively. The RESET switch has a form "C" contact arrangement with the wiper contact grounded. The R1 line is connected to the normally-closed contact of this switch, and the R2 line is connected to the normally-open contact, so that the flip-flop is held in the cleared

state (29-11 is "zero"). When the RESET switch is depressed, R1 is ungrounded and R2 is grounded, setting the reset flip-flop. When the RESET switch is released, the conditions of R1 and R2 revert to their original status, clearing the reset flip-flop. When the reset flip-flop is set, 29-8 goes to ground causing the reset single shot (29-6 and 29-3) to generate a 1 μ sec wide, zero-going reset pulse. This reset pulse is used to reset all the control flip-flops and counters.

The pick flip-flop (34-6 and 33-8) is used to store the pick order until it is executed. This flip-flop is cleared by the initializing network (or the reset pulse) by way of 12-3. The lockup flip-flop (32-3 and 32-6) is cleared by the HANG CTR signal decoded by 10-6. Assuming that the hold flip-flop has previously been cleared in placing the equipment "on line" (by operation of the RESET switch), two inputs (pins 1 and 2) of the lockup gate 33-12 will be high. The pick command (a zero-going pulse) entering on pin J1-T sets the pick flip-flop, causing the third input (pin 13) of the lockup gate, 33-12, to go high. 33-12 in going low sets the lockup flip-flop, which in turn, inhibits the lockup gate. The narrow pulse thus admitted by 33-12 sets the picker clutch flip-flop (31-3 and 31-6) and sets the main counter to its starting count through 31-11, 12-6 and 24-10. The main counter now commences to cycle.

The collector of the leading edge photo-transistor is connected to pin 13 of 34-11; pin 12 of 34-11 is connected to a time-out signal which blocks this gate while the motor is coming up to speed during startup. When the Card Reader is in operation, pin 12 of 34-11 is high, allowing operation of this gate from pin 13. When the leading edge sensor is uncovered (a card is not sensed), the output of 34-11 is high; when the leading edge of the card passes over this sensor, 34-11 goes low and remains low until the trailing edge of the card passes, at which time 34-11 again goes high.

This signal (card cover) is brought out to pin J1-10, and is used for the read check option. It also clears the mispick counter, 17-2, 18-9, and 18-5. The card cover signal also sets the leading edge flip-flop (34-8 and 34-3); this flip-flop is reset by the last state of the main counter (hang counter), which is decoded by 10-6. The output of 34-3 is applied to the leading edge single shot which is comprised of module 5 and some associated discrete components. The leading edge single shot provides a convenient way to optimize the timing to compensate for mechanical tolerances in the assembly of the read station. A trimpot adjustment on this delay is provided in R8, and since this is an important adjustment, it should not be tampered with arbitrarily. The leading edge single shot requires a negative-going edge to trigger and provides a positive-going output pulse. The single shot, therefore, triggers when the leading edge of the card is sensed and times-out for approximately 100 to 400 μ sec.

The pulse developed by the leading edge single shot synchronizes the mod 8 counter by setting it to state 2 (0011), clears the picker clutch flip-flop to terminate drive to the picker clutch, sets the main counter (which has already partly cycled) back to its starting count, and sets the enable data flip-flop (which allows data available pulses to be transmitted at the proper times to the Data Controller). The signal from the leading edge single shot is also OR'd with the normal read station reset pulses and with the \overline{PC} signal from the picker clutch flip-flop, via 13-8 and 28-6, to reset the read station SCR's (at pins 1, 4, 9, and 13 of modules 36, 39, and 40). This guarantees that the SCR's will be initially reset for a sufficient time before sensing for the first data column. At the same time, the mispick counter is cleared by the card cover signal, as previously mentioned, (in case a count has accumulated from a previous mispick), and the pick flip-flop is cleared by the \overline{ED} signal from the enable data flip-flop.

The enable data flip-flop (10-8 and 21-8) controls the gating of the data available pulses to the DATA AVAILABLE output line. This flip-flop is cleared by the initializing network (or the reset pulse) by way of 12-3. This same flip-flop is set by the leading edge signal from 3-12 (which also sets the main counter to its starting count); it is reset 80 counts later in the sequence of the main counter. States 81 through 88 of the main counter are decoded by 19-8 and used to reset the enable data flip-flop, which is reset at the leading edge of this waveform. The zero side of the enable data flip-flop enables one side of the two-input NOR gate 24-1, and resets the pick flip-flop. The fifth state of the mod 8 counter (\overline{DS}), decoded by 35-11, is applied to the other input of 24-1. The output of 24-1 is therefore DS which are pulses 120 usec wide (only during the 80 column times), and whose transitions coincide with the trailing edges of the 2- μ sec wide strobe pulses appearing at 3-6 (TP-3). These 2- μ sec wide positive-going pulses from 3-6 are applied to one input of 28-8, through strap H-1, and the positive-going DS pulse train from 24-1 (TP-2) is applied to the other input of 28-8. The output of 28-8 is DATA AVAILABLE, which is a series of 80 zero-going pulses for each card read, the timing of which occur in the last 2- μ sec of state 5 of the mod 8 counter.

The signal from the true-side of the enable data flip-flop is inverted by 35-3 and brought out as the card in station signal (\overline{CIS}), which goes to zero at the leading edge of the card and back to a "one" at the beginning of the 81st column time.

The hold flip-flop (10-12 and 11-3) is used to store the check conditions. These are, namely, power on, input hopper not empty, output hopper not full, halt switch not operated, and not more than three mispicks. The hold flip-flop is cleared by the initializing network (or the reset pulse), and if the check conditions are fulfilled, will remain in that state. The

CHECK CONDITIONS line will be "zero" for this condition. The input-hopper-empty, halt, and output-hopper full switches are "wired-OR" connected and enter the board through the EXT.SW. line (pin J1-1). A ground on the EXT.SW. line, therefore, sets the hold flip-flop and causes the CHECK CONDITIONS line to go high. Similarly, if three mispicks occur, the hold flip-flop is set on the third mispick, causing the CHECK CONDITIONS line to go high. If power to the card reader is turned off, or otherwise lost, the CHECK CONDITIONS line will become a high impedance to ground, which will be interpreted as a "one" by the receiving gate at the Data Controller.

The mispick counter, 18-5, 18-9, and 17-9 is a mod 4 or mod 6 (depending on how it is strapped on the board) shift register counter which is cleared by the initializing pulse, reset pulse, or the card cover signal. This counter is advanced by interrogating the pick flip-flop during states 81-96 of the main counter by means of 19-6, acting through 15-8.

The first state of the mispick counter is the cleared state, and the last state is decoded by 16-11 to set the hold flip-flop for the case of either three or five mispicks. The last state of the mispick counter is also decoded by 28-11 and brought out through J2-21 as the PICK FAILURE signal, which goes to zero when the unit shuts down because of mispicks. To accommodate three or five pick tries, flip-flop 17-9 is included into the input of the mispick counter, or not, by means of wire jumpers (straps). Strapping point C to point 1 provides for 3 pick tries; strapping point C to point 2 provides for 5 pick tries.

A resynchronization system is employed to allow some degree of independence from card length variations due to humidity effects, and also to aid in reading poorly registered cards. The mod 8 counter is resynchronized at the detection of "first light" in any one of the four central data rows

(bits 2, 3, 4, or 5). Flip-flop 17-5 is cleared by DATA AVAILABLE pulses which are decoded by 16-6. The flip-flop is clocked to a "one" at the beginning of state 2 of the mod 2 counter (clocked by the trailing edge of the RSRP signal from 28-3, which is "zero" for states 0 and 1 of the mod 8 counter). The flip-flop enables one side of gate 14-11. The other input of 14-11 is driven from 27-8 which, together with 25-4 and 25-10 comprise a 4-wide OR gate. The output of 27-8 is a "one" when a "one" is sensed in any one of the 4 data rows. The "any one" signal fires the resync single shot, 14-8 and 14-6, resetting the mod 8 counter to state 2 by way of 14-3 and 15-6. In this manner, the mod 8 counter is automatically resynchronized whenever a data column contains a "one" in any of the four central rows of the card.

The motor control circuitry operates in the following manner: with cards in the input hopper, operation of the POWER switch to turn on the equipment generates an initialize pulse which sets the HOLD flip-flop (10-12 and 11-3), causing 10-12 to go to zero. This places a zero on one input of 21-3, causing the output of 21-3 and one input of 21-6 to go high. If the MOTOR DISABLE line (J1-A) is high, the second input of 21-6 will be high, causing the output of 21-6 (and the inputs of 30-3) to be low. For this condition, 30-3 turns on transistor Q6, energizing the motor relay to operate the motor. The output of 21-6 going low, with the initializing of the HOLD flip-flop, allows the collector of Q8 to go high, charging capacitor C16 through resistor R26. About 300 milliseconds later, the collector of Q9 goes to ground, enabling the pick lockout gate 25-1. The pick lockout gate is employed to prevent processing a pick order before the motor is up to speed, thereby guaranteeing good strobe operation before attempting to pick cards. With the card reader in operation, if the HOLD flip-flop is reset (caused by operation of the hopper switches or mispicks), pin 1 of 21-3 will go high. 21-3 will wait until its other input goes high

(at hang counter time), at which time the output of 21-3 goes to ground, making 21-6 high. This causes the output of the time delay circuit, Q8 and Q9 to go high and inhibit the pick lockout gate, 25-1. 21-6 going high also turns off transistor Q6, through 30-3, opening the motor relay to remove power from the motor.

When the condition causing the hold is corrected by operator intervention, and the RESET button is operated, the HOLD flip-flop is reset, causing the motor to operate as described previously. As before, the pick lockout gate is enabled about 300 milliseconds after the motor is energized.

When the card reader is first turned on, pin 12 of 34-11 is held at ground for about 300 milliseconds by the time delay circuit (Q8 and Q9), acting through 20-4. This allows the leading edge detector to stabilize before enabling the leading edge detection circuit.

If the MOTOR DISABLE control line is used to shut down the motor, it must not be brought to ground unless the INTERLOCK line is low. This will guarantee that data will not be disturbed from a card being read. If the INTERLOCK line is low then, and it is desired to turn off the motor externally for a period of time, the MOTOR DISABLE line may be brought to ground level and held to ground level for the period of time desired. A ground level on this line brings pin 4 of 21-6 to ground causing the output of 21-6 to go high. This inhibits processing of further pick orders by making pin 3 of 25-1 high (as explained previously), and opens the motor relay via 30-3 and Q6 to shut down the motor. When the MOTOR DISABLE line is again allowed to go high, the output of 21-6 will go low and the motor will be re-energized. After the time-out period (approximately 300 milliseconds), the time-out circuit, Q8 and Q9, causes pin 3 of 25-1 to go to ground allowing card picking to be resumed.

4.3.5.4.6 LED Blinker Circuits - The blinker circuits are enabled from column 1 to column 88 time for each card read. One input of module 11-6 is driven from the enable data flip-flop, and this signal is a zero-going pulse that encompasses columns 1 through 80. The other input of 11-6 is fed from module 19-8, the output of which is a zero-going pulse encompassing columns 81 to 88. The resultant output of 11-6 is a positive pulse which encompasses columns 1 through 88. This enable signal is applied to pin 4 of 33-6. Input pin 5 of 33-6 is connected to 13-6. Module 13-6 decodes states 81 and 82 of the main counter, and its output is a zero going pulse for columns 81 and 82. The third input of 33-6 is driven from the zero side of 22-5, which is the second stage of the mod 8 counter. Reference to the small truth table adjacent to the counter, on the schematic, reveals that this flip-flop stores a zero for counts 2 through 5 of the counter. Since pin 3 of 33-6 is connected to the zero side of the flip-flop, 33-6 is enabled (a "one") only for counts 2 through 5 of the mod 8 counter, which is the actual time period that the reader is looking for holes to come up in each column. The output of 33-6 is therefore zero for the lights on condition, and one (high level) for the lights off condition. From the above description, then, the lights are on only during counts 2, 3, 4, and 5 of each column of the card (1 through 80) and also for column counts 83 to 88. The light source is turned off for column counts 81 and 82, and at all other times. The light source is turned off during columns 81 and 82 and cycled on again through column 88 time to provide for a read station light/dark check for each card read. (The read check board is discussed in paragraph 4.3.5.5.) The output of 33-6 is inverted by 20-6, which in turn, drives transistor Q10. Transistor Q10 pulls the switched ground line from the LED light source to ground, to turn on the LED's.

4.3.5.5 Read Check Board

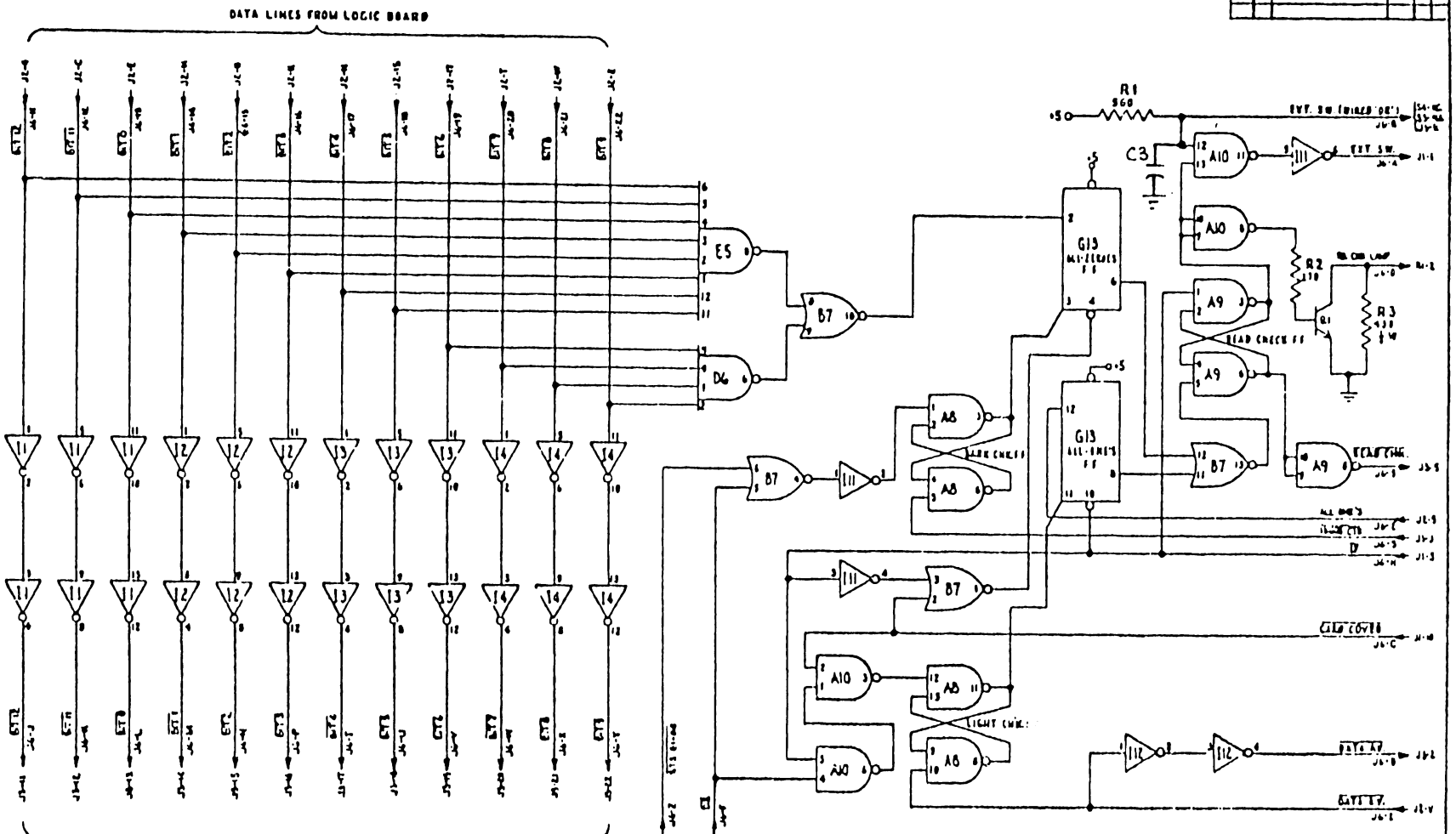
The read check board contains all of the logic necessary to perform a light/dark check on the read head and LED light source assembly. As with the logic board, the logic functions are implemented with type 7400-series TTL integrated circuit logic modules.

The read check board is shown schematically in Figure 4-10. This board is interconnected with the logic board (Figure 4-7) to provide the read check function. Therefore, reference will be made to both of these schematics in the following discussion.

On the logic board, when an all-one's condition exists, e.g., light on all bits of the read head, all of the inputs of modules 26-8 and 27-6 will be a "one" during the data sensing interval and, thus, 25-13 will be a one during these intervals. 25-13 is brought out of the logic board on pin 5 of J2, and this line is labelled ALL ONE'S. This line is a zero during the data sensing intervals if any one or more of the data bits are "zeros".

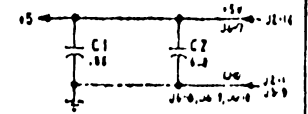
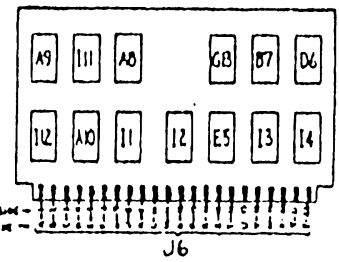
The twelve data lines from the logic board are wired into the read check board data inputs, whereupon they are applied to a 12-wide OR gate composed of modules 5-8, 6-6, and 7-10. The data lines are also double-inverted on the read check board by means of modules 1 through 4, and fed out to the interface paddle connector, J3. The inverters provide both isolation and unloaded collectors for driving the output lines. The output from module 7-10 is a "one" during the data sensing intervals for the condition of all zeros, e.g., no light on any bit of the read head. This output is a "zero" during the data sensing intervals if any one or more of the bits are "ones".

REV	DATE	BY	CHKD
1	10/10/70	...	...
2	...	...	...
3	...	...	...
4	...	...	...



- NOTES:**
1. ALL RESISTANCE VALUES ARE IN OHMS, AND ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS OTHERWISE INDICATED.
 2. ALL LOGIC MODULES HAVE PIN 7 CONNECTED TO GROUND, AND PIN 8 CONNECTED TO +5 VOLTS, UNLESS OTHERWISE INDICATED.
 3. LOGIC MODULES ARE STABILIZED AS IN THE FOLLOWING CHART:
- | SYMBOL | TYPE | SYMBOL | TYPE |
|--------|---------|--------|---------|
| A | SN7400N | E | SN7400N |
| B | SN7402N | F | SN7404N |
| D | SN7404N | G | SN7404N |

MODULE AND PIN LOCATIONS



TOULOUSE	PERIPHERAL DYNAMICS INC	
DATE	REV	...
READ CHECK SCHEMATIC		
4-10-70	3-1140-546	

FIGURE 4-10

The dark check flip-flop, modules 8-3 and 8-6, is a set/reset type of flip-flop which is reset by $\overline{\text{HANG CTR}}$ from the logic board. This flip-flop is set during the data strobe time for the 81st column by means of modules 7-4 and 11-2. $\overline{\text{DS}}$ (which is "zero" during data strobe times) and $\overline{\text{STS 81-88}}$ (which goes to "zero" at the beginning of column 81) from the logic board are applied to the two inputs of the NOR gate 7-4. The coincidence of both of these signals going to "zero" causes 11-2 to go to zero, setting the dark check flip-flop. The resulting positive-going transition at the output of module 8-3 clocks the all zeros flip-flop to sample the all zeros line (output of 7-10). If everything is operating normally, the all zeros flip-flop will receive a "one" each time it is clocked. A dark check failure, however, will advance a "zero" into this flip-flop, to flag a read check error. The all zeros flip-flop is set to a "one" whenever a card is not in the read station (via the NOR gate 7-1), or when power is first turned on, or when the RESET button is operated (via the $\overline{\text{IP}}$ line and modules 11-4 and 7-1).

The light check flip-flop, modules 8-11 and 8-8, is a set/reset type of flip-flop which is reset by data available pulses ($\overline{\text{DA}}$) from the logic board. This flip-flop is set at the first data strobe time after the trailing edge of the card uncovers the leading edge sensor. Zero-going data strobe pulses ($\overline{\text{DS}}$) are applied to one input of module 10-6, and $\overline{\text{IP}}$ (which is normally high) is applied to the other input of this module. The resulting positive-going data strobe pulses at the output of 10-6 are applied to one input of module 10-3; the $\overline{\text{CARD COVER}}$ signal from the logic board is applied to the other input. When a card leaves the read station, $\overline{\text{CARD COVER}}$ goes to a "one," and the next data strobe pulse sets the light check flip-flop. The resulting positive-going transition at the output of module 8-11 clocks the all ones flip-flop to sample the

all ones line from the logic board. If everything is operating normally, the all ones flip-flop will receive a "one" each time it is clocked. A light check failure, however, will advance a zero into this flip-flop to flag a read check error. The all ones flip-flop is set to a "one" when power is first turned on or the RESET button is operated (via the \overline{IP} line, which is pulsed to "zero" for each of these conditions).

The read check flip-flop (modules 9-3 and 9-6) is a set/reset flip-flop which is reset by the \overline{IP} signal, and set when either the all zeros flip-flop or the all ones flip-flop captures a "zero". This is accomplished by OR'ing the zero side of each of these flip-flops by means of NOR gate 7-13 into the set input of the read check flip-flop. When the read check flip-flop is set, the output of 9-6 is a "one" which is inverted by 9-8 and sent to the interface connector as a status line ($\overline{READ\ CHK}$). The false side of the read check flip-flop is OR'd with the hopper switch line by means of modules 10-11 and 11-6, the output of the latter being wired into the EXT SW input on the logic board. The false side of the read check flip-flop is also connected to a lamp driver (module 10-8, Q1, R2 and R3) to light the READ-ERROR lamp for a read check failure condition.

The \overline{DA} line from the logic board is double-inverted on the read check board and then routed to the interface paddle connector for the same reasons discussed for the data lines.

SECTION

5

**MAINT-
ENANCE**

SECTION 5
MAINTENANCE

5.1 GENERAL

This section is divided into two general categories—Preventive Maintenance and Corrective Maintenance. The first part discusses the recommended daily care items and other periodic procedures, which will enhance the overall performance of the equipment and enable it to render trouble-free operation. The second part discusses the procedures to be followed in the removal and replacement of specific parts and assemblies, if it should be required.

Two overall views of the Card Reader, with callouts on the major components, are shown in Figures 5-1 and 5-2. Most of the major components can be located with the aid of these illustrations.

5.2 PREVENTIVE MAINTENANCE

5.2.1 Daily Care

It is recommended that the card resting surface of the input hopper be cleaned once a day by the operator. Remove any dust or card stock material which has accumulated in the input hopper. A dry, lint-free cloth should be used. Visually check opening under throat gauge to ensure that all foreign material is removed. If removal of materials is necessary, use a scrap punched card and gently run back and forth under knife edge until all foreign material is removed.

5.2.2 Monthly Care

It is recommended that a periodic cleaning of the picker roller be made by the operator, on a monthly basis (or more often, as usage dictates). To facilitate this operation, follow the procedure as outlined below.

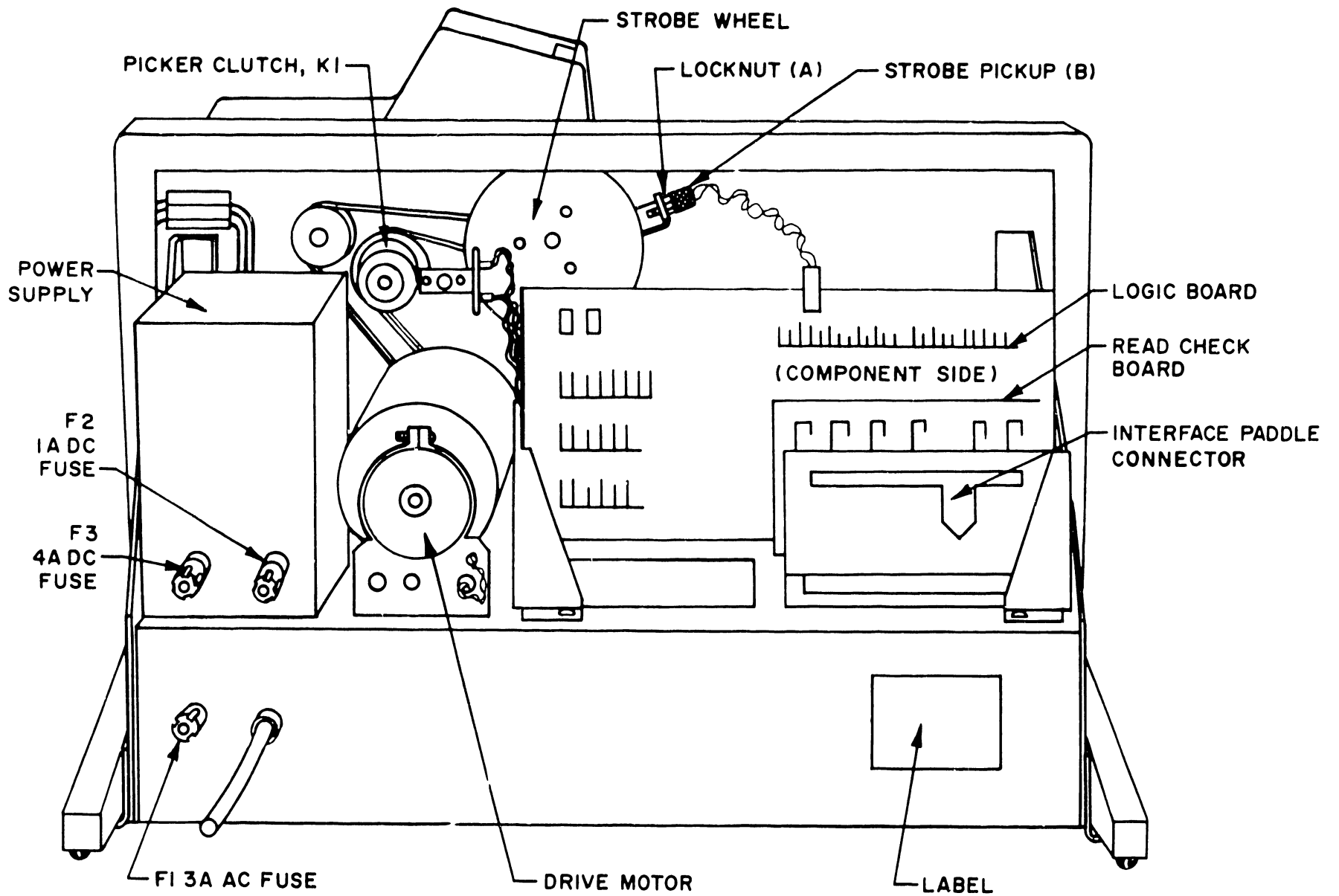


FIG. 5-1 REAR VIEW OF CARD READER, REAR COVER REMOVED

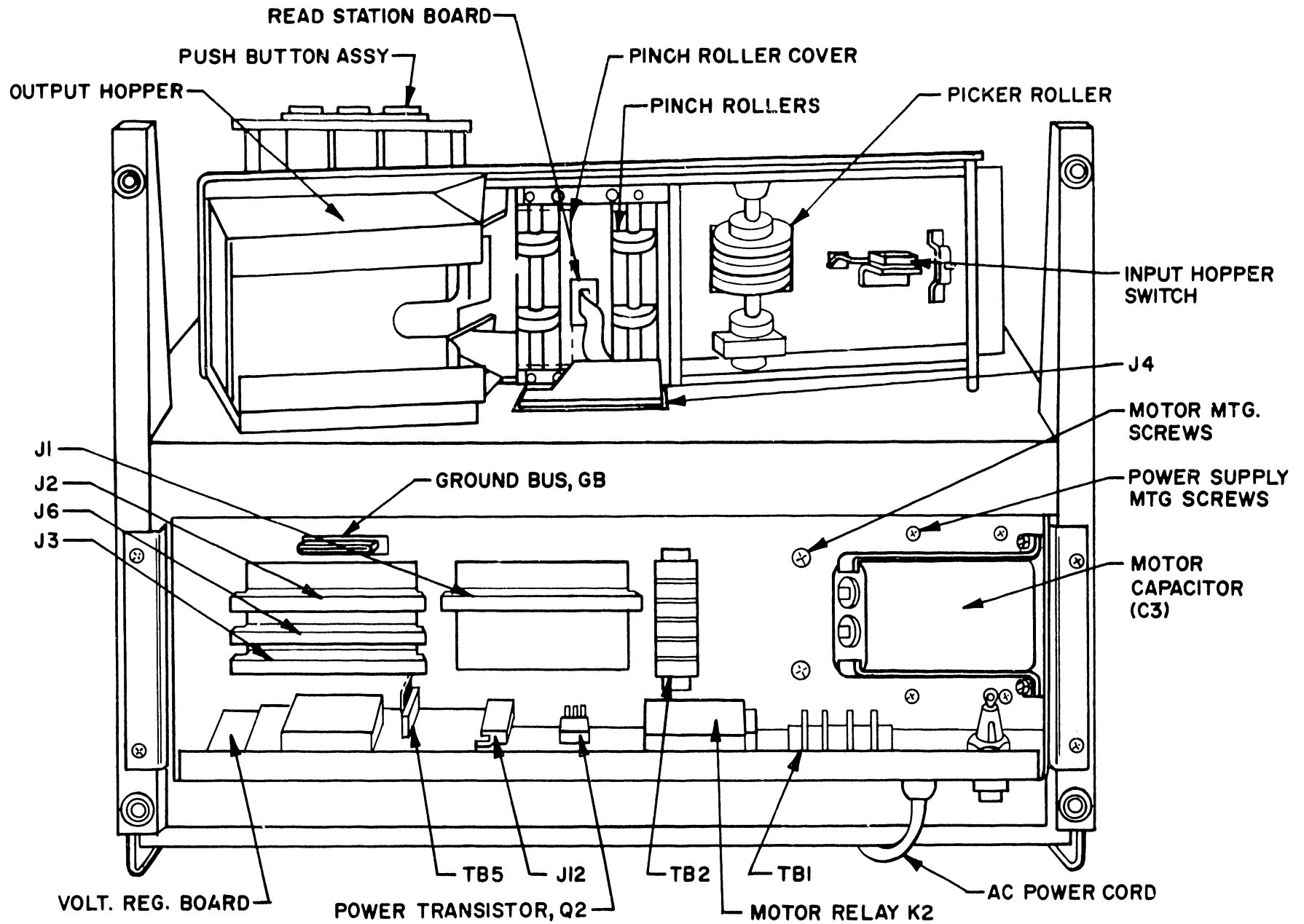


FIG. 5-2 BOTTOM VIEW OF CARD READER, FRONT COVER REMOVED

- a. With power off, remove front cover by grasping on each side and withdrawing the cover directly toward operator.
- b. Moisten a clean cloth with alcohol and place the moistened cloth over a finger and hold against the top surface of the picker roller as exposed in the input hopper. With the other hand, reach under the input hopper and rotate the picker roller while holding the moistened cloth against the top of the roller. Continue the cleaning operation until all accumulated dirt is removed.
- c. Inspect for lint buildup around read station area. Excessive lint should be removed by gently blowing and/or carefully wiping with a dry, lint-free cloth.
- d. The throat gap should be checked by placing the plastic throat gauge (PDI Part No. 3-14460-342) under the knife edge of the throat assembly. If throat is out of tolerance, operator should call for service.

Adjustment of knife is described in paragraph 5.3.2.

- e. Replace front cover by reversing the procedure followed in step a.

5.2.3 Six-Month Care

It is recommended that the following preventative maintenance procedures be accomplished on a six-month basis, or more often as usage dictates, by a trained serviceman.

- a. With power switch off and AC power source disconnected, remove front cover by grasping on each side and withdrawing the cover directly toward the operator. Remove rear cover in similar fashion.

- b. Examine all belts for evidence of wear such as frayed edges or broken fibers. If evidence of wear is noted, replace belt as described in paragraph 5.3.8 or 5.3.10.
- c. Moisten a clean cloth with alcohol and place the moistened cloth over a finger and clean the four surfaces of the read station drive rollers from above while holding cloth on rollers and slowly rotate the strobe wheel until complete surface of roller is cleaned. The four polyurethane-covered pinch rollers may be cleaned in similar fashion from below the read station. The pinch rollers are shown in Figure 5-2.
- d. Remove excessive lint buildup from the read station area. This is best accomplished by blowing out the dust with an air gun, aerosol duster can, or by blowing with the mouth.
- e. Replace front and rear covers by reversing the procedure followed in step a.
- f. Reconnect card reader to AC power source.

5.3 CORRECTIVE MAINTENANCE

Should corrective maintenance be required, follow the procedures outlined in this section. For convenience, a paragraph number listing of the various procedures is given below:

<u>Paragraph No.</u>	<u>Procedure</u>
5.3.1	Strobe Pickup Adjustment
5.3.2	Knife-Throat Adjustment
5.3.3	Output Hopper Full Switch Adjustment
5.3.4	Input Hopper Empty Switch Adjustment
5.3.5	Push Button Lamp Replacement
5.3.6	LED Assembly Replacement

<u>Paragraph No.</u>	<u>Procedure</u>
5.3.7	Picker Clutch Replacement
5.3.8	Main Drive Belt Replacement
5.3.9	Picker Roller Replacement
5.3.10	Roller Drive Belt Replacement
5.3.11	Read Station Board Replacement
5.3.12	Drive Rollers Replacement
5.3.13	Remove and Replace Read Block Assembly
5.3.14	Pinch Rollers Replacement
5.3.15	Drive Motor Replacement
5.3.16	Voltage Regulator Board Replacement
5.3.17	Voltage Regulator Power Transistor Replacement
5.3.18	Power Supply Replacement
5.3.19	Logic Module Replacement

5.3.1 Strobe Pickup Adjustment (Refer to Figure 5-1)

- a. To adjust strobe-pickup gap, loosen locknut (A), insert .005 inch feeler gauge between strobe wheel gear teeth and tip of pickup, and rotate pickup (B) to obtain snug fit. Retighten locknut (A). Gap should be between .004 and .006 inch.

5.3.2 Knife-Throat Adjustment (Refer to Figure 5-3)

- a. Loosen two knife mounting screws just enough to allow knife blade to move but still maintain contact with its mounting surface.
- b. Insert throat gauge, PDI Part No. 3-14460-342, between the knife and throat block, from input hopper side. Feeler gauges or metal stock MUST NOT BE USED.

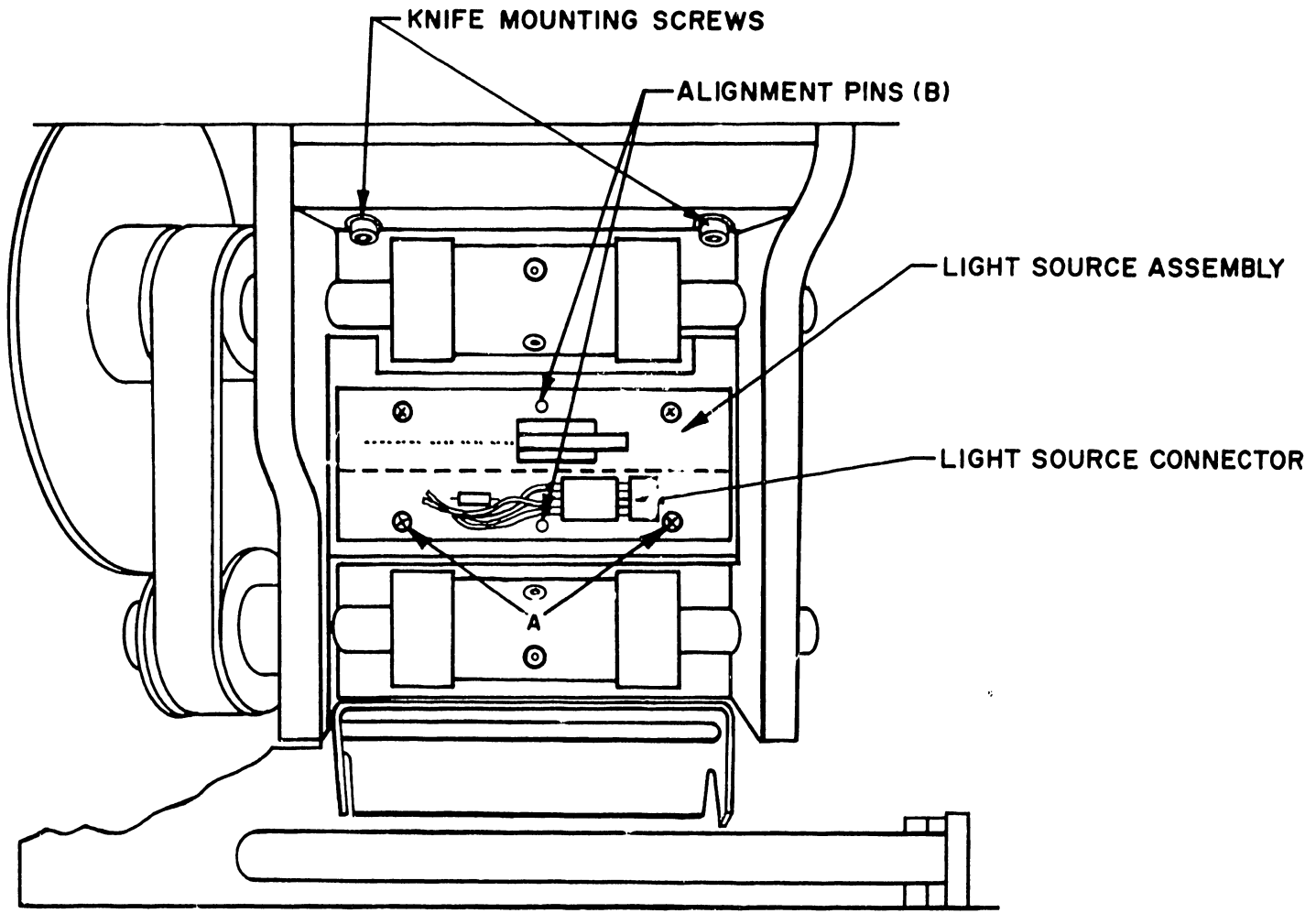


FIG. 5-3 READ STATION, TOP VIEW

- c. Slide the knife blade down onto the throat gauge gently, and without cocking the blade. Check for full-width contact of the knife with the gauge.
- d. Fully tighten the mounting screws and remove the gauge.
- e. Check adjustment by partially inserting gauge from both sides of knife to ensure that knife is parallel to throat block at the correct gap. Gauge should be slightly and equally snug on both sides of knife.

5.3.3 Output Hopper full Switch Adjustment

- a. Place 500 cards (3-3/4" thick stack of cards) in output hopper.
- b. Loosen two mounting screws that attach hopper switch to mounting bracket on top of hopper.
- c. Rotate switch back and forth to find position where switch will just be actuated with this thickness of cards in hopper and retighten screws. NOTE: It should not be necessary to bend switch arm to achieve adjustment.

5.3.4 Input Hopper Empty Switch Adjustment

- a. Loosen two mounting screws that attach hopper switch to mounting bracket on underside of input hopper.
- b. Rotate switch back and forth to find position where switch is just actuated with switch actuator protruding through card bed 3/16 inch, and retighten screws.
NOTE: It should not be necessary to bend switch arm to achieve adjustment.

5.3.5 Push Button Lamp Replacement

- a. Grasp front edges of movable portion of button firmly with fingertips and pull straight out. Movable portion of button contains lamps.

- b. Remove lamp from button by flicking out with fingernail.
- c. Slip new lamp (of same type removed) into hole position from which old lamp was removed, and replace button by sliding back into switch assembly and pressing in on button until it snaps into place.

5.3.6 LED Assembly Replacement (Refer to Figure 5-3)

- a. Disconnect light source connector by sliding plastic part of connector toward back of machine.
- b. Remove four screws (A) which secure light source in place.
- c. Carefully lift out light source P.C. board by pulling straight up on board assembly.

NOTE: If board does not lift out easily, very carefully pry around the edges with a sharp bladed instrument such as a small screwdriver to loosen head assembly from alignment pins (B).

- d. Replace light source assembly after first making sure that that individual LED's are all in reasonably good alignment with each other. Carefully drop into place so that each LED is properly started into its respective alignment hole in the aluminum mask.

The light source assembly should be pressed down over the alignment pins, and the four screws (A) replaced.

- e. Reconnect light source connector.

5.3.7 Picker Clutch Replacement (Refer to Figure 5-4)

- a. Unsolder two clutch leads (A) from terminal board.
- b. Loosen screw (B), rotate stud-mounted assembly 90-degrees, and temporarily retighten screw (B).

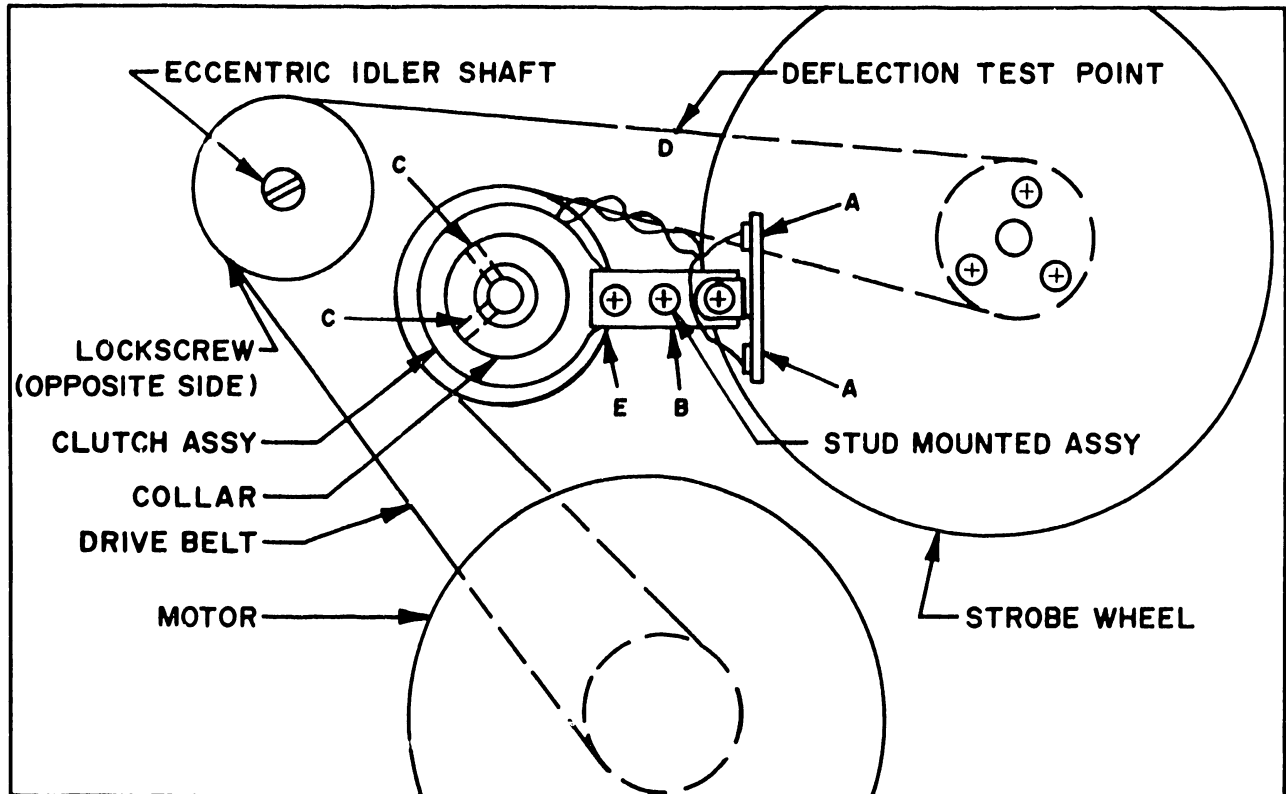


FIG. 5-4 PICKER CLUTCH AND DRIVE SYSTEM

- c. Loosen two setscrews (C) in collar and slide clutch assembly off picker roller shaft.
- d. Replace new clutch assembly by reversing the removal procedure, making sure that stop screw (E) engages slot in clutch assembly.

IMPORTANT: Adjust picker clutch for proper running clearance by sliding clutch onto picker roller shaft as far as possible and then backing off between .005 inch to .010 inch before tightening setscrews (C) in collar. This spacing adjustment is not critical, but sufficient clearance must be provided to allow clutch plate and coil to move slightly but freely on shaft.

5.3.8 Main Drive Belt Replacement (Refer to Figure 5-4)

- a. Remove three screws which secure strobe wheel to pulley hub of forward drive roller, and remove strobe wheel.
- b. Loosen lockscrew on opposite end of eccentric idler shaft.
- c. Turn idler shaft with screwdriver, one-half turn counter-clockwise to relieve belt tension.
- d. Remove belt.
- e. Replace new belt, and adjust belt tension by turning idler shaft with screwdriver in clockwise direction for proper tension, and retightening lockscrew on opposite end of idler shaft.

IMPORTANT: Correct belt tension is 1/4 in. deflection at point (D), with a one-pound force applied.
- f. Replace strobe wheel, and replace three screws to secure strobe wheel.
- g. Check for strobe pick-up gap adjustment (see Paragraph 5.3.1).

5.3.9 Picker Roller Replacement (Refer to Figure 5-5)

- a. Temporarily remove picker clutch (steps b and c of procedure for picker clutch replacement, Paragraph 5.3.7).
- b. Relieve tension on main drive belt (steps b and c of procedure for main drive belt replacement, Paragraph 5.3.8).
- c. Loosen setscrew (C) in collar.
- d. Loosen two setscrews (D) in picker roller hub.
- e. Slide shaft out by grasping picker shaft pulley with one hand and holding picker roller with other hand.

NOTE: Slide shaft out just far enough to remove roller.

- f. Install new picker roller by reversing step e above, pushing shaft in until it bottoms. Snug collar against fiber inertia damper and tighten setscrew (C) in collar.
- g. With picker roller setscrews (D) positioned over flats on picker roller shaft, center roller so that raised areas on picker roller fall between columns on a punched card. This adjustment may be easily made by placing a fully laced card in the input hopper, holding first against one side of the input hopper and then against the other side. The high points of the roller should not be visible through the punchings with the card in either extreme position. Tighten both setscrews in picker roller hub.
- h. Adjust drive belt tension (step e of procedure for main drive belt replacement, Paragraph 5.3.8).
- i. Replace picker clutch (step d of procedure for picker clutch replacement, Paragraph 5.3.7).

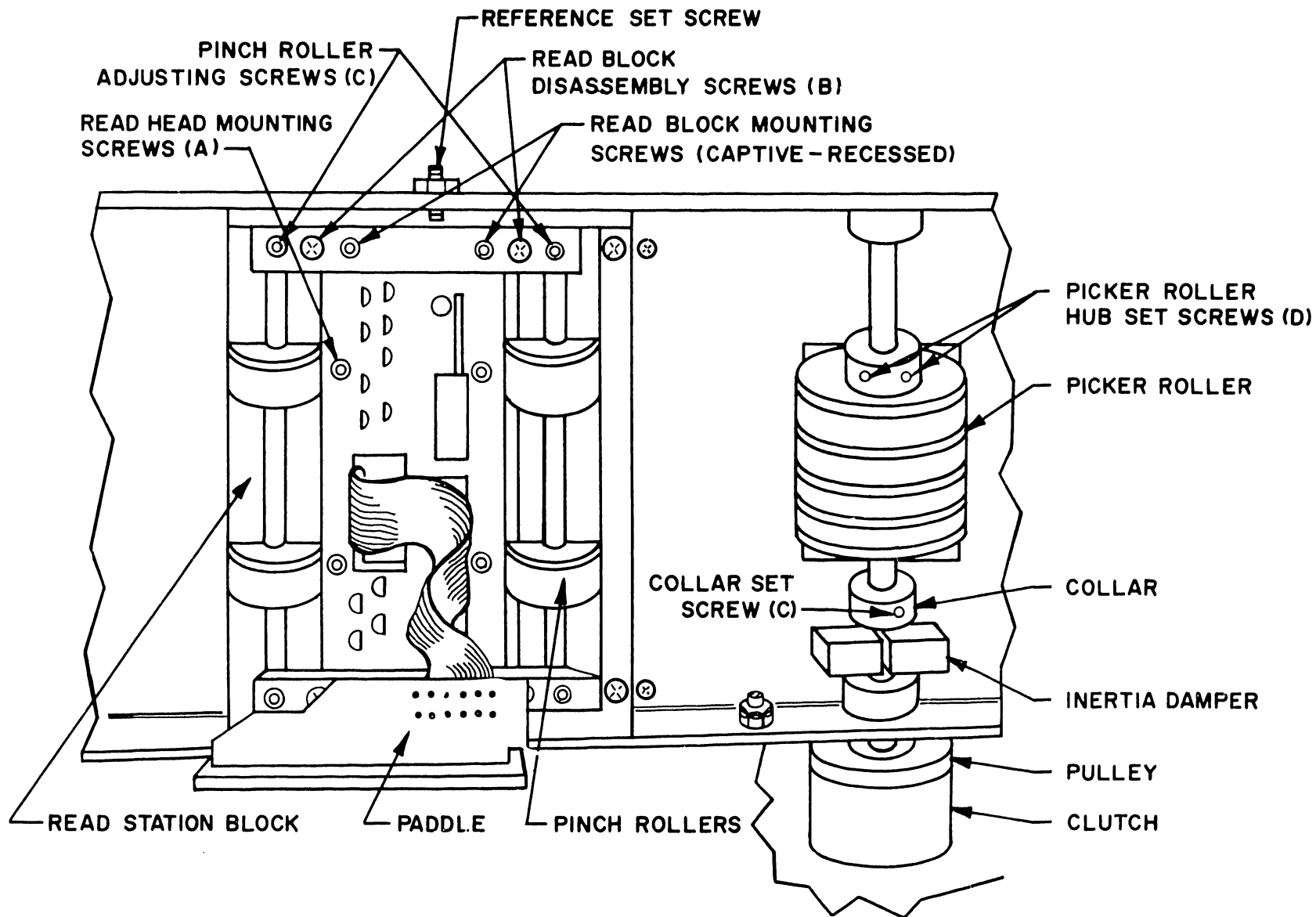


FIG. 5-5. READ STATION AND PICKER ROLLER
BOTTOM VIEW WITH PROTECTIVE COVER REMOVED

5.3.10 Roller Drive Belt Replacement (Refer to Figure 5-6)

- a. Remove main drive belt and strobe wheel (steps a through d of procedure for main drive belt replacement, Paragraph 5.3.8).
- b. Remove screws and spacers (C) and pickup mounting bracket.
- c. Loosen two setscrews (A) and (B) in both roller pulleys, and slide both pulleys (along with belt) off roller shafts.
- d. Place new belt over both pulleys and slide back onto shafts in the manner removed, taking care to align setscrews of double-pulley with flats on shaft of forward drive roller shaft.
- e. Tighten two setscrews (A) in double-pulley, and after aligning setscrews and shaft in single-pulley, tighten two setscrews (B) in single-pulley.
- f. Replace pickup mounting bracket using screws and spacers (C).
- g. Replace motor drive belt and strobe wheel (steps e and f of procedure for main drive belt replacement, Paragraph 5.3.8), and adjust strobe pickup gap (Paragraph 5.3.1).

5.3.11 Read Station Replacement Board (Refer to Figure 5-5)

- a. Unplug paddle connector.
- b. Remove four mounting screws (A), and remove assembly by carefully lifting out. DO NOT TWIST OR FORCE ASSEMBLY. This could result in bending the mounting leads of the phototransistors causing a resultant misalignment.
- c. Replace assembly in reverse order, being careful that phototransistors slip into their wells. As above, DO NOT TWIST OR FORCE ASSEMBLY.

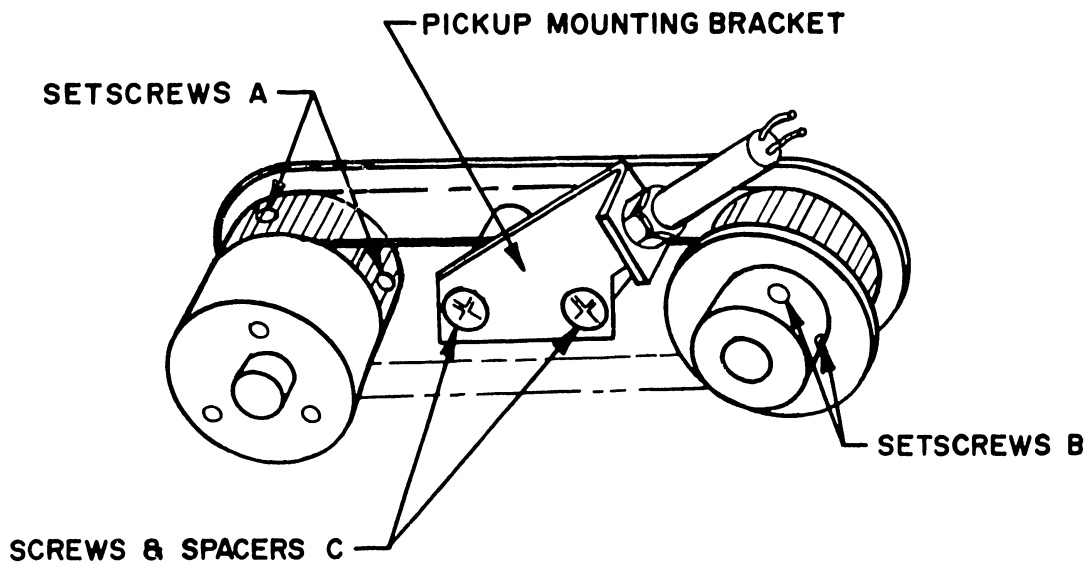


FIG. 5-6 ROLLER DRIVE

5.3.12 Drive Rollers Replacement (Refer to Figure 5-3)

If drive rollers become defective, it is recommended that both drive rollers be replaced.

- a. Remove main drive belt and strobe wheel (steps a through d of procedure for main drive belt replacement, Paragraph 5.3.8).
- b. Remove pickup mounting bracket, roller drive belt and pulleys (steps b and c of procedure for roller drive belt replacement, Paragraph 5.3.10).
- c. Loosen bearing clamp screws on the two drive roller bearings at the front of the machine, and slip bearings out of the front hopper rail and off the ends of the shafts.
- d. Loosen drive roller setscrews (two in each roller).
NOTE: These screws must be backed out sufficiently to clear shaft outer diameters.
- e. Remove first drive roller by sliding shaft and rear bearing out of the rear of the machine while holding roller in position.
- f. Replace first drive roller by holding it in position, with one setscrew pointing upwards, and slide shaft through roller from back of machine, being careful to orient flats on shaft with setscrew positions in roller, and temporarily tighten one of the setscrews.
- g. Make sure rear bearing is fully seated in rear hopper rail, and slip front bearing over shaft and into recess in front hopper rail. Tighten bearing clamp setscrew.
- h. Slightly loosen roller setscrew temporarily tightened, and slide roller on shaft to center it, aligning roller setscrew with light source alignment pins in light mask. Retighten setscrew, rotate roller slightly and tighten second setscrew.

- i. Repeat steps e through h, above, for second drive roller.
- j. Replace roller drive belt and pulleys, and pickup (steps d through f of procedure for roller drive belt replacement, Paragraph 5.3.10).
- k. Replace motor drive belt and strobe wheel (steps e and f of procedure for main drive belt replacement, Paragraph 5.3.8), and adjust strobe pickup gap (Paragraph 5.3.1).

5.3.13 Remove and Replace Read Block Assembly (Refer to Figure 5-5)

At certain times, it may be desirable to remove and replace the read block assembly (for inspection, cleaning, or for removal of a damaged card).

- a. Stand card reader on output hopper end and unplug read station paddle connector.
- b. Using a 9/64-inch allen wrench, loosen the four recessed and captivated read block mounting screws until entire read block assembly comes away in the hand.
- c. Replace assembly in the reverse order after first making sure that the assembly alignment pins engage in the alignment slots in the underneath of the hopper guide rails. Before tightening mounting screws, insert a 5-mil plastic shim or feeler gauge between outer edge of read block and reference setscrew, slide block against gauge, and tighten mounting screws. Insert read station paddle into the read station connector.

5.3.14 Pinch Rollers Replacement (Refer to Figure 5-5)

If pinch rollers become defective, it is recommended that all four pinch rollers be replaced.

- a. Stand card reader on output hopper end and unplug read station paddle connector. Back out each of the four pinch roller adjusting

screws (C) by about one turn (using 5/64 allen wrench).

- b. Remove four read block disassembly screws (B), and remove pinch roller adjustment bars.
- c. Remove pinch roller and shaft assemblies by lifting them out of the slots in the read block.
- d. Remove outer retaining ring at each roller position and slide rollers off shaft ends.
- e. Replace new pinch rollers on shafts, and outside retaining rings on shafts.
- f. Replace pinch roller and shaft assemblies in read block with flats on shafts facing toward adjustment bars, and reinstall adjustment bars with screws (B).
- g. Tighten each of the four pinch roller adjusting screws (C) to get the proper adjustment "feel" on the pinch rollers. The proper "feel" in making this adjustment is to be able to rotate each roller with the fingers with about a pound of applied force while keeping the drive rollers from rotating with the other hand. In making this adjustment, the exact amount of friction is not as important as making all four rollers "feel" about the same.
- h. Insert read station paddle into the read station connector.

5.3.15 Drive Motor Replacement (Refer to Figures 5-1 and 5-2)

In the procedure to follow, clip lacing cord where required to remove wires, and relace cable at conclusion.

- a. Loosen and free main drive belt from motor pulley (steps b and c of procedure for main drive belt replacement, paragraph 5.3.8).
- b. Disconnect three motor leads by pulling off quick-connect fasteners at TB1-3, C3-2, and TB2-6.

- c. Remove two screws which secure motor base to chassis, and remove motor.
- d. Remove pulley from motor shaft and reinstall on new motor.
- e. Replace motor, securing with screws removed in step c.
- f. Reconnect motor leads to connection points broken in step b, and dress leads as originally done.
- g. Replace main drive belt on pulleys and adjust belt tension (step e of procedure for main drive belt replacement, Paragraph 5.3.8).

5.3.16 Voltage Regulator Board Replacement (Refer to Figure 5-2)

- a. Unplug cable connector from regulator board.
- b. Remove regulator board from chassis by removing two screws, nuts and spacers; and unbolt wired TB5 from regulator board.
- c. Replace with new regulator board in the reverse order.

5.3.17 Voltage Regulator Power Transistor Replacement (Refer to Figure 5-2)

- a. Unsolder leads from transistor, carefully noting which color leads go to emitter, collector and base.
- b. Remove transistor from chassis by removing screw, spring washer, and nut, being careful not to damage mica washer. If transistor is removed with a rolling motion, mica washer should stay in place on chassis by adhesive action of silicone grease.
- c. Wipe a small dab of silicone grease over metal underside of replacement transistor before mounting. Tighten mounting screw to approximately 6 inch-pounds of torque.
- d. Resolder leads removed in step a.

5.3.18 Power Supply Replacement (Refer to Figures 5-1 and 5-2)

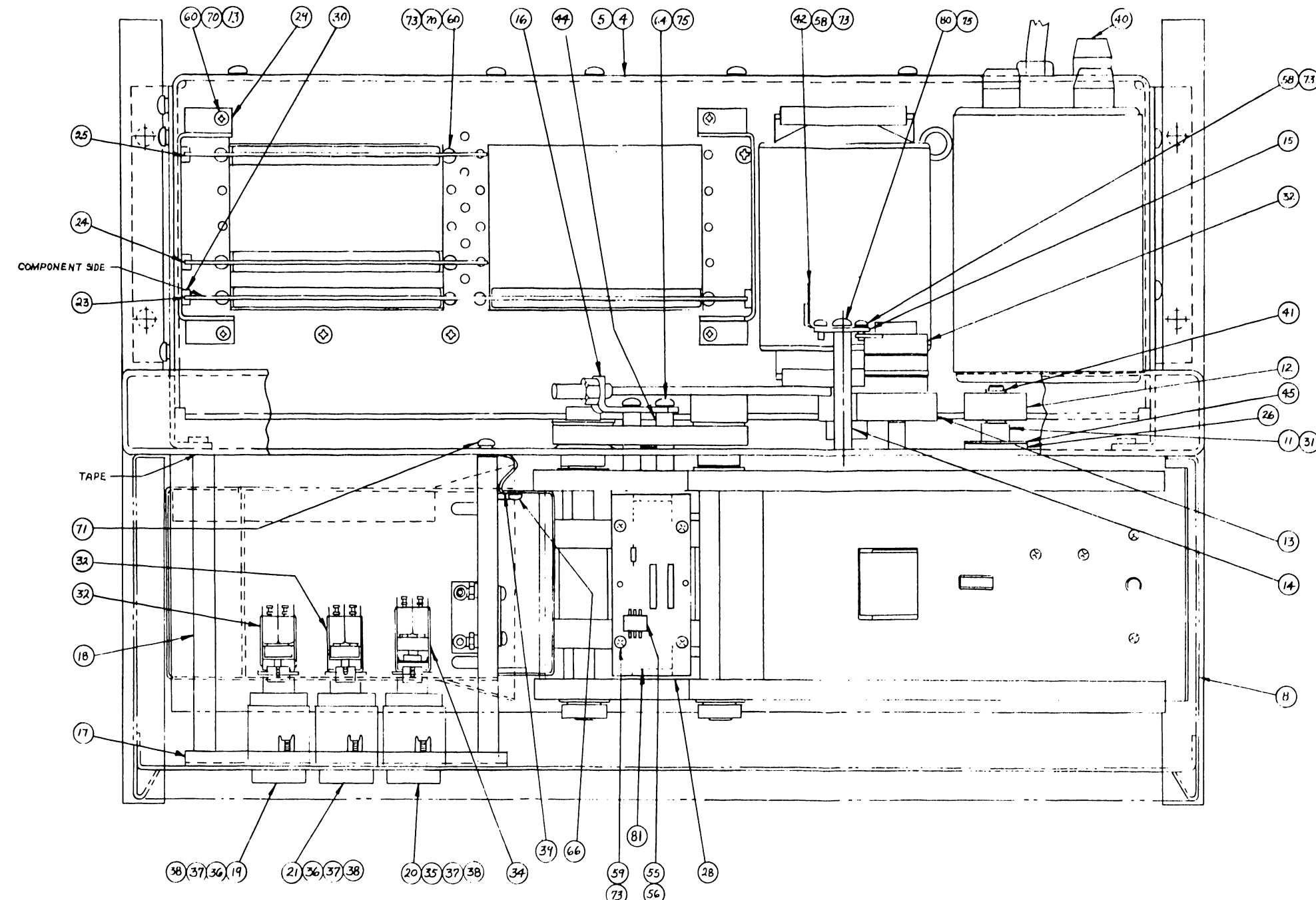
In the procedure to follow, clip wire-ties where required to remove wires, and re-tie cable at conclusion.

- a. Remove power supply input leads (quick-connect terminals) from TB2-5 and C3-1.
- b. Remove red power supply output lead (quick-connect terminal) from TB2-2.
- c. Unsolder black power supply output lead from TB5-1, and green power supply output lead from TB5-3.
- d. Remove power supply by removing four mounting screws.
- e. Install new power supply by reversing the procedure.

5.3.19 Logic Module Replacement

When replacing logic modules, care should be exercised not to damage any of the plated-through holes in the P.C. board. The recommended procedure is to first clip all the module leads, and then individually unsolder the leads from the board. A solder-sucker should be used to clean solder from the holes before loading the new module on the board. Place new module on board with pin 1 adjacent to identifying dot, and solder. After soldering the new module in place, clean solder joints with freon spray or similar solvent. The locations of the logic modules and discrete components on the board are shown in Figure 5-7.

REV	DATE	REVISION	BY	CHK



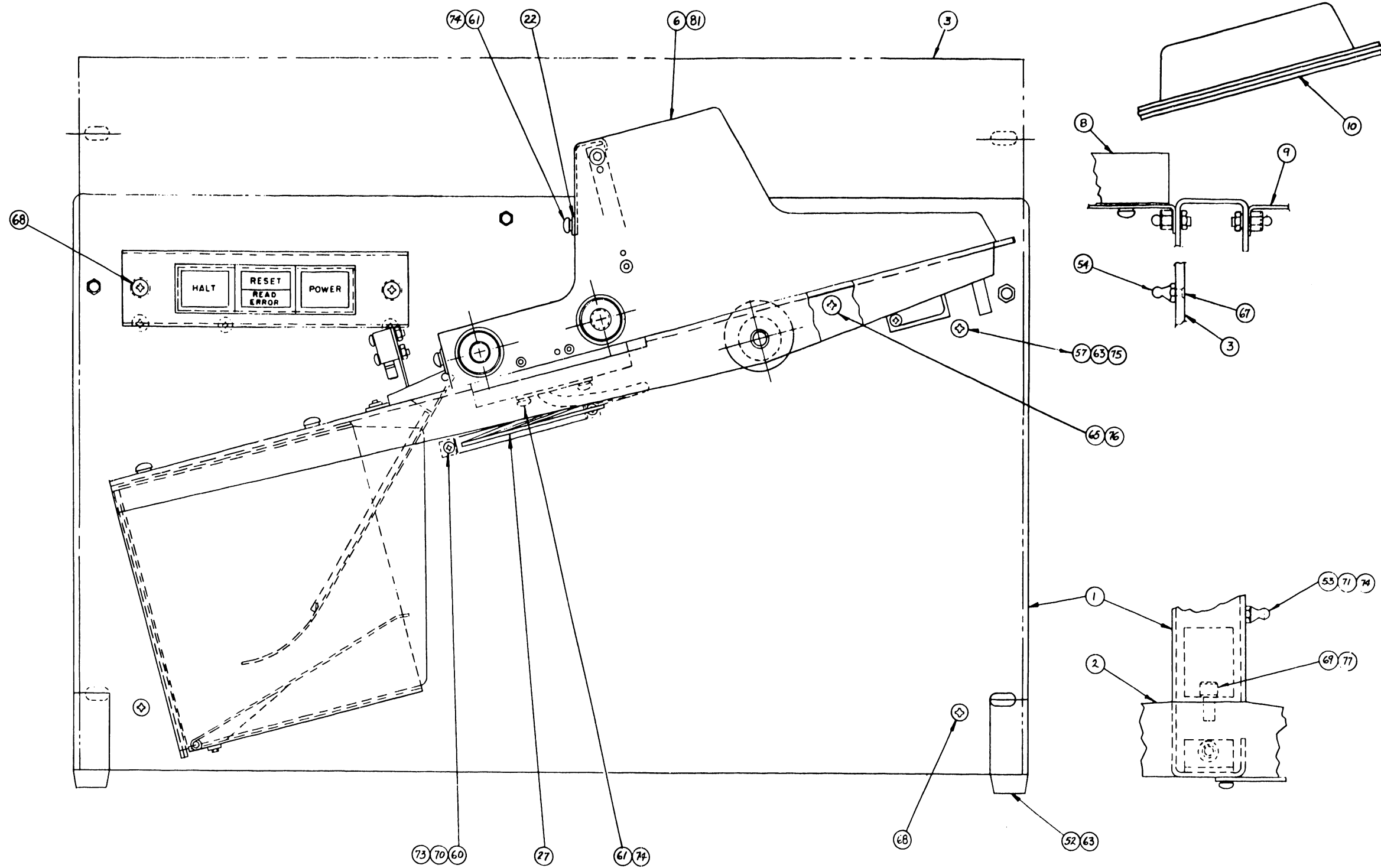
NOTES
 1. WIRE MAIN CABLE IN ACCORDANCE WITH WIRING TABLE 3-1146-1014, USING HARNESS KIT 3-1118-1015.
 2. WIRE AC CABLE IN ACCORDANCE WITH WIRING TABLE 3-1134-891, USING HARNESS KIT 3-1118-890.
 3. WIRE REGULATOR BOARD IN ACCORDANCE WITH WIRING TABLE 3-1134-893, USING HARNESS KIT 3-1118-889.

QTY	QTY	PART NO.	DESCRIPTION
2	2	3-1110-2546	81 TAPE, FOAM
1	1	3-1201-160-8320	80 SCREW, PAN HD, 6-32 X 2 1/2
AR	AR	3-14470-308	79 SHIELDER 60/40
AR	AR	3-12251-583-2	78 CABLE TIE
-	4	3-12013-164-5	77 LOCKWASHER, 1/4
1	1	3-12013-164-4	76 LOCKWASHER #10
11	15	3-12013-164-3	75 LOCKWASHER #8
7	14	3-12-13-164-2	74 LOCKWASHER #6
23	23	3-12-13-164-1	73 LOCKWASHER #4
1	1	3-12112-163-259	72 NUT, HEX, 1/4-28
1	8	3-12-12-163-63	71 NUT, HEX, #6-35
12	14	3-12-12-163-44	70 NUT, HEX, #4-40
-	4	3-12011-162-2524	69 SCREW, SOC HD, 1/4-20 X 1/2
4	4	3-12011-161-834	68 SCREW, FLAT HD, #8-32 X 1/2
3	-	3-12011-161-663	67 SCREW, FLAT HD, #6-32 X 3/8
1	7	3-12011-273	66 SCREW, PAN HD, SHEET METAL

QTY	QTY	PART NO.	DESCRIPTION
1	1	3-12011-160-1035	65 SCREW, PAN HD, 10-32 X 5/8
2	2	3-12011-160-8312	64 SCREW, PAN HD, 8-32 X 1 1/2
8	5	3-12011-160-8335	63 SCREW, PAN HD, 8-32 X 3/8
-	4	3-12011-160-8333	62 SCREW, PAN HD, 8-32 X 3/8
7	7	3-12011-160-633	61 SCREW, PAN HD, 6-32 X 3/8
17	17	3-12011-160-444	60 SCREW, PAN HD, 4-40 X 1/2
1	4	3-12011-160-443	59 SCREW, PAN HD, 4-40 X 3/8
2	2	3-12011-160-442	58 SCREW, PAN HD, 4-40 X 1/4
3	7	3-12011-160-834	57 SCREW, PAN HD, 8-32 X 1/2
3	3	3-12593-959-7	56 CONNECTOR (PIN)
1	1	3-12593-959-1	55 CONNECTOR
3	-	3-12062-1017-2	54 STUD
-	7	3-12062-1017-1	53 STUD
-	4	3-12060-310	52 BUMPER, RUBBER
1	1	3-12136-771	51 BELT, FLAT
1	1	3-12516-686	50 REFLECTANCE PICKUP
3	3	3-12687-23-1	49 GRONMET
1	1	3-12231-101-3	48 CABLE CLAMP
5	5	3-12231-110-1	47 CABLE CLAMP
1	1	3-12136-771-1	46 GEAR
1	1	3-12013-2526-1	45 WASHER, FLAT
2	2	3-2010-320-10	44 SPACER
1	1	3-12010-320-2	43 SPACER
1	1	3-12577-269	42 TERMINAL STRIP
1	1	3-12067-172-1	41 RETAINING RING, EXT, BOWED
1	1	3-12641-233-5	40 FUSE
1	1	3-1107-1440	39 JUMPER, GROUND-FLIPPER
3	3	3-12661-181-2	38 LAMP
3	3	3-12701-190-1	37 SWITCH HSG / MTO SHELL
2	2	3-12701-184-3	36 SWITCH DISPLAY MODULE
1	1	3-12701-184-5	35 SWITCH DISPLAY MODULE
1	1	3-12701-184-2	34 SWITCH MODULE
2	2	3-12706-186-1	33 SWITCH MODULE
1	1	3-12139-766	32 CLUTCH COUPLING
1	-	3-1110-763-2	31 SHAFT, IDLER PULLEY
4	4	3-12051-876-1	30 CARD GUIDE
2	2	3-1110-1103	29 SUPPORT, CARD GUIDE
1	1	3-1160-1615	28 I/R LIGHT SOURCE
1	1	3-1160-1618	27 HEAD STA AND PADDLE ASSY
1	1	3-12013-2524-1	26 WASHER SHOULDER
1	1	3-1160-1004	25 PADDLE CONNECTOR
1	1	3-1160-1418	24 READ CHECK BOARD
1	1	3-1160-847	23 LOGIC BOARD
1	1	3-1107-1020-1	22 COVER
1	1	3-1110-246-5	21 APPLIQUE, DISPLAY SCREEN
1	1	3-1110-246-2	20 APPLIQUE, DISPLAY SCREEN
1	1	3-1110-246-8	19 APPLIQUE, DISPLAY SCREEN
2	2	3-1110-176	18 SPACER, SWITCH BRACKET
1	1	3-1110-175	17 ANTI-XE SWITCH SUPPORT
1	1	3-1110-662	16 SUPPORT, TRANSLUCER
1	1	3-1110-772	15 PLATE, CLUTCH STOP
1	1	3-12010-320-13	14 SPACER
1	1	3-1107-752	13 PICKER PULLEY ASSY
1	1	3-1107-691	12 IDLER PULLEY ASSY
-	1	3-1110-763-2	11 SHAFT, IDLER PULLEY
1	1	3-1107-1432	10 CARD FEEDER ASSY
-	1	3-1107-1053	9 REAR COVER ASSY
1	1	3-1107-1052-1	8 FRONT COVER ASSY
-	1	3-1110-331	7 PLATE, BOTTOM
1	1	3-1107-1049-2	6 INPUT-OUTPUT MODULE
1	1	3-1107-1041-2	5 COMPONENT SHELL ASSY
1	1	3-1110-1056	4 COMPONENT SHELL ASSY
1	1	3-1110-1056	3 BACK PAN
1	1	3-1107-177-12	2 FOOT, CABLE PEACE
1	1	3-1107-177-12	1 CHASSIS

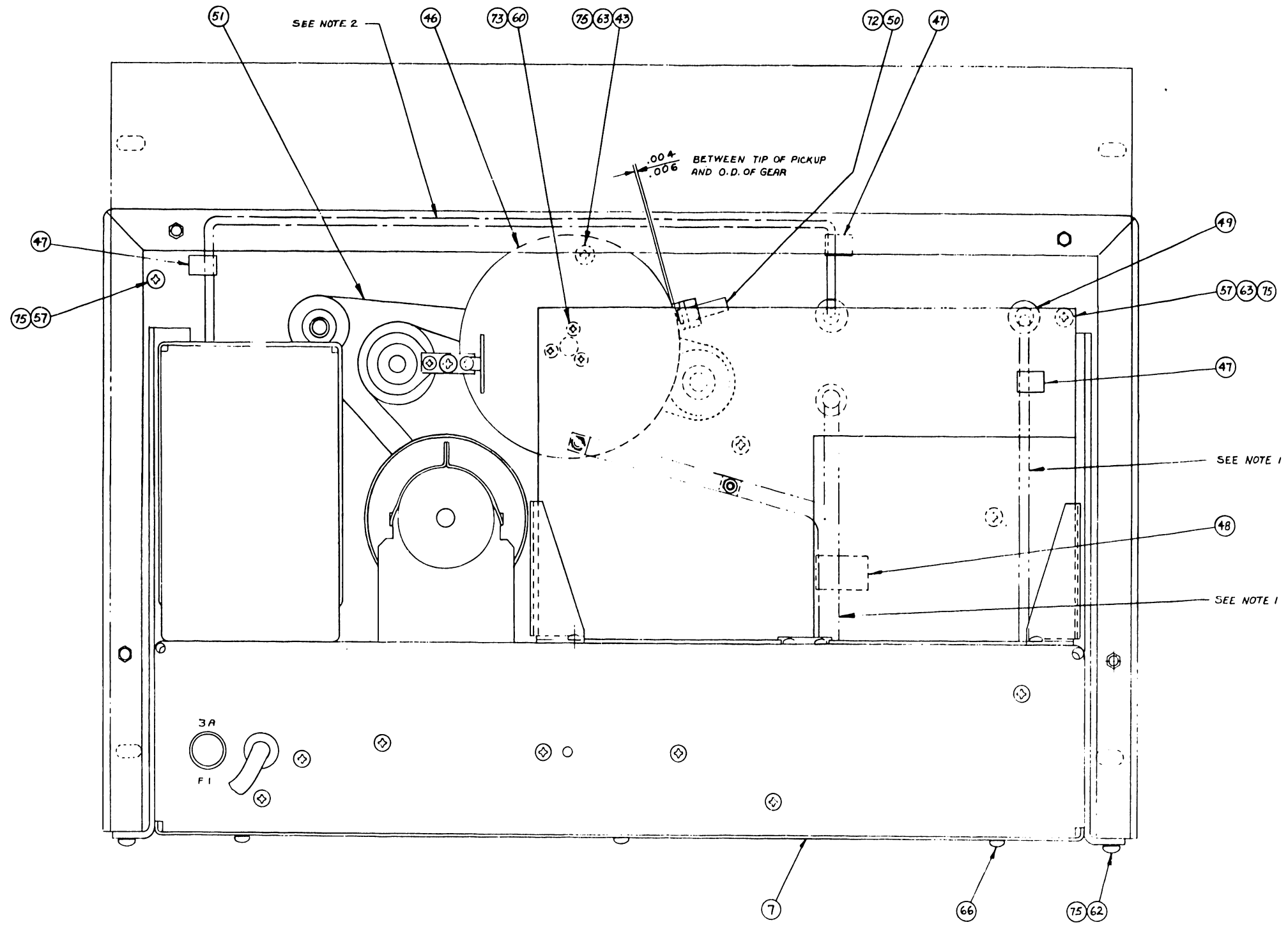
PERIPHERAL DYNAMICS INC.
 TITLE: CARD READER, MODEL 3155
 DATE: 7-12-80
 PART NO: 3-1105-2744

REV	DATE	BY	CHK



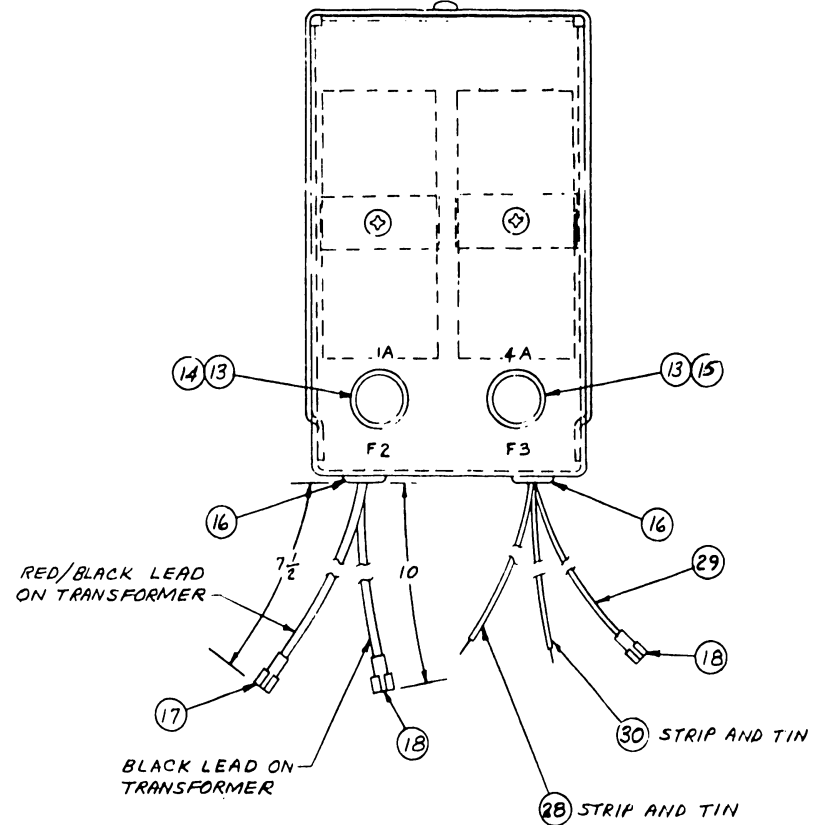
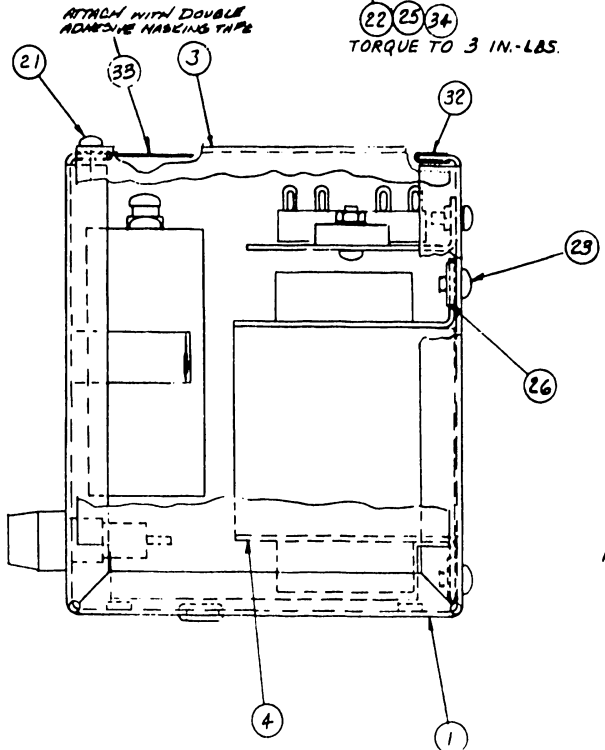
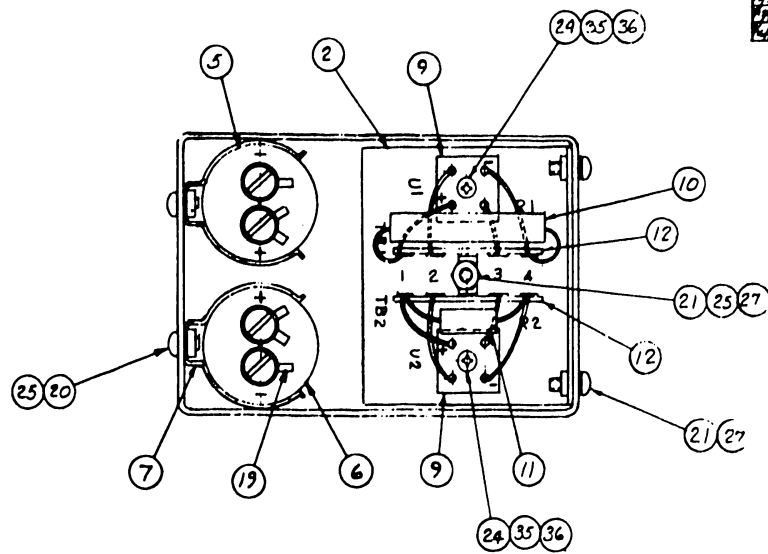
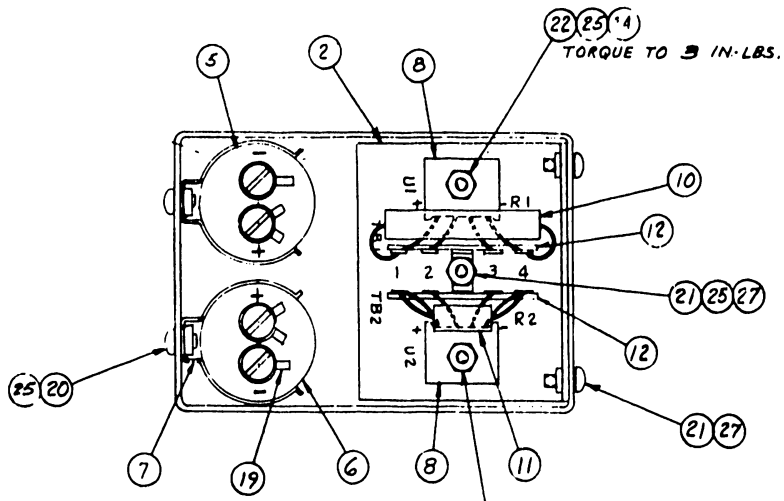
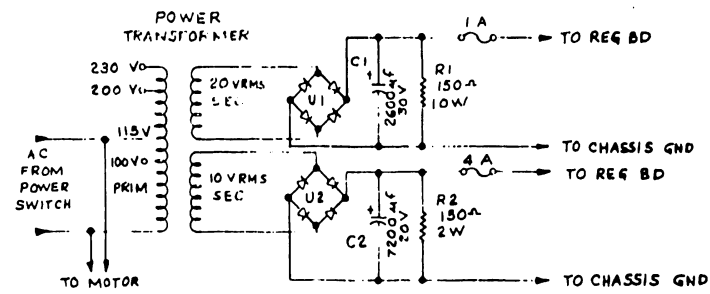
TOLERANCES UNLESS OTHERWISE SPECIFIED		PERIPHERAL DYNAMICS INC.	
DECIMAL	SCALE	1/1	DRAWN BY <i>SPJ</i>
FRACTIONAL	TITLE	CARD READER, MOD 3155	
ANGULAR	DATE	9-16-80	DRAWING NUMBER 3-1105-2744

DATE	BY	REVISION	REASON	APP'D	CHK'D



TOLERANCES UNLESS NOTED	PERIPHERAL DYNAMICS INC.	
DECIMAL	SCALE 1/1	DRAWN BY <i>[Signature]</i>
FRACTIONAL	APPROVED BY <i>[Signature]</i>	
ANGULAR	DATE 9-17-60	DRAWING NUMBER 3-1105-2744

REV	DESCRIPTION	DATE	BY
1	3-1107-1040-1	6-11-71	RT
2	3-1107-1040-2	6-11-71	RT
3	3-1107-1040-3	6-11-71	RT
4	3-1107-1040-4	6-11-71	RT
5	3-1107-1040-5	6-11-71	RT
6	3-1107-1040-6	6-11-71	RT
7	3-1107-1040-7	6-11-71	RT
8	3-1107-1040-8	6-11-71	RT
9	3-1107-1040-9	6-11-71	RT
10	3-1107-1040-10	6-11-71	RT
11	3-1107-1040-11	6-11-71	RT
12	3-1107-1040-12	6-11-71	RT
13	3-1107-1040-13	6-11-71	RT
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19	3-1107-1040-19	6-11-71	RT
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21	3-1107-1040-21	6-11-71	RT
22	3-1107-1040-22	6-11-71	RT
23	3-1107-1040-23	6-11-71	RT
24	3-1107-1040-24	6-11-71	RT
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29	3-1107-1040-29	6-11-71	RT
30	3-1107-1040-30	6-11-71	RT
31	3-1107-1040-31	6-11-71	RT
32	3-1107-1040-32	6-11-71	RT
33	3-1107-1040-33	6-11-71	RT
34	3-1107-1040-34	6-11-71	RT
35	3-1107-1040-35	6-11-71	RT
36	3-1107-1040-36	6-11-71	RT



NOTES:
1. ASSY 3-1107-1040 AND ASSY 3-1107-1040-1 ARE INTERCHANGABLE.

QTY	QTY	PART NO	ITEM	DESCRIPTION
REQD	ASBY		NO	
2	-	3-12018-164-1	36	LOCKWASHER, #4
2	-	3-12012-163-44	35	NUT, HEX, 4-40
-	2	3-12018-816-2	34	LOCKWASHER, DISKED TYPE
1	1	3-12067-1213-1	33	MATERIAL INSULATION 1 1/2" x 5"
2	2	3-12012-1082-2	32	NUT, SPEED, 6-32
AR	AR	3-14470-308	31	SOLDER, 60/40
AR	AR	3-12585-1217-5	30	WIRE, INS, 20 AWG, GREEN
AR	AR	3-12585-1217-2	29	WIRE, INS, 20 AWG, RED
AR	AR	3-12585-1217-0	28	WIRE, INS, 20 AWG, BLACK
3	3	3-12018-164-2	27	LOCKWASHER, #6
4	4	3-12012-1082-4	26	NUT, SPEED, 8-32
3	5	3-12012-163-63	25	NUT, HEX, 6-32
2	-	3-12011-160-443	24	SCREW, PAN HD, 4-40 x 1/2
4	4	3-12011-160-833	23	SCREW, PAN HD, 6-32 x 3/8
-	2	3-12011-160-634	22	SCREW, PAN HD, 6-32 x 1/2
5	5	3-12011-160-633	21	SCREW, PAN HD, 6-32 x 3/8
2	2	3-12011-160-632	20	SCREW, PAN HD, 6-32 x 1/2
6	6	3-12590-318-2	19	TERMINAL, RING TONGUE
2	2	3-12067-242-3	18	RECEPTACLE, QC
1	1	3-12067-242-1	17	RECEPTACLE, QC
2	2	3-12657-203-6	16	GROMMET
1	1	3-12641-233-7	15	FUSE, 4 AMP
1	1	3-12641-233-4	14	FUSE, 1 AMP
2	2	3-12643-232	13	FUSE HOLDER F2, F3
2	2	3-12597-269-1	12	TERMINAL STRIP T81, T82
1	1	3-12591-829-15	11	RESISTOR, 150A, 2W R2
1	1	3-12592-268	10	RESISTOR, 150A, 10W R1
2	-	3-12517-1771	9	RECTIFIER, BRIDGE
-	2	3-12517-796-3	8	FW BRIDGE RECTIFIER, U1, U2
2	2	3-12290-794-2	7	CLIP, COMPONENT
1	1	3-12542-795	6	CAPACITOR, ELECT. C2
1	1	3-12542-267	5	CAPACITOR, ELECT. C1
1	1	3-12563-764	4	TRANSFORMER
1	1	3-1110-1021	3	SHIELD, POWER SUPPLY
1	1	3-1167-1026	2	BRACKET, COMPONENT
1	1	3-1107-1025	1	BASE, POWER SUPPLY

TOLERANCES (UNLESS SHOWN OTHERWISE)

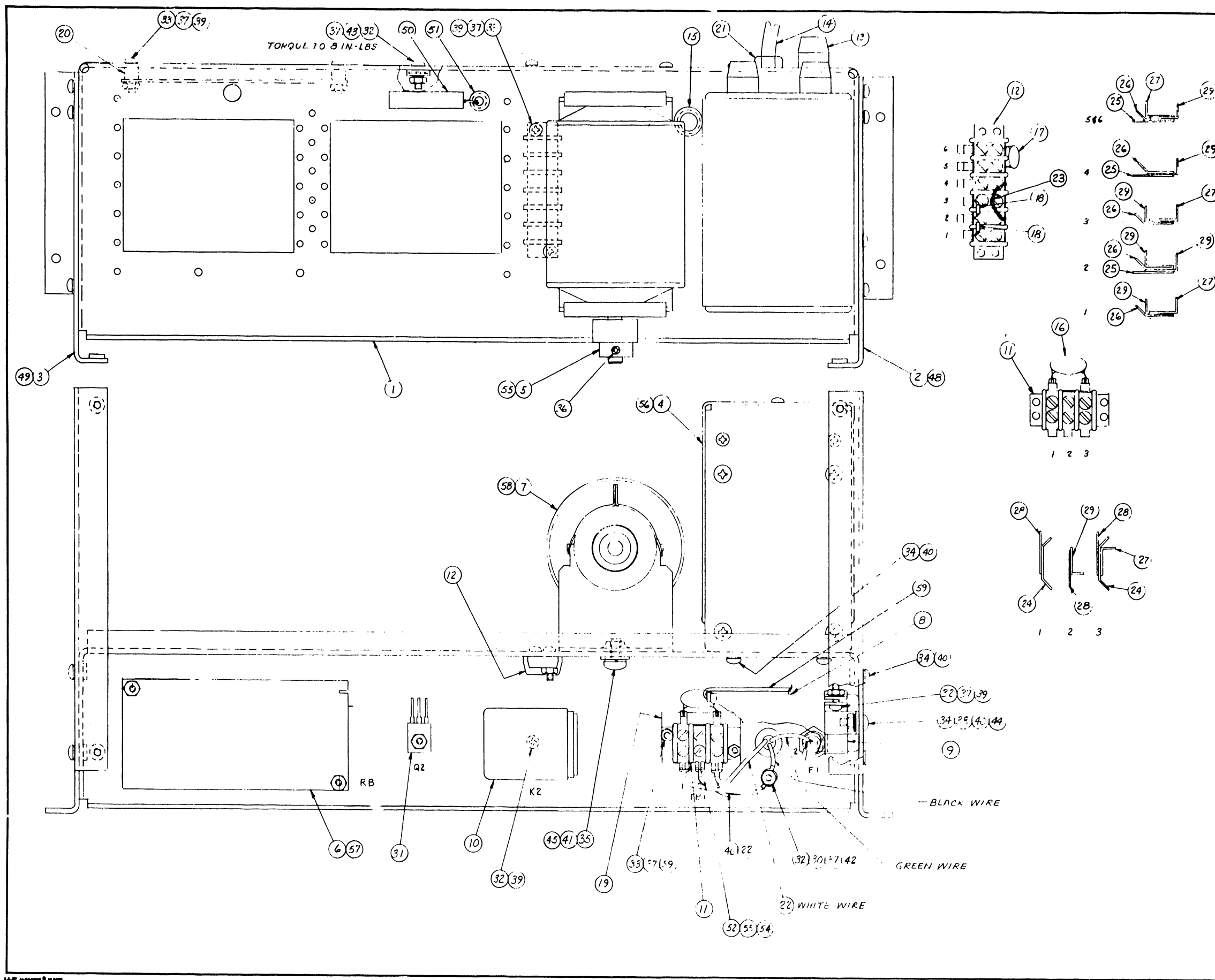
PERIPHERAL DYNAMICS INC

DESIGNED BY: RT

APPROVED BY: [Signature]

FRACTIONAL: 1/8 TITLE: POWER SUPPLY

ANGULAR: DATE: 6-11-71 DRAWING NUMBER: 3-1107-1040

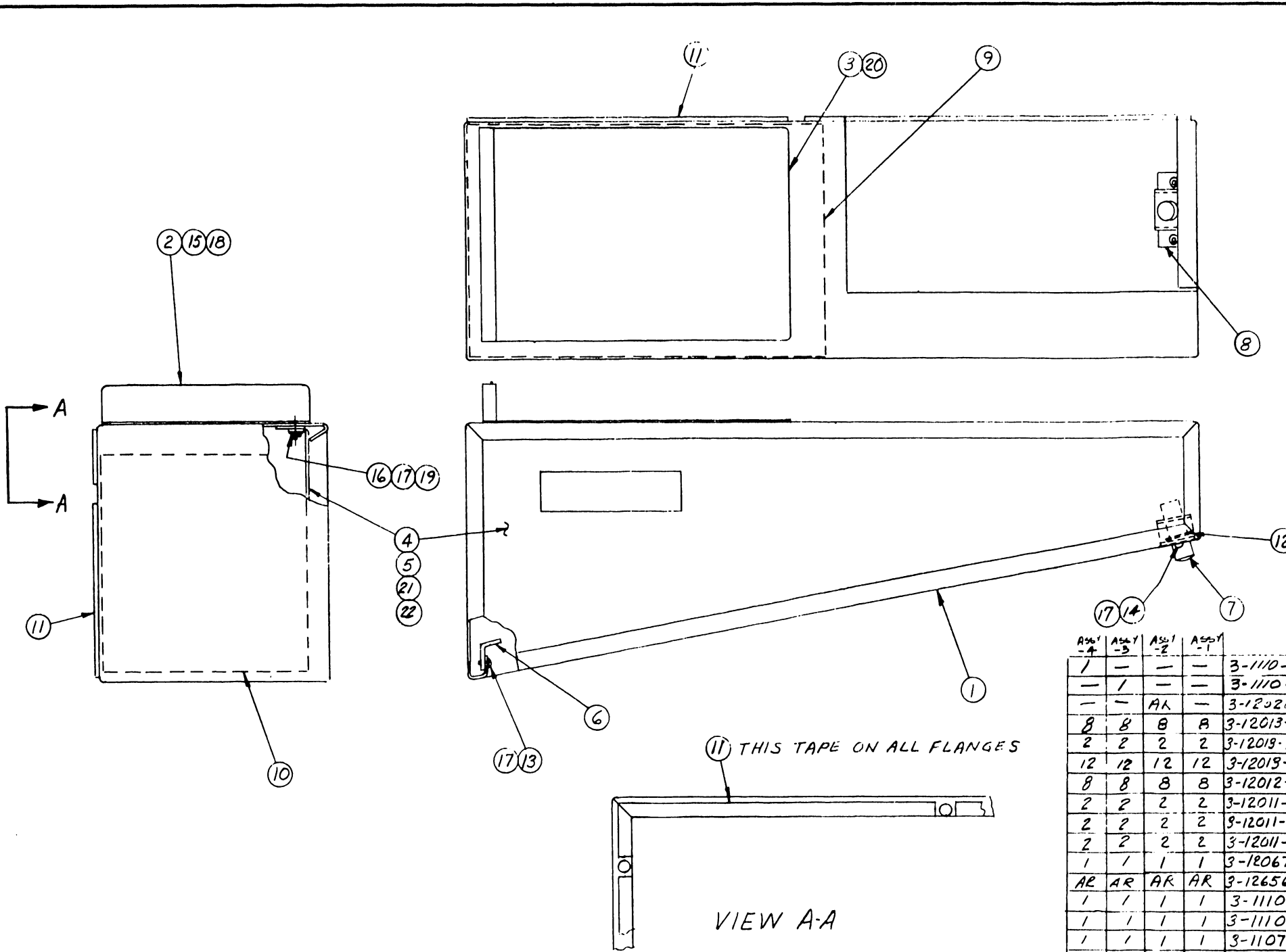


REV	DATE	BY	CHK	APP
1	6-15-71	RTJ		
2				
3				
4				
5				

QTY	REQD	PART NO.	DESCRIPTION
2	-	3-12067-207B	59 CLAMP, CAPACITOR
1	-	3-12081-875-1	58 MOTOR
1	-	3-1160-1414	57 REGULATOR ASSY, P.S.
1	-	3-1107-1040-1	56 POWER SUPPLY
1	-	3-1110-1620-1	55 PULLEY MOTOR
1	1	3-12067-242-3	54 RECEPTACLE, Q.C.
1	1	3-12590-318-2	53 TERMINAL, KING TOW. SW.
4	4	3-12595-845-2	52 WIRE, INS, 20 AWG, RED
-	1	3-12657-203-4	51 GROMMET
-	1	3-12674-1105	50 METER, ELAPSED TIME
1	-	3-1107-1066-2	49 GUSSET, REAR CHASSIS
1	-	3-1107-1066-1	48 GUSSET, REAR CHASSIS
AR	AR	3-14476-354	47 SOLDER, 60/40
AA	AA	3-12583-265-8	46 WIRE, INS, 20 AWG, 16
2	2	3-12590-211-6	45 WASH. FLAT, 1/4
2	2	3-12613-271-4	44 WASH. FLAT, #8
1	1	3-12613-816-2	43 LOCKWASHER, DISHED TYPE, #6
1	1	3-12613-769-3	42 LOCKWASHER, INT TOOTH, #6
2	2	3-12613-164-5	41 LOCKWASHER, 1/4
12	12	3-12613-164-3	40 LOCKWASHER, #8
8	8	3-12613-164-2	39 LOCKWASHER, #6
2	2	3-12612-163-83	38 NUT, HEX, B-37
9	9	3-12612-163-63	37 NUT, HEX, C-37
2	2	3-12611-165-835	36 SET SCREW, B-32 x 3/16
2	2	3-12611-160-2584	35 SCREW, PAN H.D., 1/4 20 x 1/2
12	12	3-12611-160-834	34 SCREW, PAN H.D., 1/4 20 x 1/2
6	6	3-12611-160-635	33 SCREW, PAN H.D., 1/4 20 x 1/2
4	4	3-12611-160-634	32 SCREW, PAN H.D., 1/4 20 x 1/2
1	1	3-12501-815	31 TRANSISTOR, MJE 3055
1	1	3-12590-318-1	30 TERMINAL, KING TOW. SW.
8	8	3-12067-325-2	29 TERMINAL LUG, SOLDER
3	3	3-12067-325-1	28 TERMINAL LUG, SOLDER
5	5	3-12067-324-3	27 TAB, G.C.
6	6	3-12067-324-2	26 TAB, G.C.
4	4	3-12067-324-1	25 TAB, G.C.
2	2	3-12067-243-4	24 TAB, G.C.
AR	AR	3-12585-264-3	23 WIRE, INS, 24 AWG, RED
2	2	3-12067-242-2	22 RECEPTACLE, 1/2"
1	1	3-12067-326	21 BUSHING, STRAIN RELIEF
2	2	3-12010-320-2	20 SPACER
1	1	3-12591-852	19 MAPLEK STRIP
2	2	3-12512-227-1	18 RECTIFIER, SILICON
1	1	3-12541-219-8	17 CAPACITOR, 0.1 uF
1	1	3-12541-219-7	16 CAPACITOR, 0.01 uF
1	1	3-12657-203-3	15 GROMMET
1	1	3-12583-197	14 POWER CABLE
1	1	3-12649-232	13 FUSE HOLDER
1	1	3-12597-205-6	12 PARALLEL STRIP, 6 TERM
1	1	3-12597-205-3	11 BARRICA STRIP, 3 TERM
1	1	3-12571-180-2	10 RELAY
-	1	3-12067-229	9 CLAMP, CAPACITOR
1	1	3-12547-228-3	8 CAPACITOR
-	1	3-12081-875	7 MOTOR
-	1	3-1160-1003	6 REGULATOR ASSY, P.S.
-	1	3-1110-747	5 PULLEY MOTOR
-	1	3-1107-1040	4 POWER SUPPLY
-	1	3-1107-1009-2	3 GUSSET, REAR CHASSIS
-	1	3-1107-1009-1	2 GUSSET, REAR CHASSIS
1	1	3-1107-1006	1 CHASSIS, REAR

TOLERANCES (EXCEPT AS NOTED)	PERIPHERAL DYNAMICS INC.
DIMENSIONAL	SCALE 1/1
FRACTIONAL	DRAWN BY RTJ
DECIMAL	APPROVED BY
TITLE	COMPONENT SHELF ASSY
DATE	6-15-71
DRAWING NUMBER	3-1107-1041

DATE	BY	REVISION	RECORD	AUTH.	DR.	CHK.
3/17/71	A	CHG PT. 14,			RJ	
3/17/71	B	ADD ASS'Y'S		EM	RJ	RJ
3/17/71	C	ADDED ASS'Y A		EM	RJ	RJ
3/17/71	D	CHG ITEM 15 BCO G51		EM	RJ	RJ



ASST	ASST	ASST	ASST	QTY	QTY	PART NO.	ITEM	DESCRIPTION
4	3	2	1	REQD	REQD		NO.	
1	-	-	-			3-1110-1401	22	INSERT, FRONT COVER - RICKER SW
-	1	-	-			3-1110-1394	21	INSERT, FRONT COVER - MARK SENSE
-	-	AR	-			3-12020-1395	20	TAPE ADHESIVE
8	8	8	8			3-12013-271-3	19	WASHER, FLAT, #6
2	2	2	2			3-12019-164-9	18	LOCK WASHER, #8
12	12	12	12			3-12019-164-2	17	LOCK WASHER, #6
8	8	8	8			3-12012-163-63	16	NUT, HEX, G-32
2	2	2	2			3-12011-160-834	15	SCREW, PAN HD, 8-32 X 1/2
2	2	2	2			3-12011-160-633	14	SCREW, PAN HD, G-32 X 1/8
2	2	2	2			3-12011-160-632	13	SCREW, PAN HD, G-32 X 1/4
1	1	1	1			3-12067-171-3	12	RETAINING RING, EXT
AR	AR	AR	AR			3-12656-55B	11	TAPE, SOUND-DEADENING
1	1	1	1			3-1110-334-1	10	SHEET, DAMPING
1	1	1	1			3-1110-333-2	9	SHEET, DAMPING
1	1	1	1			3-1107-366	8	BRACKET, PUSHBUTTON
1	1	1	1			3-1110-365	7	PUSHBUTTON, CARD LIFTER
1	1	1	1			3-1110-1092	6	BRACKET, ANGLE
-	-	1	-			3-1110-417-1	5	INSERT, FRONT COVER
-	-	-	1			3-1110-917	4	INSERT, FRONT COVER
-	-	1	-			3-1110-1019	3	PLATE, TAMPING
1	1	1	1			3-1110-196	2	BLOCK, TAMPING
1	1	1	1			3-1107-133-14	1	FRONT COVER
QTY	QTY	QTY	QTY			PART NO.	ITEM	DESCRIPTION
REQD	REQD	REQD	REQD				NO.	

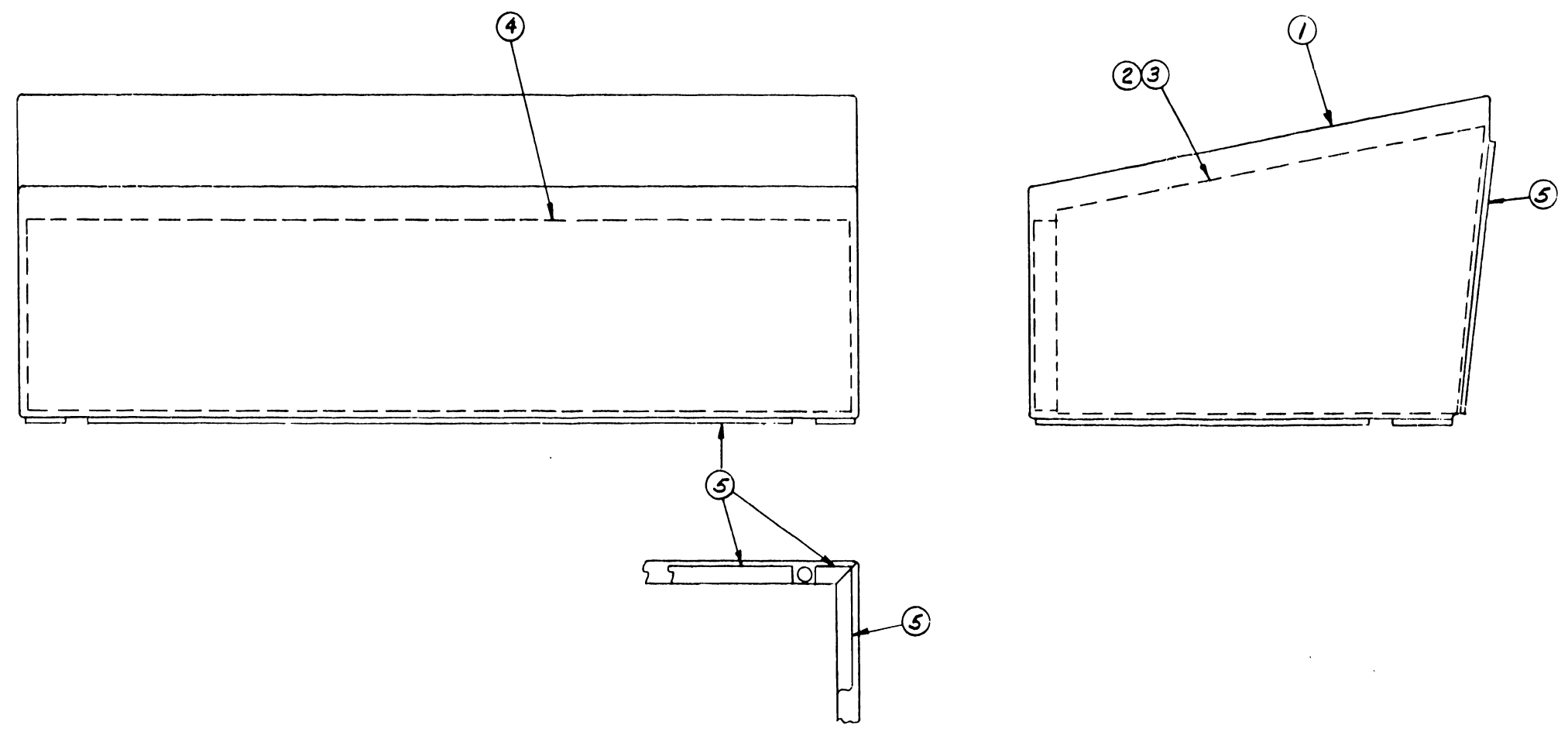
NOTES:
 1. SURFACES MUST BE CLEAN AND DRY BEFORE INSTALLING DAMPING SHEETS, ITEMS 9 & 10, AND TAPE, ITEM 11.

THIS TAPE ON ALL FLANGES

VIEW A-A

TOLERANCES (EXCEPT AS NOTED)		PERIPHERAL DYNAMICS INC	
DECIMAL		SCALE	DRAWN BY R.T.J.
±		1/2	APPROVED BY
FRACTIONAL		TITLE	
±		FRONT COVER ASSY	
ANGULAR		DATE	DRAWING NUMBER
±		6-18-71	3-1107-1052

DATE	BY	REVISION	REASON	AUTH.	OR.	CHK.
1971	A	CHG	PT. NO.			



NOTES:
 1. SURFACES MUST BE CLEAN AND DRY BEFORE INSTALLING DAMPING SHEETS, ITEMS 2, 3 & 4, AND TAPE, ITEM 5.

AR	3-12656-55B	5	TAPE, SOUND DEADENING
1	3-1110-393-1	4	SHEET, DAMPING
1	3-1110-392-4	3	SHEET, DAMPING
1	3-1110-392-3	2	SHEET, DAMPING
1	3-1107-152-15	1	REAR COVER
QTY REQD	PART NO.	ITEM NO.	DESCRIPTION
TOLERANCES (EXCEPT AS NOTED)			
PERIPHERAL DYNAMICS INC			
DECIMAL		SCALE	DRAWN BY R.T.J.
±		1/2	APPROVED BY
FRACTIONAL	TITLE		
±	REAR COVER ASSY		
ANGULAR	DATE	DRAWING NUMBER	
±	6-18-71	3-1107-1053	

APPENDIX

A

APPENDIX A

SUPPLEMENTARY MAINTENANCE INFORMATION - STANDARD CARD READER

TIMING ADJUSTMENT

Normally, it will not be necessary to adjust the timing of the card reader in routine maintenance situations. There are instances, however, when it is desirable to check and possibly reset the timing adjustment. Such a situation might arise, for example, if a read station sensor assembly or light source assembly must be replaced, or if a 60Hz unit is converted for 50Hz use.

Timing adjustment must be performed with the aid of a computer in order to tell whether the card reader is reading error-free or if it is making errors in reading. In general, a deck of punched cards of known good registration is used. All the cards of the deck have the same pattern, and the first card is read and loaded into memory. All the succeeding cards in the deck are read and compared against memory to determine if any data errors are made. The program should stop feeding cards if an error is made, and it is sometimes helpful if data expected vs. data read can be examined to determine the nature of an error. In addition to the above, an oscilloscope is required to monitor the timing adjustment.

Leading Edge Single Shot Adjustment:

1. Connect card reader to computer.
2. Connect oscilloscope probe to test point #1 (a small turret lug labeled TP-1) on the logic board. Connect probe ground to adjacent turret lug labeled GND. Set oscilloscope to sync negative with time base on 0.1 millisecond/cm and a 2 volts/cm display.

3. Load deck of identical pattern punched cards into reader with column 1 to the left and row 12 toward front of machine.

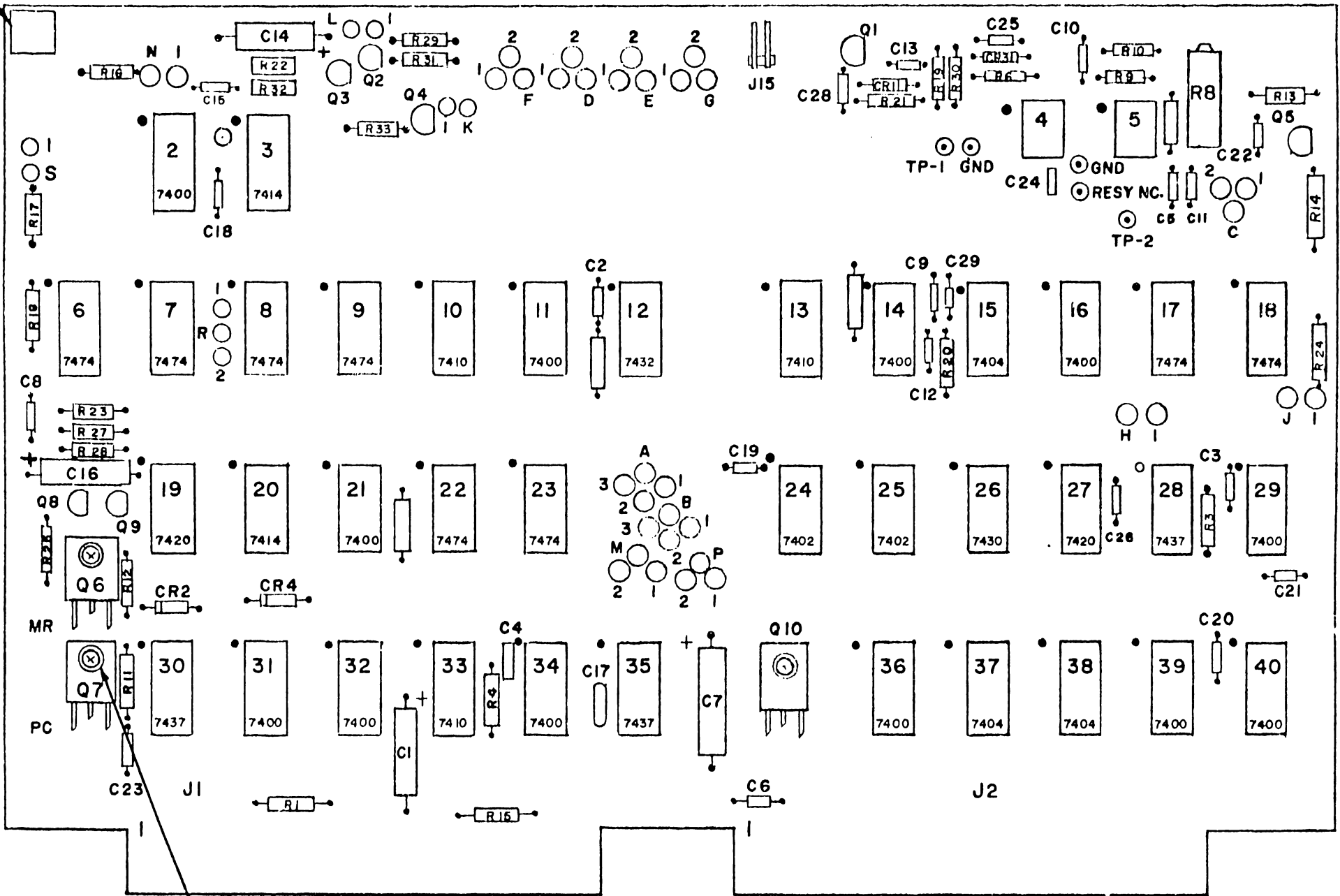
4. Connect RESYNC turret lug to adjacent GND turret lug on logic board, using small clip lead, to inhibit resync function.

5. With card reader processing cards under computer control, note width of zero-going pulse on oscilloscope trace, and adjust trimpot R8 on logic board clockwise until card reader stops, indicating that a data error has been made. Adjust trimpot counterclockwise a little at a time until point is reached where reader will process the deck error-free, and record width of pulse from oscilloscope (this is the upper margin reading).

6. Repeat step 5, adjusting trimpot R8 in the counterclockwise direction until errors are made. Adjust trimpot clockwise a little at a time until point is reached where reader will process the deck error-free, and record width of pulse from oscilloscope (this is the lower margin reading).

7. Add the upper and lower margin readings obtained in steps 5 and 6, and divide by two. Readjust trimpot R8 on logic board to give this value of timing, and remove shorting clip from RESYNC test point.

BOARD IDENTIFICATION



SEE DETAIL

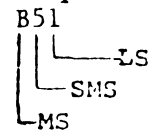
LOCATION OF COMPONENTS ON LOGIC BOARD

A-3

BASIC LOGIC BOARD
STRAPPING CHART
(Revision B)
3-1160-849-U
SPEED AND DATA STROBE

SIGNIFICANT	A =	300 CPM, 60Hz (250 CPM, 50Hz) & DATA STROBE STATE						RESET/SET	MOD 8	
	B =	A-2	B-2	D-1	E-2	F-1	G-1	DS-4 TIME	M-2 P-1 M = RESET	
	C =	A-1	B-1	D-1	E-2	F-1	G-1	DS-5 TIME	M-2 P-1 P = SET	
MOST	D =	300 CPM, 50Hz (350 CPM, 60Hz) & DATA STROBE STATE						SET/RESET	MOD 8	
	E =	A-2	B-2	D-1	E-2	F-2	G-1	DS-4 TIME	M-2 P-1	
	F =	A-1	B-1	D-1	E-2	F-2	G-1	DS-5 TIME	M-2 P-1	
MOST	G =	500 CPM, 60Hz (400 CPM, 50Hz) & DATA STROBE STATE						SET/RESET	MOD 8	
	H =	A-2	B-2	D-2	E-1	F-1	G-2	DS-4 TIME	M-2 P-1	
	J =	A-1	B-1	D-2	E-1	F-1	G-2	DS-5 TIME	M-2 P-1	
SECOND MOST SIGNIFICANT	1 =	MISPICK & DATA AVAILABLE & LITE CHK/DARK CHK.								
	2 =	C-1		N-1	S-1	C-1 = 3 MISPICKS				
	3 =	C-1	H-0	N-1	S-1	H-1 = 2 us DA				
	4 =	C-1	H-1	N-1	S-1	H-0 = 120 us DA				
	5 =	C-2	H-0	N-1	S-1					
	6 =	C-1	H-1	N-1	S-0					
	7 =	C-1	H-0	N-1	S-0					
	8 =	C-2	H-1	N-1	S-0	N-1	S-1	READ CHECK (VERIFIER PUNCH COL. 81)		
		C-2	H-0	N-1	S-0	S-0	N-1	STD READ CHECK (NO VERIFIER PUNCH COL 81)		
		(0=Open)								
LEAST SIGNIFICANT	1 =	RSRP & STROBE AMPLIFIER & STATES DECODE								
	2 =	J-1	K-0	L-0	R-1	J-1 = RSRP IN				
	3 =	J-1	K-0	L-0	R-2	J-0 = RSRP OUT				
	4 =	J-0	K-0	L-0	R-1	K-1 = STROBE AMP IN				
	5 =	J-0	K-0	L-0	R-2	L-1 =				
	6 =	J-1	K-1	L-1	R-1	K-0 = STROBE AMP OUT				
	7 =	J-1	K-1	L-1	R-2	L-0 =				
	8 =	J-0	K-1	L-1	R-1	R-1 = STATES DECODE				
	J-0	K-1	L-1	R-2	R-2 = STATES DECODE					

- NOTE: 1. 3 Digit - Letter & numbers will indicate (Speed & Data Strobe Time - Set/Reset Mod 8; Read Check Verifier Punch Col. 81 and States Decode) and will be stamped in the upper left hand corner in squared area. Standard Unit. B51
2. A3, B3, J0 straps used only for Mark Sense.
3. -2, -3 have strobe amplifier omitted.
4. Lamp machines 2, -4
LED machines -1, -3
5. For Model 6111, Logic Board is strapped as for 500 CPM operation.
6. For Model 2022 Mark Sense without read check option, straps M & S must be open.



PART

II

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 - 1.2 General Description

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 - 2.3 Operational Checks
 - 2.4 Installation Requirements
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 - 4.1 Block Diagram

5. MAINTENANCE
 - 5.1 General
 - 5.2 Preventive Maintenance
 - 5.3 Corrective Maintenance

SECTION

1

INTRO-

DUCTION

SECTION 1
INTRODUCTION

1.1 SCOPE

This manual contains supplementary information on the PDI 3055M Series Mark Sense Card Readers. This supplementary information, when used in conjunction with the information contained in the Operation/Maintenance Manual for the basic 3055H Series card reader, provides complete operation and maintenance information for the 3055M Series readers.

1.2 GENERAL DESCRIPTION

The PDI 3055M Series Card Readers are self-contained optical mark readers capable of sensing either marks or holes on standard 40 or 80-column mark-sense cards without the necessity of a clock track. The card readers are capable of reading marks and holes intermixed on the same cards as long as mark-sense cards are used (cards which are printed with reflective inks), and both holes and marks are done in the same format (all 80-column, or all 40-column). For most mark reading, the 40-column format is preferable because the increased spacing between columns makes it easier for the persons marking the cards to enter the data correctly. Moreover, on the 40-column cards, coding information is usually printed directly on the cards and the operator can mark the cards correctly without having to refer to coding tables. For most applications, the internal machine timing furnished as "standard" is preferable because cards printed without a timing track cost only about half that of cards printed with timing tracks. For certain applications, however, clock tracks are preferable. For these instances, clock track capability can be provided on either the 9-edge or the 12-edge, as an optional feature.

With the exception of the additional parts required for mark-sense, the 3055M series card readers are identical, both electrically and mechanically, with the 3055H series card readers. This supplementary manual will deal only with those differences; all other information required will be found in the 3055H series manual. The mark-sense card readers contain a different type of read station and light sources, and an additional PC board containing the amplifiers and additional circuitry needed for mark-sense. There are also a few minor changes to the logic board and the wiring. Revised schematics and wiring diagrams are included in this supplement to cover these points.

The reflective read station used with the mark-sense readers is mounted from beneath the bed of the card reader. It is comprised of 13 phototransistors and 12 light-emitting diodes, which emit in the infrared region. Twelve of the sensors are used to sense data and the thirteenth one is used to sense the leading edge of the card. When reading either holes or marks in the marks mode, infrared from the LED's is reflected back from the card into the data sensing phototransistors. A maximum amount of light is reflected into the sensors on those portions of the card which do not have marks or holes. For a mark or a hole, a minimum amount of light is reflected since the mark or hole absorbs some of the light. Almost any medium can be used to mark the cards as long as it has a non-reflective characteristic. It is recommended that an ordinary #2 lead pencil be used to mark the cards since the pencils are easy to obtain, have the desired characteristic, and the pencil marks are easy to change, should a mistake be made.

When reading either holes or marks in the marks mode, mark-sense cards must be used; i.e., cards that are printed with reflective ink. The cards are read face down with column 1 leading, from the underside. The leading edge sensor is illuminated from above the card path and when this light beam is interrupted by the card, a leading edge signal is generated. The data is read

by sensing the reflected light from the card with the data sensors. When a mark is encountered, the mark absorbs some of this light and this light loss is detected by the phototransistors. When a hole is encountered, the light passes through the hole and this loss of light is detected by the phototransistors. Therefore, the hole and a mark look identical to the read station when operating in the marks mode.

In order to provide complete flexibility, a punch mode of operation is provided for use in reading standard punched cards which are printed in non-reflective ink and may have pencil marks or other sorts of marks on them. The only positive way of reading cards of this type is to read through the cards. For this reason, the mark-sense card readers are equipped with an additional light source mounted above the cards. This light source is an infrared-emitting LED assembly comprised of 12 LED's for the data and a 13th LED for illuminating the leading edge detector. This array is energized in the punch mode and the LED array underneath is de-energized. When operated in this mode, the card reader functions similarly to the standard 2022H series in which light passes through the holes of the card to be sensed by the read station.

The amplifier board contains the data amplifier potentiometers, and erasure discrimination circuitry, the data latches, the 40/80 column timing circuitry, a clock track amplifier and timing circuitry (if provided), and a zener regulator to power the data amplifiers. This board is about half the size of the logic board and is mounted adjacent to the logic board in the backpan. The amplifier board contains all the additional circuitry required for mark-sense operation.

SECTION

2

INSTAL-

LATION

SECTION 2
INSTALLATION

2.1 GENERAL

This section of the mark sense supplementary manual again covers only those points of difference between the mark sense units and the standard 3055H series reader. Where there are no differences in specific areas, the reader will be referred to the 3055H manual.

2.2 UNPACKING AND HANDLING

Refer to 3055H manual.

2.3 OPERATIONAL CHECKS

Refer to 3055H manual, omitting step "a" and substituting the following procedure in place of step "d".

- d. Operate POWER switch: POWER lamp should light; RESET lamp should light; MARKS or PUNCH lamp should light; 40 COL. or 80 COL. lamp should light; and if clock track capability has been provided, CLK. TRK. or INT. CLK. lamp should light. Operate MARKS/PUNCH switch, 40 COL/80 COL switch, and CLK. TRK./INT. CLK. switch (if provided); alternate indicator lamps should light on these switches.

2.4 INSTALLATION REQUIREMENTS

All details in 3055H manual apply, with the following exceptions:

- (a) Power requirements in para. 2.4.2 are 180 watts maximum.
- (b) In Figure 2-2, there are five (or six) indicator switches in the control grouping instead of the three shown. Also, the 3055HT dimensions apply for the Model 3055MT and the 3055HR dimensions apply for the Model 3055MR.

(c) In addition to the card reader operating modes described in para. 2.4.3.3, there are the additional operating modes of MARKS (reflective reading) or PUNCH (transmissive reading), 80-column or 40-column formats, and Internal or Clock track timing if provided.

2.5 INSTALLATION CHECKS

The procedure given in the 3055H manual applies for 80-column internal timing. In the 40-column timing mode, only 40 data available pulses are issued per card, at a rate of approximately 1.9 milliseconds per column.

SECTION

3

OPERA-

TION

SECTION 3

OPERATION

3.1 GENERAL

All of the paragraphs of Section 3 in the 3055H manual apply. Information on the additional operational features of the mark sense reader is given below:

3.2 OPERATING CONTROLS AND INDICATORS

In addition to the three basic controls (POWER, RESET and HALT) of the 3055H series reader, the 3055M series mark sense readers have the following two (or three) additional controls:

- (a) MARKS/PUNCH - An alternate action push button indicator that selects reflective or transmissive mode operation of the read station. The lighted half of the indicator displays the selected condition.
- (b) 40 COL/80 COL - An alternate action push button indicator that selects either the 40 or 80-column internal timing formats. The lighted half of the indicator displays the selected condition.
- (c) CLK TRK/INT CLK - (Optional Feature) An alternate action push button indicator that conditions the reader either to generate timing from a clock track printed on the cards, or to generate internal timing in either of the two standard selectable formats. The lighted half of the indicator displays the selected condition.

3.3 OPERATING INSTRUCTIONS

Follow the general operating instructions given in the 3055H manual. Specific additional instructions for the mark sense models are given in the following paragraphs.

3.3.1 Punch Mode Operation

Punch Mode is provided in the PDI mark sense card readers for the purpose of reading standard 80-column punched card decks. The MARKS/PUNCH switch must be

placed in the PUNCH position, and the 40 COL/80 COL switch must be placed in the 80 COL position. Under these conditions, the reader is set to read the data in the transmissive mode; that is, through the holes in the cards. In this mode, the card reader is insensitive to the type of ink used in printing the cards, or any extraneous marking that may be on the cards as well. It is the most positive method of reading punched cards, and should be used in preference to the MARKS mode wherever all the data fields in a given deck are punched holes.

The cards are to be loaded into the input hopper face down, with column 1 leading and row 12 toward the front of the machine.

3.3.2 Marks Mode Operation

In the marks mode, the card reader is conditioned to read the data reflectively from the cards. The data may be punched or marked, or consist of both punches and marks, intermixed. Such a situation might arise, for example, in an inventory control application; where certain fields of information such as part numbers might be punched, and certain other fields such as quantities might be hand marked. Reading cards in the marks mode does impose the basic requirement that mark sense type cards must be used; that is, the cards must be printed with a reflective type ink. This is so because the sense head reads non-reflective marks against the normally reflective background nature of the card stock. Another requirement is that the cards must be kept reasonably clean. Even though the PDI mark sense card readers incorporate such advanced features as discrimination against erasures and background smudges, the clarity of the desired marks should be maintained. If the desired marks are allowed to become smudgy or smeared, the marks themselves will ultimately be discriminated against.

3.3.2.1 Mark Sense Cards

The card stock shall conform to the American Standard Specification X3.11-1966, and in addition, shall have a minimum reflectance of 80% as measured with a Kidder Model 082 (or equivalent) Tester using a barium sulfate plaque as a

a standard for 100% reflectance. The measurements shall be taken in the near infrared light region.

All printing on the cards shall be done with reflective ink. The pre-printed envelope or marks defining the location of the data fields and other printing shall have a reflectance equivalent to that of the card stock.

The locations of the pre-printed marking guides for 80-column and 40-column internal timing are shown in Figure 3-1.

If clock tracks are to be used, the clock marks shall be printed with non-reflective ink. These clock marks shall have a maximum reflectance of 5% as measured on the Kider Model 082 (or equivalent) tester. The clock track is to be placed along either the 9-edge or 12-edge of the card, as required. If location is not specified at time of order, this option is furnished with clock track sensing along the 9-edge of the cards as standard.

A single clock mark is to precede each column of data. The dimensioning of the clock marks and their placement with respect to the data areas of the card is shown in Figure 3-1.

3.3.2.2 Marking the Cards

The cards may be marked with any medium that is sufficiently non-reflective. The marks should be clear and legible, and exhibit no greater than 5% reflectance as measured above. A standard number 2 lead pencil gives reflectance readings of about 3% and is ideal for marking the cards because of its general availability and the ease with which mistakes in marking may be corrected. When marking the cards, it is not necessary to scrub back and forth over a mark to make it appear big and black. In fact, such a technique is likely to cause problems rather than prevent them. It is the clarity and positioning of the mark that is more important than the apparent intensity of the mark to the eye. Positionwise, if a mark is placed outside of a marking area, it should be erased and placed in the proper area instead of widening out the mark until it extends into the proper

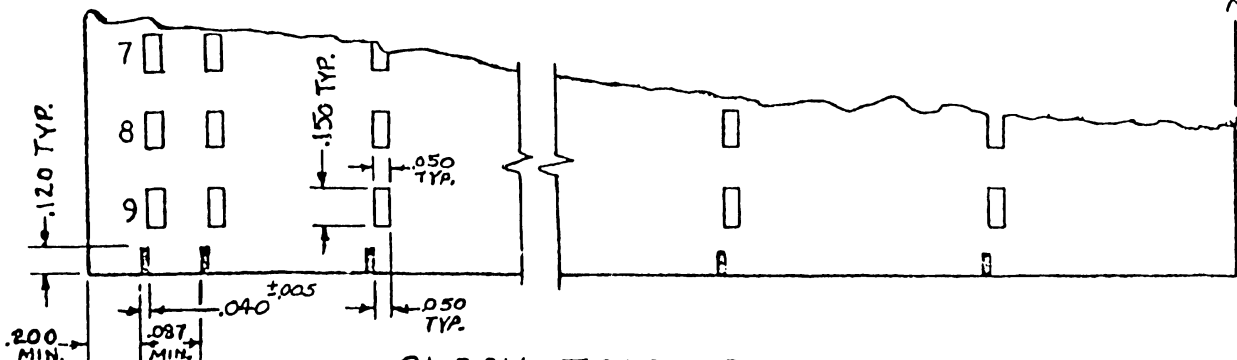
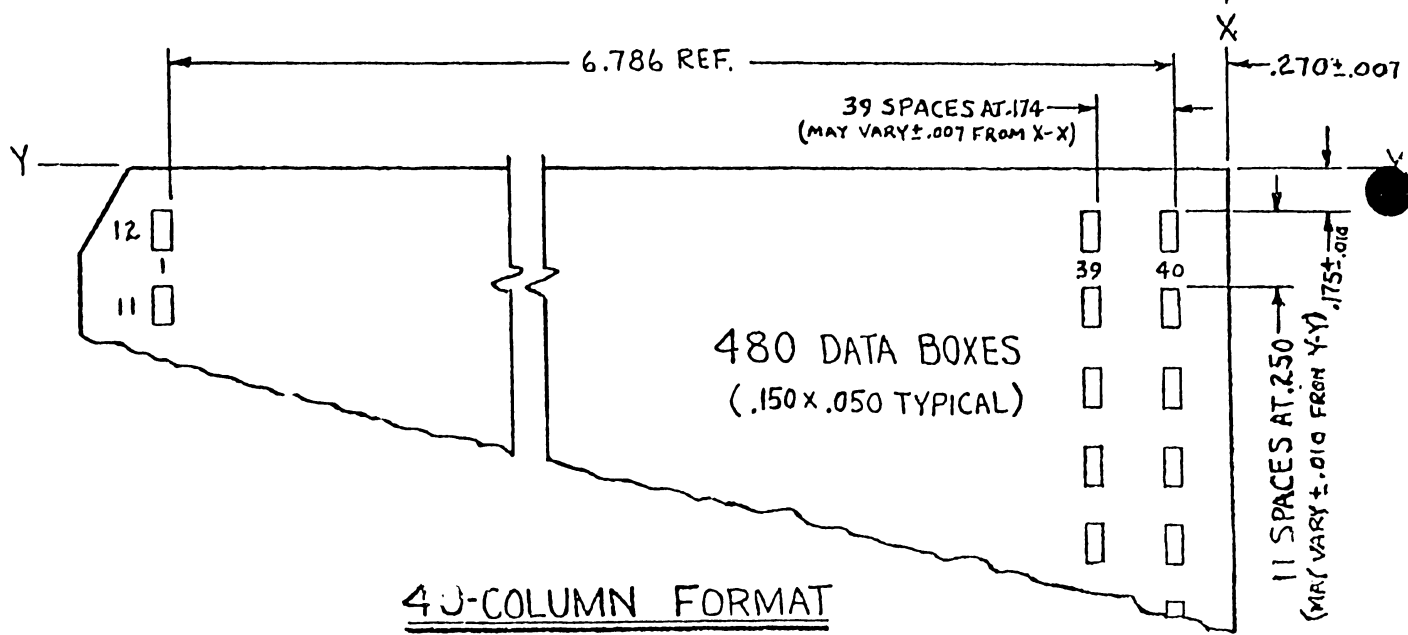
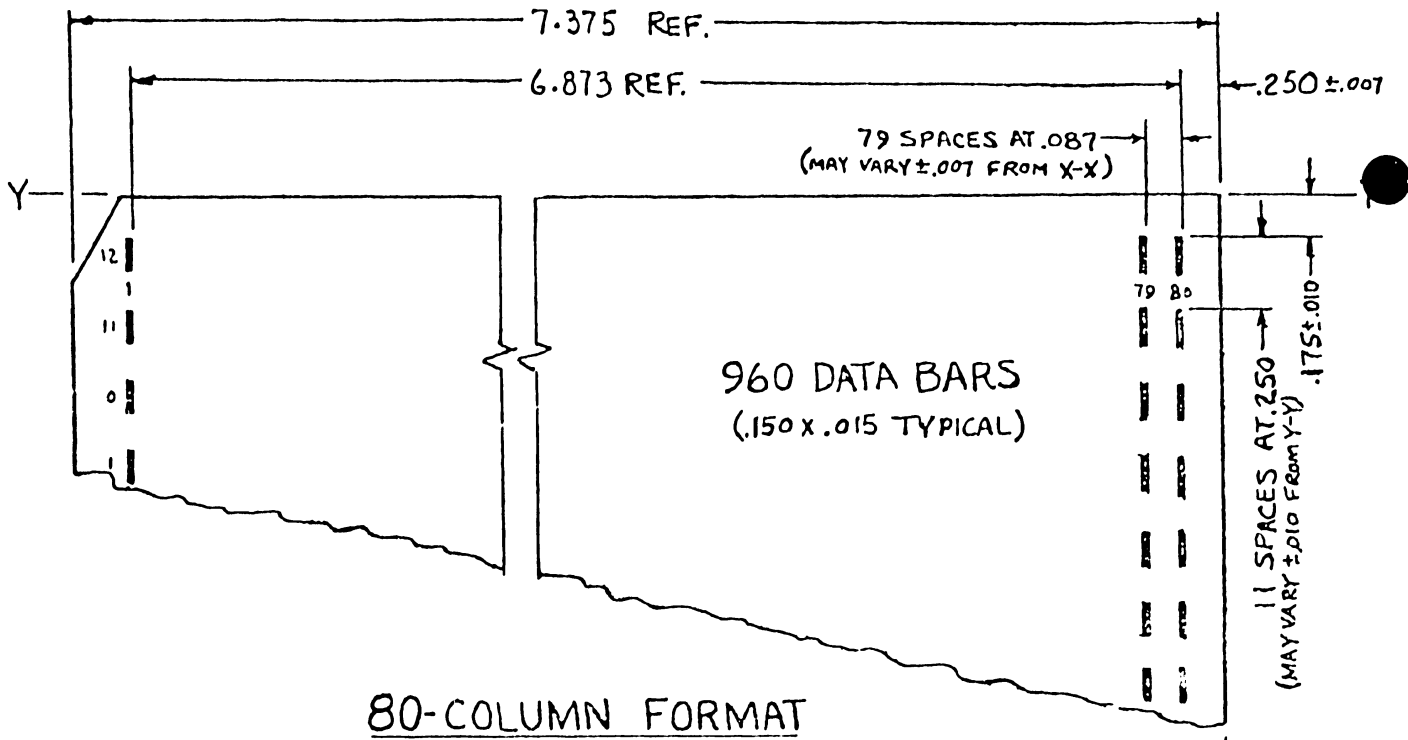


FIGURE 3-1. PDI MARK SENSE CARD FORMATS
3-4

area. To sum up, it is necessary only to make a simple one or two stroke pencil mark over the guidance printing on the card. The average thickness of such a mark, for example, is on the order of .015" - .020".

3.3.2.3 Cards that are both Punched and Marked

To read both punches and marks on the same cards, it is only necessary to use mark sense type cards and to enter all the data in the same format; i.e., all 80-column format or all 40-column format. The cards are read in the MARKS mode with the proper selection of internal timing format.

SECTION

4

PRINCIPLES OF

OPERATION

SECTION 4

PRINCIPLES OF OPERATION

4.1 BLOCK DIAGRAM

The inter-relationship of the additional parts required to transform a standard 3055H series card reader into a 3055M series mark sense card reader is shown in block diagram form in Figure 4-1. It can be seen from this diagram that the principal areas of interest are the read station, the amplifier board, the additional switch-indicators required, and the additional power supply. Each of these areas will be treated, in turn, in the following discussion with reference to the block diagram.

4.1.1 Read Station

The read station is composed of two distinct parts; the read station sensors and reflective-mode light source; and the transmissive-mode light source. The read station sensor array, located beneath the card path on the light source/sense head board, consists of 12 photo-transistors mounted in-line on a small PC board in the appropriate positions for reading the 12 rows of data contained on standard tabulating cards. Twelve transistor amplifiers, each of which amplifies the signal level obtained from its row sensor, are also located on the board. If clock track capability is provided, an additional photo-transistor is provided, in line with the 12 data sensors, adjacent to either the row 9 edge, or the row 12 edge, of the card for sensing a clock track (a series of non-reflective marks printed along the specified edge of the cards, one clock mark immediately preceding each point on the card where a column of 12 possible data bits are to be read out). In addition to the foregoing, another photo-transistor is located slightly downstream from the data sensors and centrally located between rows 3 and 4 of the card, for leading edge detection. This sensor is illuminated by the leading edge light source, which is located above the card path as an integral

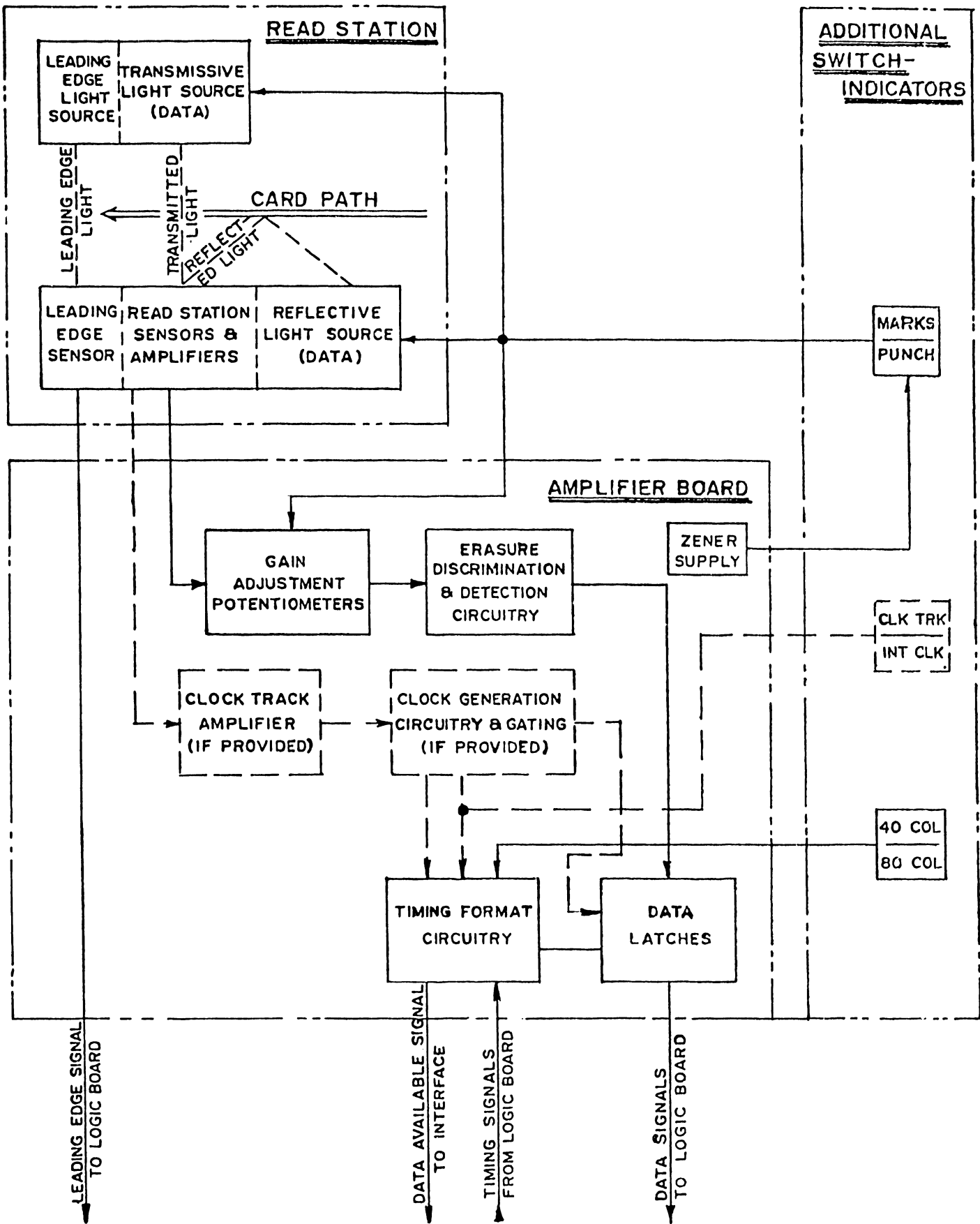


FIG. 4-1 BLOCK DIAGRAM, MARK SENSE ADDITIONS TO STANDARD CARD READER

part of the transmissive light source, and detects the absence of light as a card passes through the read station. The leading edge sensor provides information basic to the internal timing structure of the card reader. The reflective light source, also located beneath the card path on the light source/sense head board, is comprised of 12 infrared light emitting diodes (LED's), mounted in-line, and spaced in correspondence with the 12 data sensors; e.g., at the centers of each of the 12 data rows of the cards. If the clock track feature is provided, an additional LED is provided on the clock track edge of this array to illuminate the clock track area of the cards. Both the reflective light source array and sensor are mounted in a vertical orientation, and a prism is used to angle the radiation so that the light is reflected from the bottom surface of the cards into the read station sensors. The reflective light source is operative only when the MARKS/PUNCH switch is in the MARKS position.

The transmissive light source, located above the card path, is comprised of 13 infrared LED's mounted on a small PC board. Twelve of these LED's are mounted in-line in opposition to the 12 data sensors and the 13th (the leading edge light source) is mounted in opposition to the leading edge sensor. The leading edge LED is always operative, while the 12 data LED's are operative only when the MARKS/PUNCH switch is in the PUNCH position.

4.1.2 Amplifier Board

The amplifier board contains all of the additional circuitry required to interface the special mark sense read station to the logic board of a standard PDI punched card reader. This board contains 12 gain adjustment potentiometers, one for each data-row sensor of the read station. A separate gain adjustment is incorporated into each of the data amplifiers so that the outputs from all 12 bits may be standardized. The amplified and standardized signals from the data amplifiers are passed through 12 identical R-C coupled circuits, to the gates of their respective SCR latches. The latches will be triggered ON, only if risetime and

pulse amplitudes exceed a certain detection threshold. In the reading of marks, it is characteristic of the read station to produce a pulse output with sharper rise and fall times for a well-defined mark, and to produce slower rise and fall times for an erased or smeared mark. Advantage is taken of this fact in the PDI mark sense system by detecting only those outputs indicative of an intended mark, and rejecting those outputs indicative of a poorly-erased or unintended mark.

The timing format circuitry, under control of the 40 COL/80 COL switch, either allows the 80-column timing signals from the logic board ($\overline{\text{RSRP}}$ and $\overline{\text{DA}}$) to reset the data latches and to transmit data available signals (strobe signals) to the interface directly, or "edits" these signals to reset the data latches and provide data available signals to the interface at the 40-column rate. For the latter case, the data latches are reset by the reset pulses for all the odd numbered of the normal 80 columns, and data available pulses are sent to the interface for all the even numbered of the normal 80 columns. This technique allows more latitude in recovering the data from poorly marked cards; that is, the cards do not have to be quite so carefully marked since twice the window is available for 40-column operation as for 80-column operation.

If clock track capability is provided, the clock track signal from this sensor is amplified and passed through the clock generation circuitry which, for each clock mark, first clears the data latches and then supplies a data available pulse to the interface at an appropriate later time when the data should be present in the data latches. If the 40 COL/80 COL switch is in the 80 column position, to read 80 column density cards, the $\overline{\text{DA}}$ pulse will be supplied approximately $5/8$ of a column spacing ($5/8 \times .087''$) past the leading edge of the clock mark and the leading edge of the data marks must occur within this spacing. If the 40 COL/80 COL switch is in the 40 column position, to read 40 column density cards, the $\overline{\text{DA}}$ pulse will be supplied approximately 1.25 column spacing ($1.25 \times .08$

past the leading edge of the clock mark and the leading edge of the data marks must occur within this spacing. Thus, when operating in "80 column clock track", the clock marks should be no closer together than .087"; and when operating in "40 column-clock track", the clock marks should be no closer together than .174". Clock track operation is, however, completely asynchronous, in that clock marks may occur anywhere within the data field of the card, and their centers need not correspond with the defined centers for normal punched card reading. It is, however, required that the leading edge of the first clock mark occur no closer than .20" from the leading edge of the card, and that the last clock mark occur no further back than .30" from the trailing edge of the card. The CLK TRK/INT CLK switch must be set to CLK TRK for clock track operation, and to INT CLK for normal internal timing functions.

In reflective reading (MARKS mode), a data hole or mark absorbs light causing a reduction in output from the read station sensors. Conversely, in transmissive reading (PUNCH mode), a data hole allows light to strike the sensors causing an increase in output from the sensors. As a result of this logical inversion, it is necessary to invert the polarity of the data amplifiers in marks versus punch mode. In marks mode, the amplifiers are operated in normal common emitter configuration from a 7.5 volt zener supply for increased dynamic range. In punch mode, the amplifiers are operated as emitter followers from the normal 5 volt TTL supply. The outputs of the amplifiers as presented to the R-C coupling networks will therefore be positive pulses for data in both modes of operation, and the data latches are triggered ON at the leading edge of these positive data pulses.

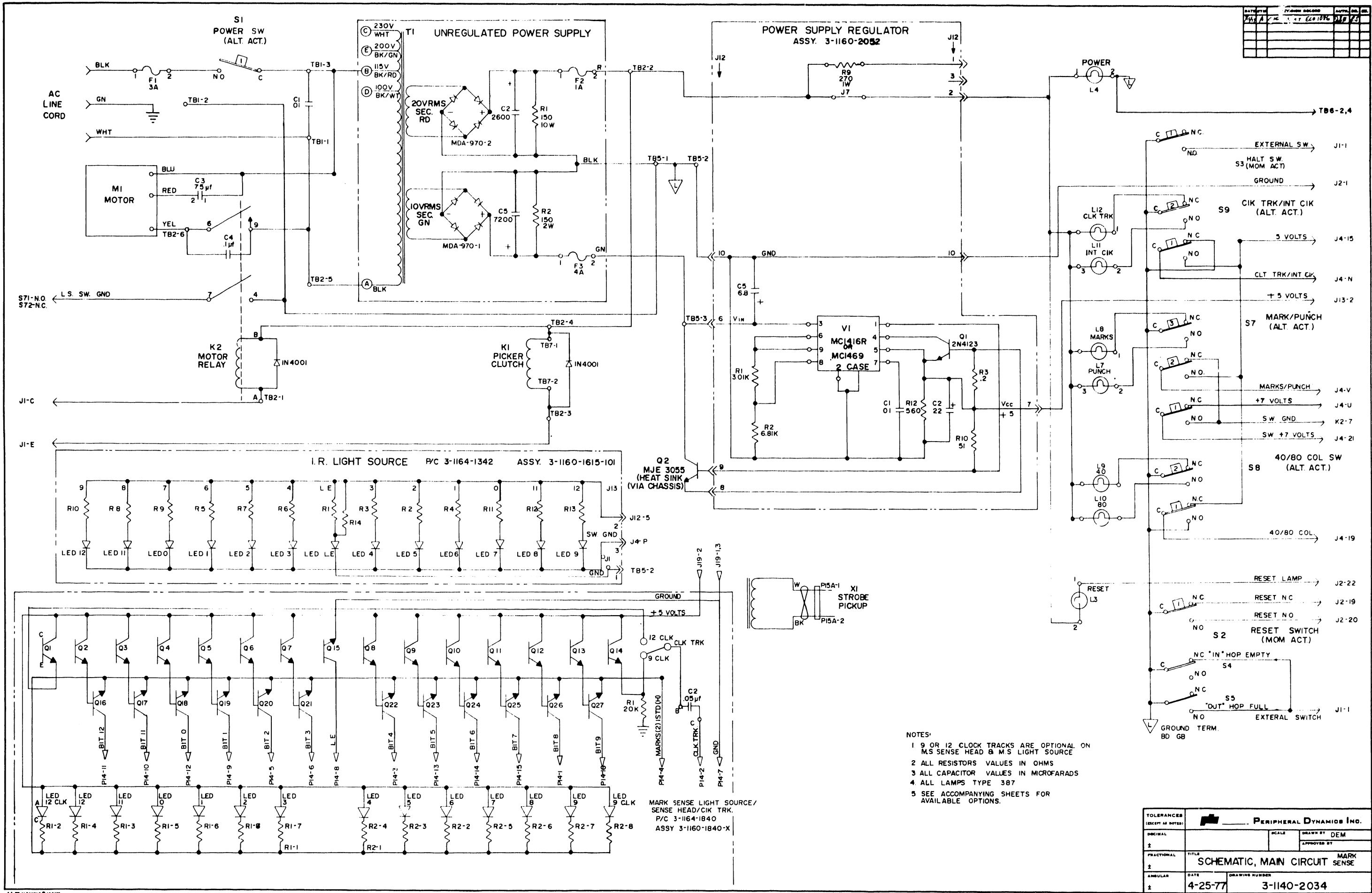
4.1.3 Additional Switch Indicators

The standard PDI punched card readers have three pushbutton/indicator controls. These are POWER, RESET and HALT. The standard PDI mark sense card readers have two additional pushbutton/indicator controls labelled MARKS/PUNCH

and 40 COL/80 COL. Optionally, if clock track capability is provided, there is a sixth pushbutton/indicator, labelled CLK TRK/INT CLK. The first three control switches operate in the same manner as described in the 3055H series manual; the remaining two (or three) control switches are of the alternate action type and function as described in the foregoing paragraphs.

4.1.4 A complete set of schematic diagrams for the series 3055M mark sense card readers are included in this supplementary manual. The main circuit schematic is shown in Figure 4-2; the logic board schematic is shown in Figure 4-3 and the amplifier board schematic is shown in Figure 4-4.

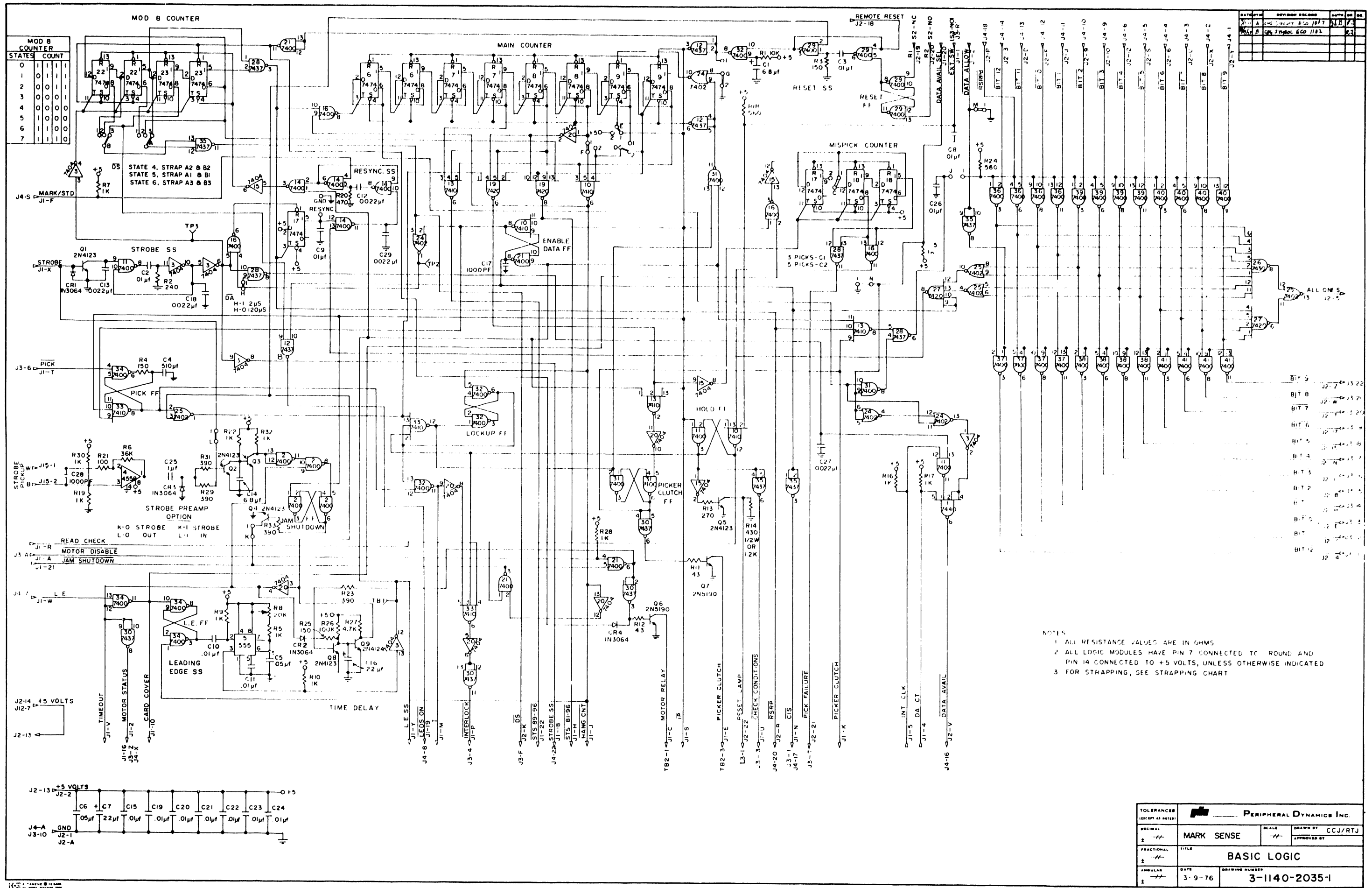
DATE	BY	REV	APP'D
4-25-77	DEM	1	DEM



- NOTES:
- 1 9 OR 12 CLOCK TRACKS ARE OPTIONAL ON M.S. SENSE HEAD & M.S. LIGHT SOURCE
 - 2 ALL RESISTOR VALUES IN OHMS
 - 3 ALL CAPACITOR VALUES IN MICROFARADS
 - 4 ALL LAMPS TYPE 387
 - 5 SEE ACCOMPANYING SHEETS FOR AVAILABLE OPTIONS.

MARK SENSE LIGHT SOURCE/
SENSE HEAD/CIK TRK.
P/C 3-1164-1840
ASSY 3-1160-1840-X

TOLERANCES (EXCEPT AS NOTED)	PERIPHERAL DYNAMICS INC.	
ORIGINAL	SCALE	DRAWN BY DEM
±		APPROVED BY
FRACTIONAL	TITLE	MARK
±	SCHMATIC, MAIN CIRCUIT SENSE	
ANGULAR	DATE	DRAWING NUMBER
±	4-25-77	3-1140-2034

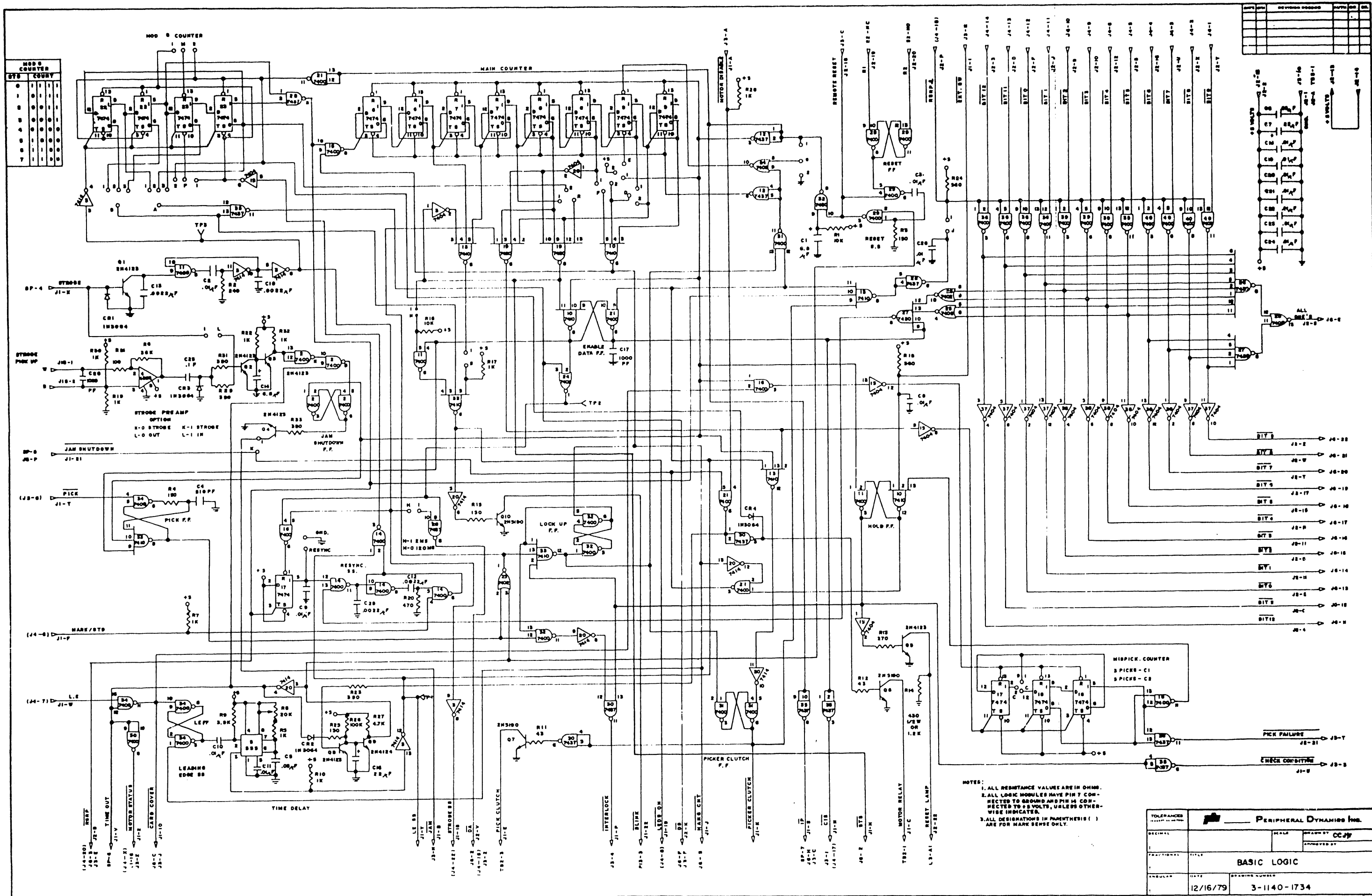


DATE	REVISION	BY	NO.
10/17/76	1	CCJ/RTJ	1
11/17/76	2	CCJ/RTJ	2

- NOTES
- 1 ALL RESISTANCE VALUES ARE IN OHMS
 - 2 ALL LOGIC MODULES HAVE PIN 7 CONNECTED TO GROUND AND PIN 14 CONNECTED TO +5 VOLTS, UNLESS OTHERWISE INDICATED
 - 3 FOR STRAPPING, SEE STRAPPING CHART

TOLERANCES (EXCEPT AS NOTED)	PERIPHERAL DYNAMICS INC.		
DECIMAL	MARK SENSE	SCALE	DRAWN BY CCJ/RTJ
FRACTIONAL	TITLE BASIC LOGIC		
ANGULAR	DATE 3-9-76	DRAWING NUMBER	3-1140-2035-1

FIGURE 4-3 4-8

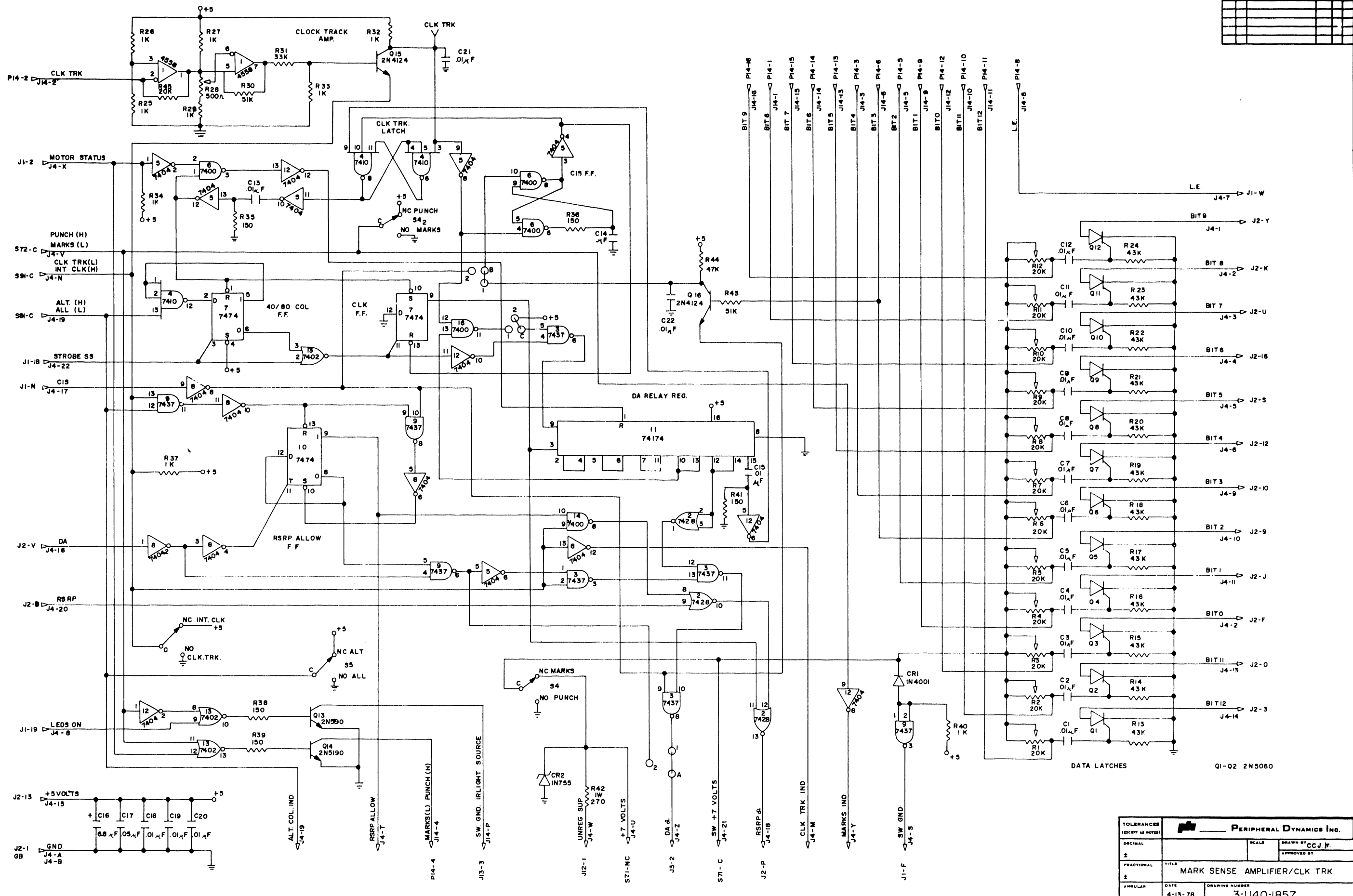


NOTES:
 1. ALL RESISTANCE VALUES ARE IN OHMS.
 2. ALL LOGIC MODULES HAVE PIN 7 CON-
 NECTED TO GROUND AND PIN 14 CON-
 NECTED TO +5 VOLTS, UNLESS OTHER-
 WISE INDICATED.
 3. ALL DESIGNATIONS IN PARENTHESES ()
 ARE FOR MARK SENSE ONLY.

TOLERANCES		PERIPHERAL DYNAMICS Inc.	
RESISTORS	±1%	SCALE	BY CCJ
CAPACITORS	±5%	DESIGNED BY	
BASIC LOGIC			
DATE	12/16/79	PRINTING NUMBER	3-1140-1734

FIGURE 4-3A 4-8A

DATE	REVISED	BY	CHKD



TOLERANCES (EXCEPT AS NOTED)		PERIPHERAL DYNAMICS INC.	
DECIMAL		SCALE	DRAWN BY CCJ/F
FRACTIONAL			APPROVED BY
ANGULAR		DATE	TITLE
		4-13-78	MARK SENSE AMPLIFIER/CLK TRK
		DRAWING NUMBER	
		3-1140-1857	

FIGURE 4-4

SECTION

5

**MAINT-
ENANCE**

SECTION 5
MAINTENANCE

5.1 GENERAL

This section is divided into two general categories--Preventive Maintenance and Corrective Maintenance. The first part discusses the recommended daily care items and other periodic procedures, which will enhance the overall performance of the equipment and enable it to render trouble-free operation. The second part discusses the procedures to be followed in the removal and replacement of specific parts and assemblies, if it should be required.

Two overall views of the Card Reader, with callouts on the major components are shown in Figures 5-1 and 5-2. Most of the major components can be located with the aid of these illustrations.

5.2 PREVENTIVE MAINTENANCE

5.2.1 Daily Care

It is recommended that the card resting surface of the input hopper be cleaned once a day by the operator. Remove any dust or card stock material which has accumulated in the input hopper. A dry, lint-free cloth should be used. Visually check opening under throat gauge to ensure that all foreign material is removed. If removal of materials is necessary, use a scrap punched card and gently run back and forth under knife edge until all foreign material is removed.

5.2.2 Weekly Care

Because of the contaminating nature of the graphite pencil markings, it is recommended that a periodic cleaning of the picker roller and read station rollers be made by the operator on a weekly basis (or more often, as usage dictates). To facilitate this operation, follow the procedures outlined below.

NOTE: If cards are marked with ballpoint pens or markers containing non-reflective ink, the weekly care procedures can be placed on a monthly basis.

5-2

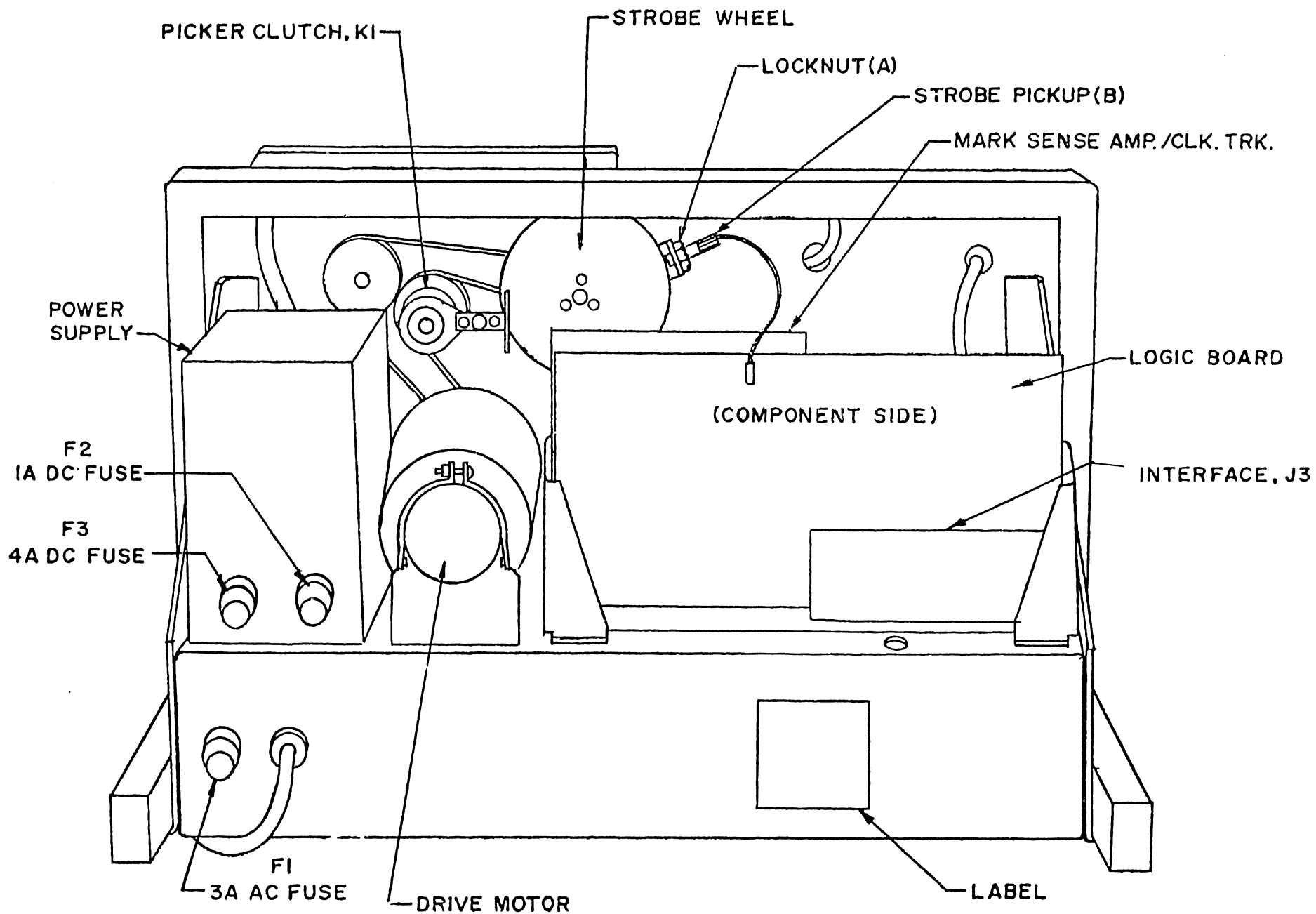


FIG. 5-1 REAR VIEW OF CARD READER, REAR COVER REMOVED

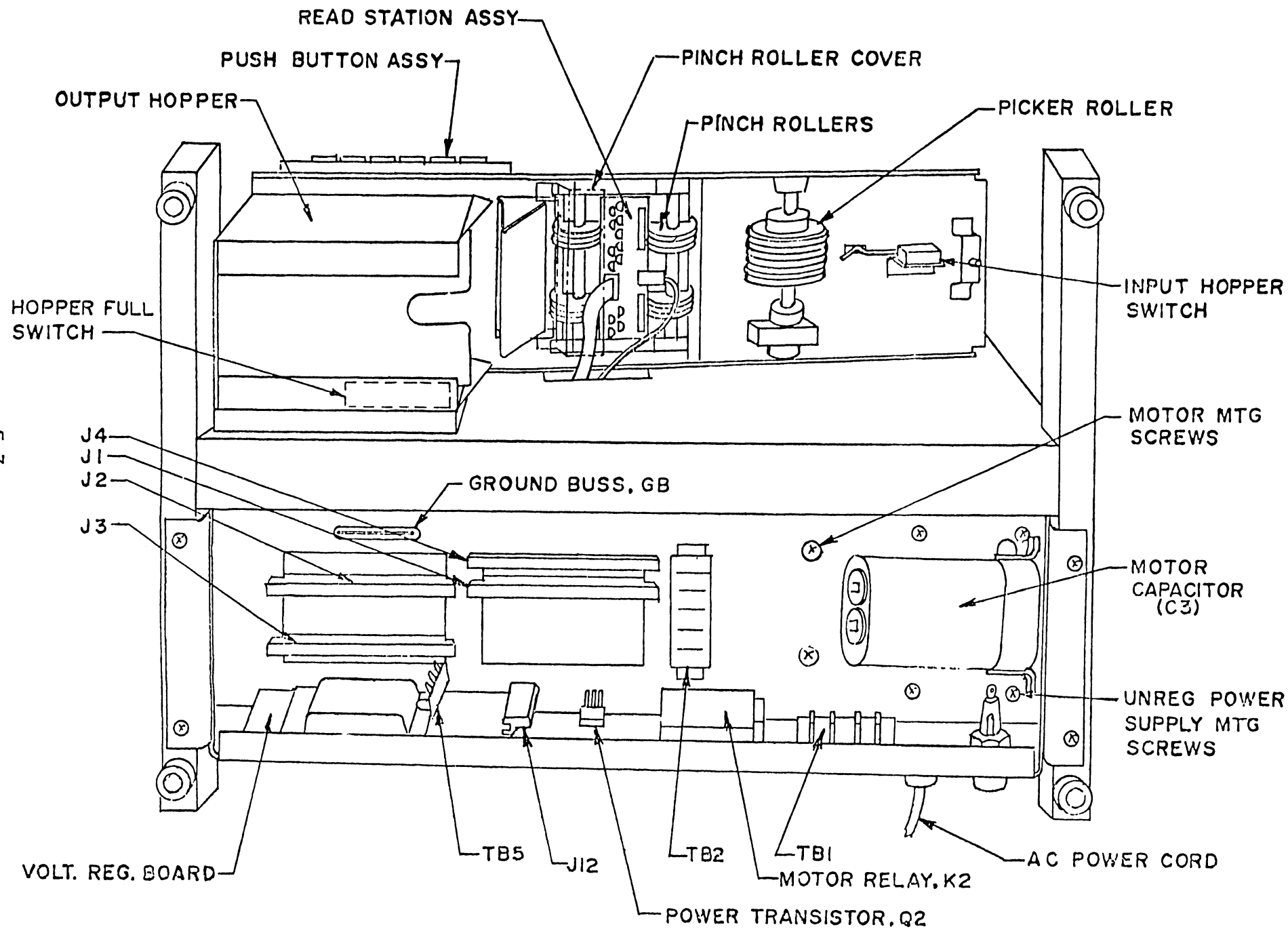


FIG. 5-2, BOTTOM VIEW OF CARD READER, FRONT COVER REMOVED

- a. With power off, rear cover may be pulled off in similar fashion.
- b. Moisten a clean cloth with alcohol and place the moistened cloth over a finger and hold against the top surface of the picker roller as exposed in the input hopper. With the other hand, read under the input hopper and rotate the picker roller while holding the moistened cloth against the top of the roller. Continue the cleaning operation until all accumulated dirt is removed.
- c. Moisten a clean cloth with alcohol and place the moistened cloth over a finger and clean the four surfaces of the read station drive rollers from above while holding cloth on rollers and slowly rotating strobe when until complete surface of roller is cleaned. The four polyurethane-covered pinch rollers may be cleaned in similar fashion from below the read station. The pinch rollers are shown in Figure 5-2.
- d. Replace front and rear covers by reversing the procedure followed in step a.

5.2.3 Monthly Care

A periodic cleaning of the card reader is recommended on a monthly basis to assure proper trouble-free operation of the card reader.

- a. With power off, rear cover may be pulled off in similar fashion.
- b. Moisten a clean cloth with alcohol and place the moistened cloth over a finger and hold against the top surface of the picker roller while rotating picker roller from underneath with the other hand. Continue cleaning until all accumulated dirt is removed.
- c. Wipe out input hopper with alcohol-moistened cloth.

- d. Moisten a clean cloth with alcohol and clean the four surfaces of the polyurethane-covered pinch rollers from below, and the four surfaces of the read station drive rollers from above, while rotating strobe wheel with other hand.
- e. Inspect for lint buildup around read station area. Excessive lint should be removed by gently blowing and/or carefully wiping with a dry, lint-free cloth.
- f. The throat gap should be checked by placing the plastic throat gauge (PDI Part Number 3-14460-342) under the knife edge of the throat assembly. If the throat is out of tolerance, operator should call for service.

Adjustment of knife is described in paragraph 5.3.2.
- g. Replace front cover by reversing procedure followed in step a.

5.2.4 Six-Month Care

It is recommended that the following preventive maintenance procedures be accomplished on a six-month basis, or more often as usage dictates, by a trained serviceman.

- a. With power switch off and AC power source disconnected, remove cover by pulling outward from both ends. Rear cover may be pulled off in similar fashion.
- b. Examine all belts for evidence of wear such as frayed edges or broken fibers. If evidence of wear is noted, replace belt as described in paragraphs 5.3.10 or 5.3.12.
- c. Moisten a clean cloth with alcohol and place the moistened cloth over a finger and clean the four surfaces of the read station drive rollers from above while holding cloth on rollers and slowly rotate the strobe wheel until complete surface of roller is cleaned. The four polyurethane-covered pinch rollers may be

cleaned in similar fashion from below the read station. The pinch rollers are shown in Figure 5-2.

- d. Remove excessive lint buildup in the holes of the top LED aperture block. This is accomplished by removing the mounting screws on the top LED assembly and removing the assembly, thereby making the lamp aperture block accessible as described in paragraph 5.3.8. Remove all lint or dust from the top LED aperture block with a clean cloth or by gently blowing. Carefully blow any dust or lint from the LED's before replacing the top LED assembly.
- e. Replace front and rear covers by reversing the procedure followed in step a.
- f. Reconnect card reader to AC power source.

5.3 CORRECTIVE MAINTENANCE

Should corrective maintenance be required, follow the procedures outlined in this section. For convenience, a paragraph number listing of the various procedures is given below:

<u>Paragraph No.</u>	<u>Procedure</u>
5.3.1	Strobe Pickup Adjustment
5.3.2	Knife Throat Adjustment
5.3.3	Input Hopper Empty Switch Adjustment
5.3.4	Amplifier Gain Adjustment
5.3.5	Clock Track Amplifier Adjustment
5.3.6	Leading Edge Single Shot Adjustment
5.3.7	Push-Button Lamp Replacement
5.3.8	Top LED Head Replacement
5.3.9	Picker Clutch Replacement
5.3.10	Main Drive Belt Replacement
5.3.11	Picker Roller Replacement
5.3.12	Roller Drive Belt Replacement
5.3.13	Pinch Rollers Replacement
5.3.14	Read Station Replacement
5.3.15	Drive Motor Replacement
5.3.16	Voltage Regulator Board Replacement
5.3.17	Voltage Regulator Power Transistor Replacement
5.3.18	Unregulated Power Supply Replacement
5.3.19	Logic Module Replacement
5.3.20	Output Hopper Full Switch Adjustment

5.3.1 Strobe Pickup Adjustment (Refer to Figure 5-1)

- a. To adjust strobe-pickup gap, loosen locknut (A), insert .005 in. feeler gauge between strobe wheel gear teeth and tip of pickup, and rotate pickup (B) to obtain snug fit. Retighten locknut (A). Gap should be between .004 and .006 in.

5.3.2 Knife-Throat Adjustment (Refer to Figure 5-3)

- a. Loosen two knife mounting screws just enough to allow knife blade to move but still maintain contact with its mounting surface.
- b. Insert throat gauge, PDI Part Number 3-14460-342, between the knife and throat block, from input hopper side. Feeler gauges or metal stock MUST NOT BE USED.
- c. Slide the knife blade down onto the throat gauge gently, and without cocking the blade. Check for full-width contact of the knife with the gauge.
- d. Fully tighten the mounting screws and remove the gauge.
- e. Check adjustment by partially inserting gauge from both sides of knife to ensure that knife is parallel to throat block at the correct gap. Gauge should be slightly and equally snug on both sides of knife.

5.3.3 Input Hopper Empty Switch Adjustment

- a. Loosen two mounting screws that attach hopper switch to mounting bracket on underside of input hopper.
- b. Rotate switch back and forth to find position where switch is just actuated with switch actuator protruding through card bed $3/16$ in., and retighten screws. NOTE: It should not be necessary to bend switch arm to achieve adjustment.

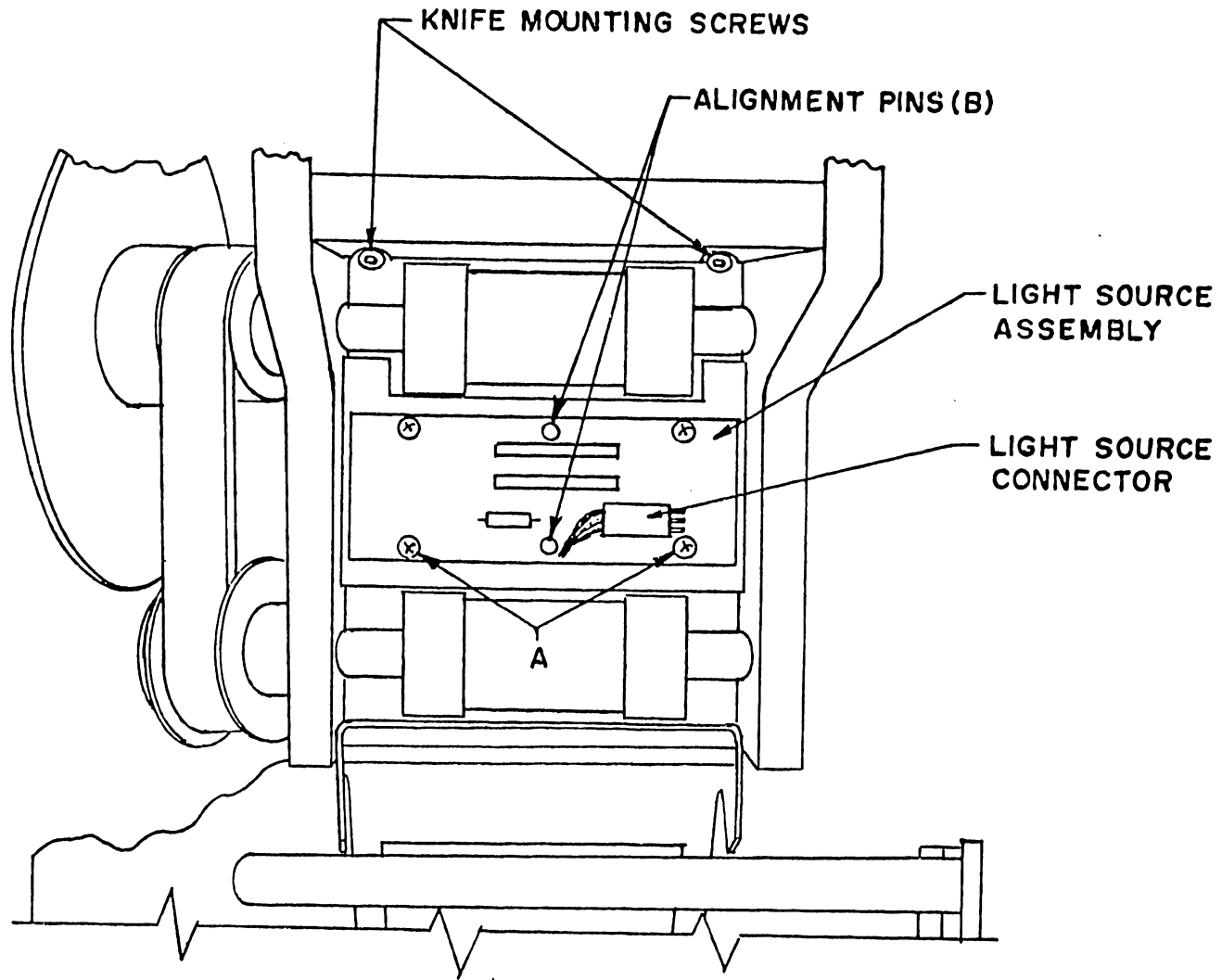


FIG. 5-3, READ STATION, TOP VIEW

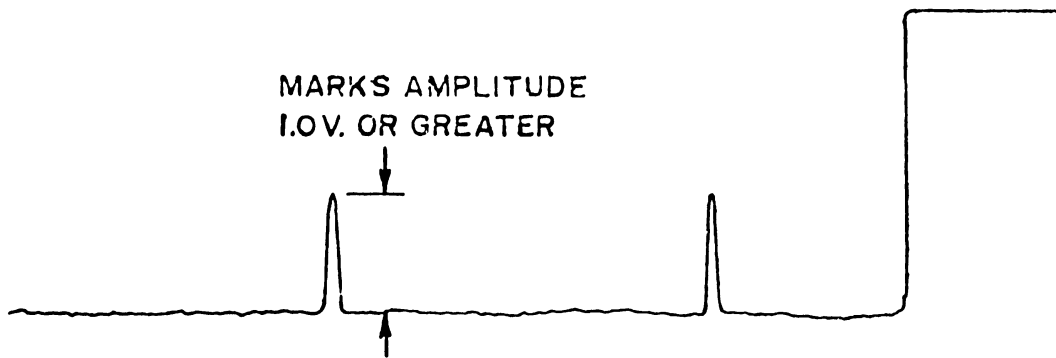
5.3.4 Amplifier Gain Adjustment

The following procedure may be used for checking and/or setting up the gain adjustments on the mark sense amplifier board. This will normally only have to be done if the read station or amplifier board have been replaced.

- a. Set up card reader to read MARKS in either 40 COL. or 80 COL. mode, and place a deck of mark sense type cards in the input hopper. The deck should be comprised of cards which are all punched identically and contain several punches per data row. (An ideal pattern would be one in which all rows are punched every tenth column.)
- b. Use a pick jumper paddle in output connector J3 of card reader, or otherwise apply a steady state ground signal to pin 6 of J3.
- c. Sync oscilloscope from T.P.1 of the logic board (sync negative), set scope time base to 2 msec/cm, and set scope vertical gain to 1v/cm. The oscilloscope ground may be connected conveniently to the ground turret lug located adjacent to T.P.1 of the logic board.
- d. With oscilloscope probe on T.P.12 of amplifier board and card reader reading cards, a waveform similar to Figure 5-4(a) should be observed. If the amplitude is significantly different from that shown, adjust trimpot R1 (adjacent to the bit 12 test point) either clockwise to increase gain, or counter-clockwise to decrease gain, to give correct amplitude. Amplifier should be tuned until almost fully saturated for reflective card surface (area of card between data holes), with just a slight amount of waviness between holes. This will result in maximum amplitude of data pulses, which should be in excess of 4 volts, and typically 5 volts or greater.
- e. Repeat this procedure for bits 11 through 9, adjusting trimpots R2, R3, R4, etc., in turn, until all twelve amplifier outputs resemble Figure 5-4(a).



(a) PUNCHED CARDS IN MARKS MODE



(b) MARKED CARDS IN MARKS MODE
OR
PUNCHED CARDS IN PUNCH MODE

FIG 5-4, AMPLIFIER GAIN ADJUSTMENT WAVEFORMS

- f. When marked decks are run, the amplitudes of the marks should be at least 1.0 volts as shown in Figure 5-4(b).
- g. When punched decks are run in PUNCH mode, the amplitude of the punches must be at least 2.0 volts, but may typically be 4.0 volts or greater.

5.3.5 Clock Track Amplifier Adjustment

The following procedure may be used for checking and/or setting up the clock track amplifier gain on the mark sense amplifier board. This will normally be done if the read station or amplifier board have been replaced.

- a. Set up card reader to read MARKS in either 40 COL or 80 COL mode.
- b. Set CLK.TRK./INT.CLK. switch to CLOCK TRACK mode.
- c. Place a deck of mark sense type cards, with pre-printed clock track in the input hopper.
- d. Use a pick jumper paddle in output connector J3 of card reader, or otherwise apply a steady state ground signal to pin 6 of J3.
- e. Sync oscilloscope from T.P.1 of the logic board (sync negative), set scope time base to 2.0 msec/c., and set scope vertical gain to 2v/cm. The oscilloscope ground may be connected conveniently to the ground turret lug located adjacent to T.P.1 on the logic board.
- f. With oscilloscope probe on clock track test point (labelled C.T. at top left of mark sense amplifier board), and card reader process-cards, adjust trimpot R28 (adjacent to C.T. test point) until negative pulses at TTL levels are observed on the scope. The potentiometer should be adjusted until the width of the clock track pulses correspond to the width of the clock track marks printed on the card. This, .040 in. clock marks should typically yield approximately 0.5 msec to 0.6 msec pulses.

5.3.6 Leading Edge Single Shot Adjustment

Normally, it will not be necessary to perform a leading edge single shot adjustment to the card reader in routine maintenance situations. There are instances, however, when it is desirable to check and possibly reset this adjustment. Such a situation might arise, for example; if a read station assembly or top light source assembly must be replaced, or if a 60Hz unit is converted for 50Hz use. Amplifier gains must be properly adjusted before this procedure is attempted (see paragraph 5.3.4).

This adjustment must be performed with the aid of a computer or with PDI Off-Line Card Reader Tester 1011 (optionally available printed circuit test board), in order to tell whether the card reader is reading error-free or if it is making errors in reading. In general, a deck of punched cards of known good registration is used. All the cards of the deck have the same pattern, and the first card is read and loaded into memory. All the succeeding cards in the decks are read and compared against memory to determine if any data errors are made. The program should stop feeding cards if an error is made, and it is sometimes helpful if data expected vs. data read can be examined to determine the nature of an error.

Punched hole patterns are used to make this adjustment because punch registration and hole uniformity is far superior to marks placed on cards by hand. It is preferable to have decks punched on mark sense type cards; however, standard punched card decks may be used, face up, if the unprinted sides are fairly clean and free of ink marks.

In addition to the above, an oscilloscope is required to monitor the adjustment.

- a. Connect card reader to computer via J3 connector, or insert PDI Off-Line Card Reader Tester 1011 into J3 connector slot.

- b. Connect probe of oscilloscope to L.E. test point (T.P.1) on logic board. Set oscilloscope to sync negative, with time base on 0.1 millisecond/cm; set vertical amplitude to 2 volts/cm. The oscilloscope ground may be connected conveniently to the ground turret lug located adjacent to T.P.1 of the logic board.
- c. Set card reader to read cards in PUNCH mode, 80-column format, and load deck of identical pattern punched cards into reader. Note: Cards must be loaded with printing side up if standard punched cards (cards printed with black ink) are used.
- d. Connect RESYNC test point (located at top right of logic board) to ground turret lug located above it, using a small clip lead. This will inhibit resync function.
- e. With card reader processing cards under computer control, note width of zero-going pulse on trace of oscilloscope, and adjust trimpot R8 on logic board clockwise until card reader stops, indicating that a data error has been made. Adjust trimpot counter-clockwise a little at a time until point is reached where reader will process the deck error-free, and record width of pulse from trace (this is the upper margin reading in PUNCH mode).
- f. Repeat step e, adjusting trimpot R8 in the counter-clockwise direction until errors are made. Adjust trimpot clockwise a little at a time until point is reached where reader will process the deck error-free, and record width of pulse from trace (this is the lower margin reading in PUNCH mode).
- g. Add the upper and lower PUNCH margin readings obtained in steps e and f, and divide by two. Record this value as the center of

margin reading in PUNCH mode, and remove shorting slip from RESYNC test point.

- h. With the equipment set up as in steps a and b above, set card reader to read cards in MARKS mode, 80-column format.
- i. Load same deck of cards, and in same manner, used for step c above.
- j. With card reader processing cards under computer control, note width of zero-going pulse on trace of oscilloscope, and adjust trimpot R8 on logic board clockwise until card reader stops, indicating that a data error has been made. Adjust trimpot counter-clockwise a little at a time until point is reached where reader will process the deck error-free, and record width of pulse from trace (this is the upper margin reading in MARKS mode).
- k. Repeat step j, adjusting trimpot R8 in the counter-clockwise direction until errors are made. Adjust trimpot clockwise a little at a time until point is reached where reader will process the deck error-free, and record width of pulse from trace (this is the lower margin reading in MARKS mode).
- l. Add the upper and lower MARKS margin readings obtained in steps j and k, and divide by two. Record this value as the center of margin reading in MARKS mode.
- m. Add the center of margin reading for MARKS mode, to the center of margin reading for PUNCH mode, and divide by two. Readjust trimpot R8 to give this value on oscilloscope. Leading edge single shot is now adjusted for optimum reading in both PUNCH and MARKS mode.

5.3.7 Push Button Lamp Replacement (Type 387 bulb used with long switches, type 7387 with short switches)

- a. Grasp front edges of movable portion of button firmly with fingertips and pull straight out.

- b. Remove lamp (type 387) from button; (or type 7387) by removing small tab containing lamp from switch housing.
- c. Either slip new lamp into hole position from which old lamp was removed (type 387); or replace new lamp into tab-holder and replace tab in housing (type 7387). Replace button by sliding back into switch assembly and pressing in on button until it snaps into place.

5.3.8 Top LED Head Replacement (Refer to Figure 5-3)

- a. Disconnect light source connector by sliding plastic part of connector toward back of machine.
- b. Remove four screws (A) which secure light source in place.
- c. Carefully lift out light source PC board by pulling straight up on board assembly. NOTE: If board does not lift out easily, very carefully pry around the edges with a sharp bladed instrument such as a small screwdriver to loosen head assembly from alignment pins B.
- d. Replace light source assembly after first making sure that the individual LED's are all in reasonably good alignment with each other. Carefully drop into place so that each LED is properly started into its respective alignment hole in the aluminum mask. The light source assembly should be pressed down over the alignment pins, and the four screws (A) replaced.
- e. Reconnect light source connector making sure that original alignment is observed.

5.3.9 Picker Clutch Replacement (Refer to Figure 5-5)

- a. Unfasten two clutch leads (A) from terminal board.
- b. Loosen screw (B), rotate stud-mounted assembly 90 degrees, and temporarily retighten screw (B).
- c. Loosen two setscrews (C) in collar and slide clutch assembly off picker roller shaft.
- d. Replace new clutch assembly by reversing the removal procedure, making sure that stop screw (E) engages slot in clutch assembly.
IMPORTANT: Adjust picker clutch for proper running clearance by sliding clutch onto picker roller shaft as far as possible and then backing off between .005 in. to .010 in. before tightening setscrews (C) in collar. This spacing adjustment is not critical, but sufficient clearance must be provided to allow clutch plate and coil to move slightly but freely on shaft.

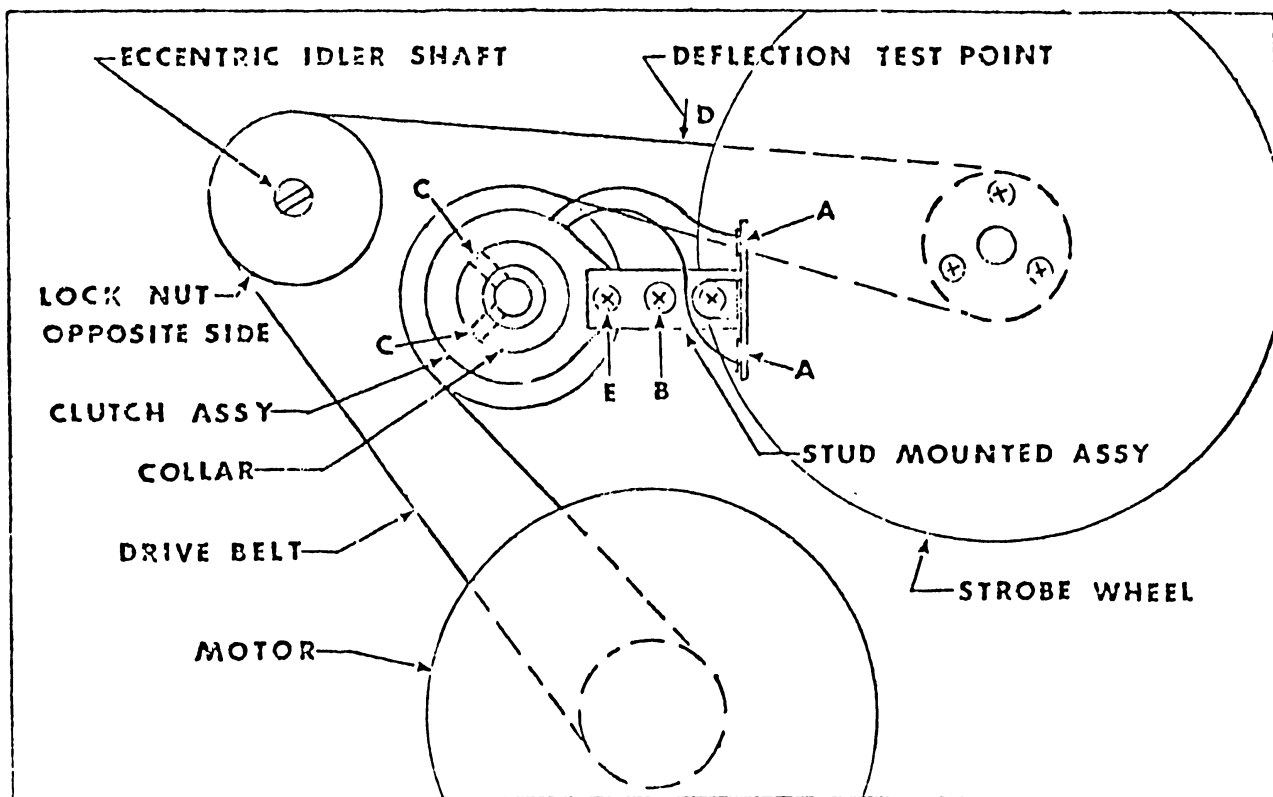


FIG. 5.5 PICKER CLUTCH AND DRIVE SYSTEM

5.3.10 Main Drive Belt Replacement (Refer to Figure 5-5)

- a. Remove three screws which secure strobe wheel to pulley hub of forward drive roller, and remove strobe wheel.
- b. Loosen lock screw on opposite end of eccentric idler shaft.
- c. Turn idler shaft with screwdriver, one-half turn counter-clockwise to relieve belt tension.
- d. Remove belt.
- e. Replace new belt, and adjust belt tension by turning idler shaft with screwdriver in clockwise direction for proper tension, and retightening lock screw on opposite end of idler shaft.

IMPORTANT: Correct belt tension is 1/4 in. deflection at point (D), with one-pound force applied.

- f. Replace strobe wheel and replace three screws to secure strobe wheel.
- g. Check for strobe pick-up gap adjustment (See Paragraph 5.3.1).

5.3.11 Picker Roller Replacement (Refer to Figure 5-6)

- a. Temporarily remove picker clutch (steps b and c of procedure for picker clutch replacement, Paragraph 5.3.9).
- b. Relieve tension on main drive belt (steps b and c of procedure for main drive belt replacement, Paragraph 5.3.10).
- c. Loosen setscrew (C) in collar.
- d. Loosen two setscrews (D) in picker roller hub.
- e. Slide shaft out by grasping picker shaft pulley with one hand and holding picker roller with other hand. NOTE: Slide shaft out just far enough to remove roller.
- f. Install new picker roller by reversing step e above, pushing shaft in until it bottoms. Snug collar against fiber inertia damper and tighten setscrew (C) in collar.

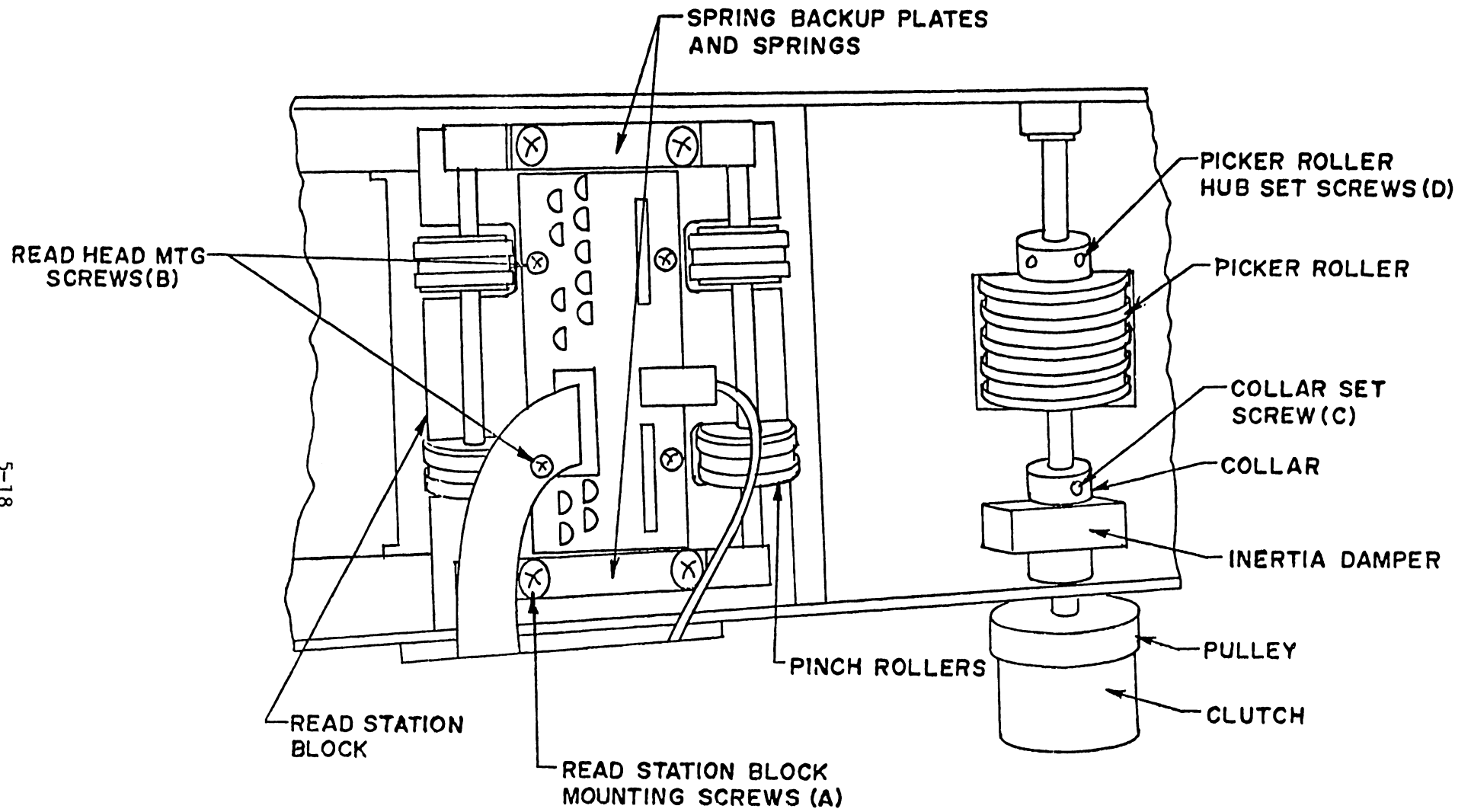


FIG. 5-6. READ STATION AND PICKER ROLLER, BOTTOM VIEW WITH PROTECTIVE COVER REMOVED

- g. With picker roller setscrews (D) positioned over flats on picker roller shaft, center roller so that raised areas on picker roller fall between columns on a punched card. This adjustment may be easily made by placing a fully laced card in the input hopper, holding first against one side of the input hopper and then against the other side. The high points of the roller should not be visible through the punchings with the card in either extreme position. Tighten both setscrews in picker roller hub.
- h. Adjust drive belt tension (step e of procedure for main drive belt replacement, Paragraph 5.3.10).
- i. Replace picker clutch (step d of procedure for picker clutch replacement, Paragraph 5.3.9).

5.3.12 Roller Drive Belt Replacement (Refer to Figure 5-7)

- a. Remove main drive belt and strobe wheel (steps a through d of procedure for main drive belt replacement, Paragraph 5.3.10).
- b. Remove screws and spacers (C) and pickup mounting bracket.
- c. Loosen two setscrews (A) and (B) in both roller pulleys, and slide both pulleys (along with belt) off roller shafts.
- d. Place new belt over both pulleys and slide back onto shafts in the manner removed, taking care to align setscrews of double-pulley with flats on shaft of forward drive roller shaft.
- e. Tighten two setscrews (A) in double-pulley, and after aligning setscrews and shaft in single-pulley, tighten two setscrews (B) in single-pulley.
- f. Replace pickup mounting bracket using screws and spacers (C).

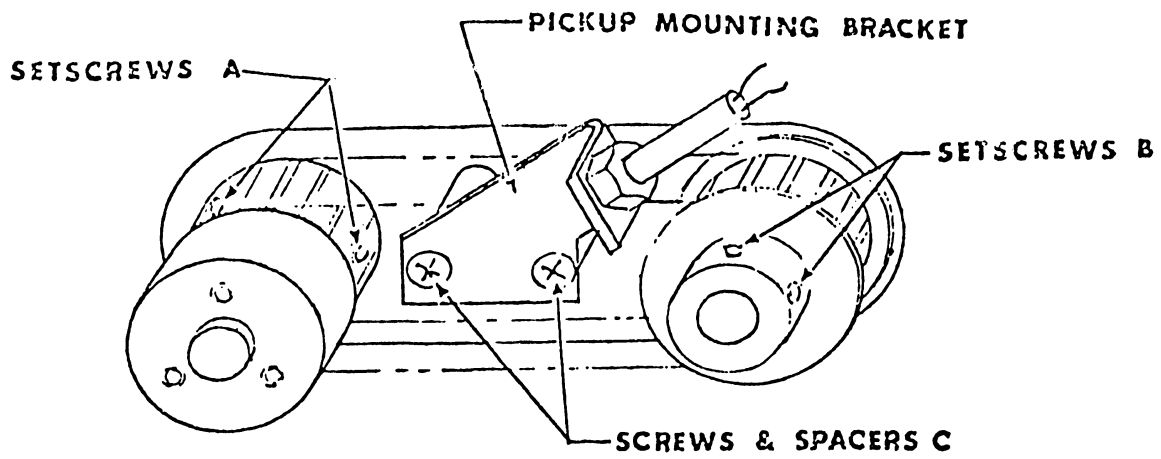


FIG. 5.7 ROLLER DRIVE

- g. Replace motor drive belt and strobe wheel (steps e and f of procedure for main drive belt replacement, Paragraph 5.3.10), and adjust strobe pickup gap (Paragraph 5.3.1).

5.3.13 Pinch Rollers Replacement (Refer to Figure 5-6)

If pinch rollers become defective, it is recommended that all four pinch rollers be replaced.

- a. Stand card reader on output hopper end and remove four screws (A), spring backup plates, and springs.
- b. Remove pinch roller and shaft assemblies, without disturbing block.
- c. Remove outer retaining ring at each roller position and slide rollers off shaft ends.
- d. Replace new pinch rollers on shafts, and outside retaining rings on shafts.
- e. Replace pinch roller and shaft assemblies in block with flats on shafts toward springs.
- f. Replace springs, spring backup plates, and screws (A). Make sure that alignment pins in phenolic block engage alignment slots in bottom of side rails, center assembly sideways, and tighten screws (A).

5.3.14 Read Station Replacement (Refer to Figure 5-6)

- a. Disconnect read head connector (J14) from amplifier board.
- b. Stand card reader on output hopper end, remove four mounting screws (B), and remove head assembly by carefully lifting out. DO NOT TWIST OR FORCE ASSEMBLY. This could result in bending the mounting leads of the photo-transistors or LED's causing a resultant misalignment.
- c. Work cable assembly containing J14 connector out through slot toward front of card reader.

- d. Replace assembly in reverse order, being careful that photo-transistors and LED's slip into their wells. As above, DO NOT TWIST OR FORCE ASSEMBLY. Secure with four screws (B).
- e. In reconnecting read head connector J14, make sure pins in connector are properly mated.
- f. Follow procedure for checking amplifier gain adjustment, Paragraph 5.3.4.
- g. Follow procedure for checking clock track amplifier adjustment, paragraph 5.3.5.
- h. Follow procedure for checking leading edge single shot adjustment, Paragraph 5.3.6.

5.3.15 Drive Motor Replacement (Refer to Figures 5-1 and 5-2)

In the procedure to follow, Clip lacing cord where required to remove wires, and relace cable at conclusion.

- a. Loosen and free main drive belt from pulley (steps b and c of procedure for main drive belt replacement, Paragraph 5.3.10).
- b. Disconnect three motor leads by pulling off quick-connect fasteners at TB1-3, C3-2, and TB2-6.
- c. Remove two screws which secure motor base to chassis, and remove motor.
- d. Remove pulley from motor shaft and reinstall on new motor.
- e. Replace motor, securing with screws removed in step c.
- f. Reconnect motor leads to connection points broken in step b, and dress leads as originally done.
- g. Replace main drive belt on pulleys and adjust belt tension (step e of procedure for main drive belt replacement, Paragraph 5.3.10).

5.3.16 Voltage Regulator Board Replacement (Refer to Figure 5-2)

- a. Unplug cable connector from regulator board.
- b. Remove regulator board from chassis by removing two screws, nuts and spacers; and unbolt wired TB5 from regulator board.
- c. Replace with new regulator board in the reverse order.

5.3.17 Voltage Regulator Power Transistor Replacement (Refer to Figure 5-2)

- a. Unsolder leads from transistor, carefully noting which color leads go to emitter, collector and base.
- b. Remove transistor from chassis by removing screw, spring washer, and nut, being careful not to damage mica washer. If transistor is removed with a rolling motion, mica washer should stay in place on chassis by adhesive action of silicone grease.
- c. Wipe a small dab of silicone grease over metal underside of replacement transistor before mounting. Tighten mounting screw to approximately 6 inch-pounds of torque.
- d. Resolder leads removed in step a.

5.3.18 Unregulated Power Supply Replacement (Refer to Figures 5-1 and 5-2)

In the procedure to follow, clip lacing cord where required to remove wires, and relace cable at conclusion.

- a. Remove power supply input leads (quick-connect terminals) from TB2-5 and C3-1.
- b. Remove red power supply output lead (quick-connect terminal) from TB2-4.
- c. Unsolder black power supply output lead from TB5-2, and green power supply output lead from TB5-3.
- d. Remove power supply by removing four mounting screws.
- e. Install new power supply by reversing the procedure.

5.3.19 Logic Module Replacement

When replacing logic modules, care should be exercised not to damage any of the plated-through holes in the PC board. The recommended procedure is to first clip all the module leads, and then individually unsolder the leads from the board. A solder-sucker should be used to clean solder from the holes before loading the new module on the board. Place new module on board with pin 1 adjacent to identifying dot and solder. After soldering the new module in place, clean solder joints with freon spray or similar solvent. The locations of the logic modules and discrete components on the logic board are shown in Figure 5-8. The locations of the logic modules and discrete components on the amplifier board are shown in Figure 5-9.

5.3.20 Output Hopper Full Switch Adjustment

- a. Place 300 cards (2.1" thick stack of cards) in output hopper.
- b. Loosen two mounting screws that attach hopper switch to mounting bracket on top of hopper.
- c. Rotate switch back and forth to find position where switch will just be actuated with this thickness of cards in hopper and retighten screws. NOTE: It should not be necessary to bend switch arm to achieve adjustment.

BOARD IDENTIFICATION

5-25

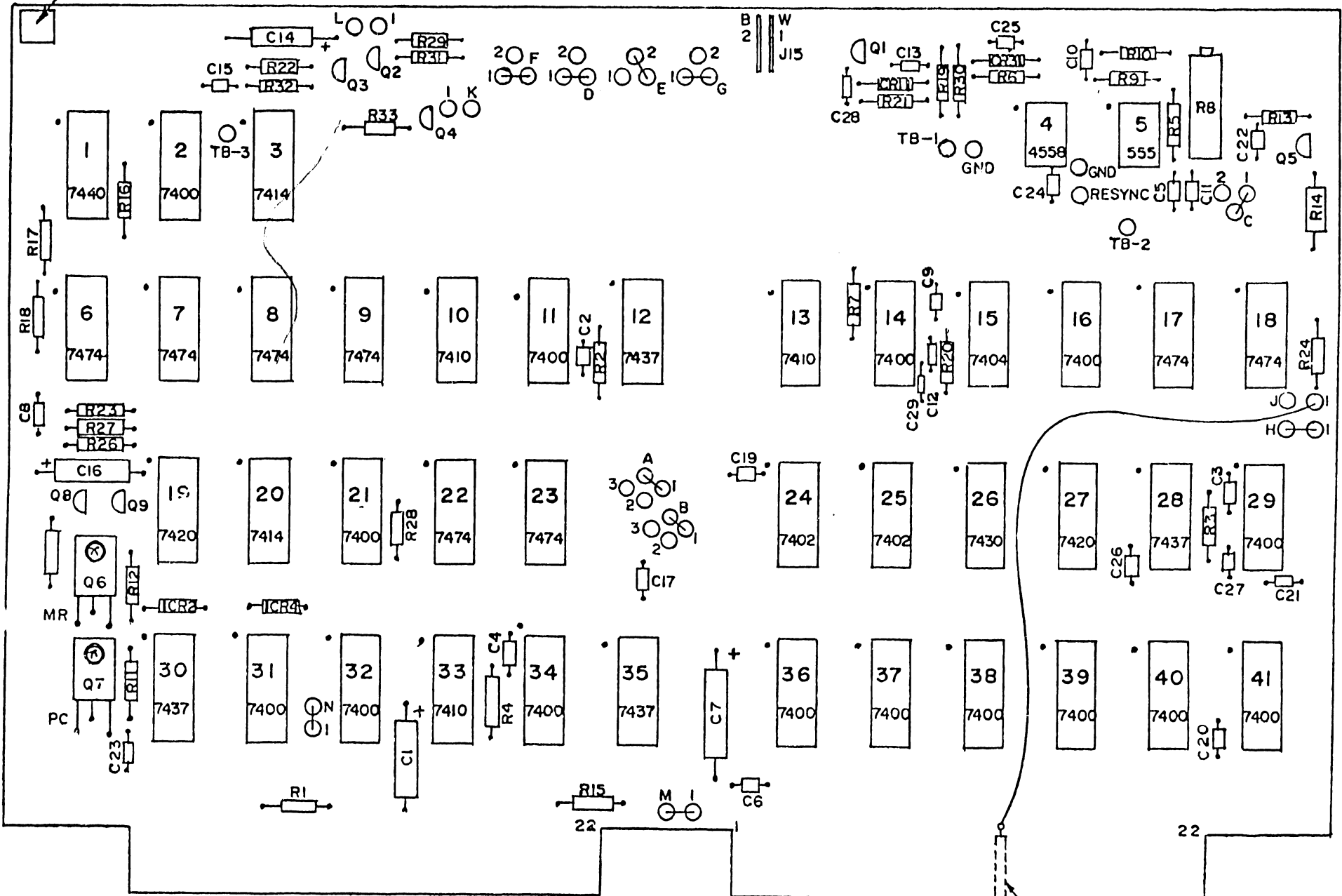


FIG. 5-8 LOCATION OF COMPONENTS ON LOGIC BOARD

BOARD IDENTIFICATION

5-25A

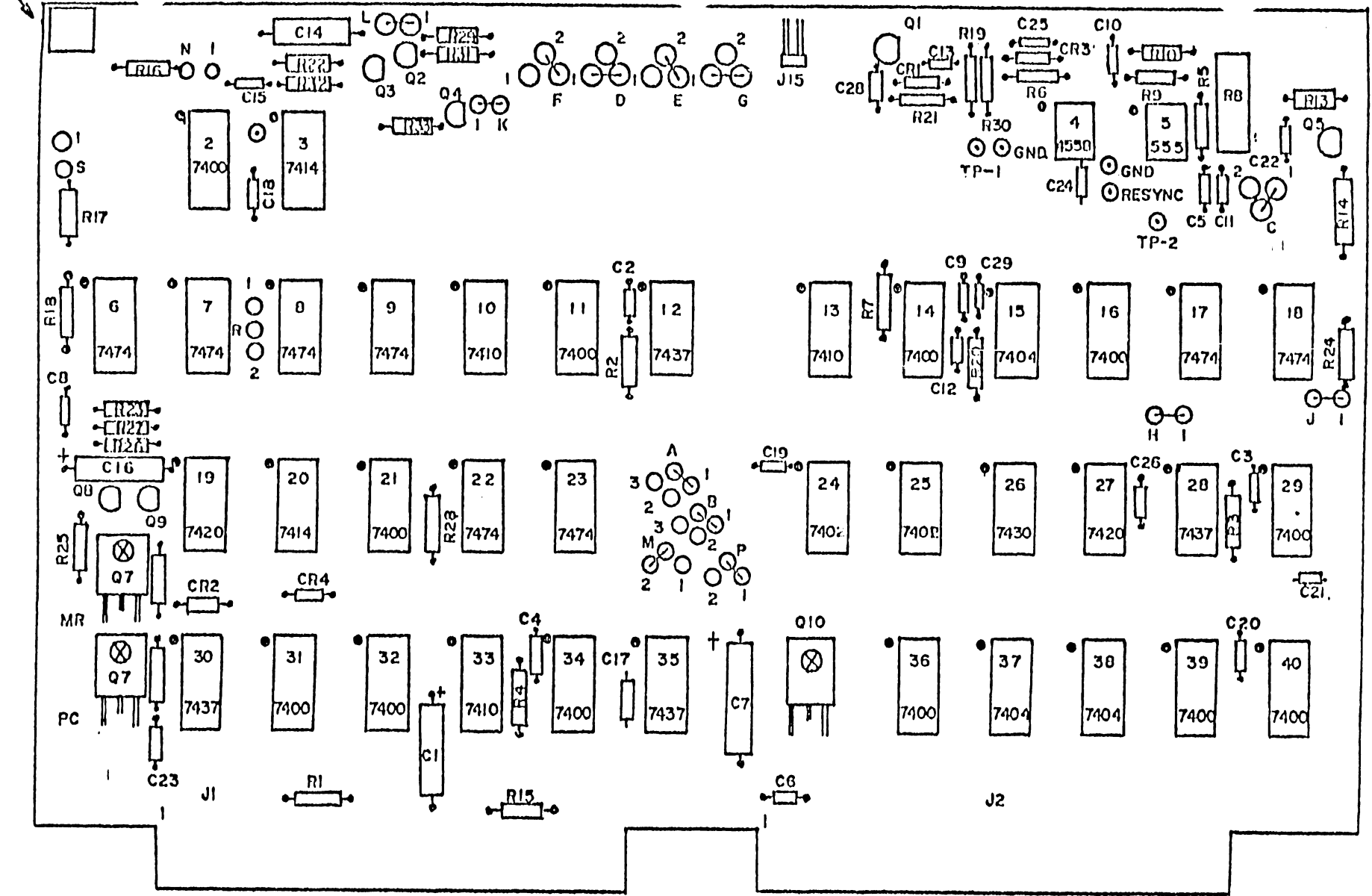
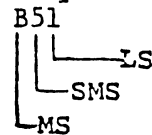


FIG. 5-8A
 BASIC LOGIC
 ASSY. 3-1160-849

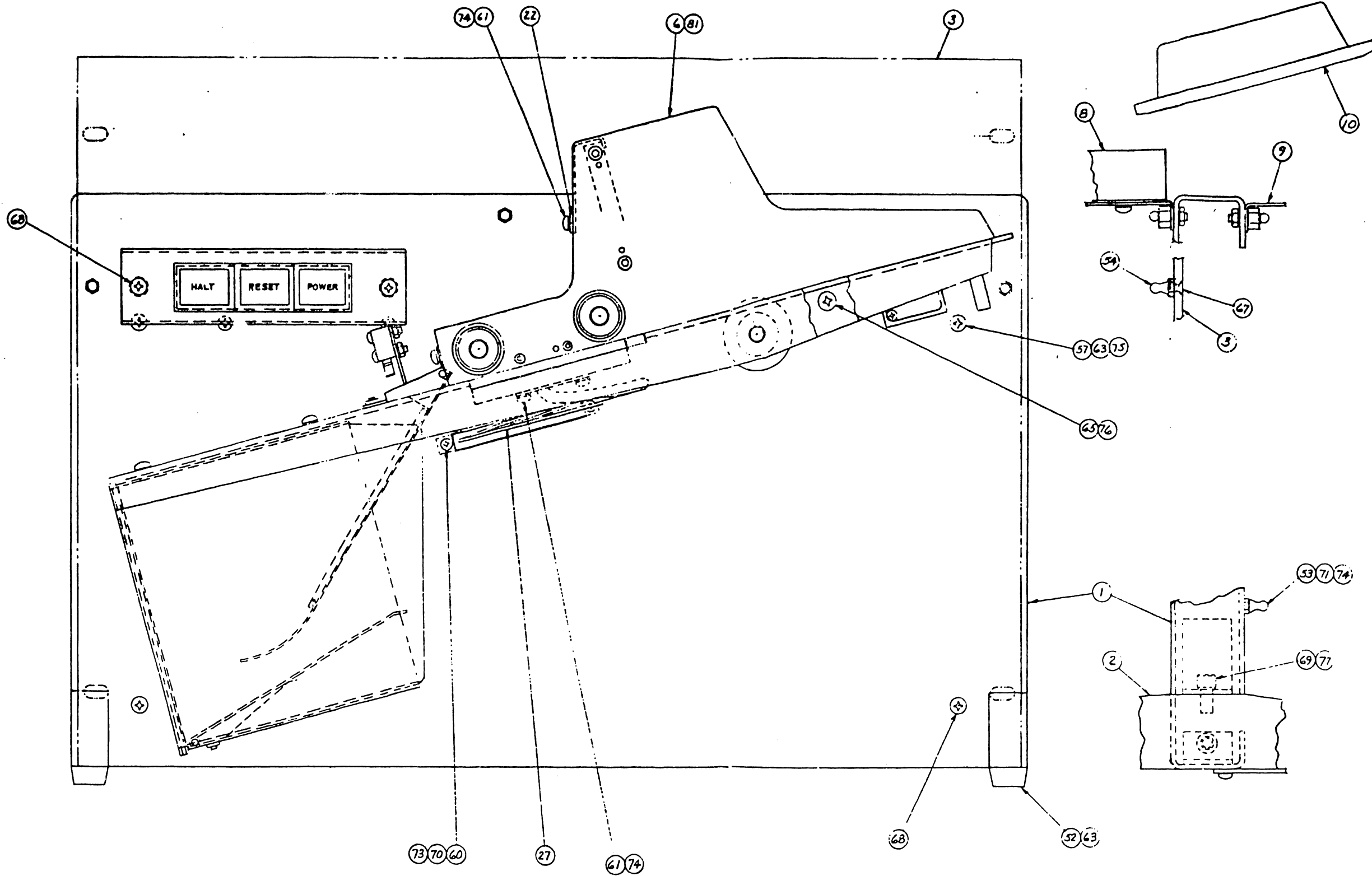
BASIC LOGIC BOARD
STRAPPING CHART
(Revision B)
3-1160-849-U
SPEED AND DATA STROBE

SIGNIFICANT	A =	300 CPM, 60Hz (250 CPM, 50Hz) & DATA STROBE STATE						RESET/SET	MOD 8
	B =	A-2	B-2	D-1	E-2	F-1	G-1 DS-4 TIME	M-2 P-1	M = RESET
	C =	A-1	B-1	D-1	E-2	F-1	G-1 DS-5 TIME	M-2 P-1	P = SET
SIGNIFICANT	D =	300 CPM, 50Hz (360 CPM, 60Hz) & DATA STROBE STATE						SET/RESET	MOD 8
	E =	A-2	B-2	D-1	E-2	F-2	G-1 DS-4 TIME	M-2 P-1	
	F =	A-1	B-1	D-1	E-2	F-2	G-1 DS-5 TIME	M-2 P-1	
MOST SIGNIFICANT	G =	500 CPM, 60Hz (400 CPM, 50Hz) & DATA STROBE STATE						SET/RESET	MOD 8
	H =	A-3	B-3	D-1	E-2	F-1	G-1 DS-6 TIME (MS)	M-1 P-2	
	J =	A-2	B-2	D-2	E-1	F-1	G-2 DS-4 TIME	M-2 P-1	
SIGNIFICANT	1 =	MISPICK & DATA AVAILABLE & LITE CHK/DARK CHK.							
	2 =	C-1	H-1	N-1	S-1	C-1 = 3 MISPICKS			
	3 =	C-1	H-0	N-1	S-1	H-1 = 2 us DA			
	4 =	C-2	H-1	N-1	S-1	H-0 = 120 us DA			
	5 =	C-2	H-0	N-1	S-1				
	6 =	C-1	H-1	N-1	S-0				
	7 =	C-1	H-0	N-1	S-0				
	8 =	C-2	H-1	N-1	S-0	N-1 S-1	READ CHECK(VERIFIER PUNCH COL. 81)		
	C-2	H-0	N-1	S-0	S-0 N-1	STD READ CHECK (NO VERIFIER PUNCH COL 81)			
		(0=Open)							
LEAST SIGNIFICANT	1 =	RSRP & STROBE AMPLIFIER & STATES DECODE							
	2 =	J-1	K-0	L-0	R-1	J-1	= RSRP IN		
	3 =	J-1	K-0	L-0	R-2	J-0	= RSRP OUT		
	4 =	J-0	K-0	L-0	R-1	K-1	= STROBE AMP IN		
	5 =	J-0	K-0	L-0	R-2	L-1	=		
	6 =	J-1	K-1	L-1	R-1	K-0	= STROBE AMP OUT		
	7 =	J-1	K-1	L-1	R-2	L-0	=		
	8 =	J-0	K-1	L-1	R-1	R-1	= STATES DECODE		
	J-0	K-1	L-1	R-2	R-2	= STATES DECODE			

- NOTE: 1. 3 Digit - Letter & numbers will indicate (Speed & Data Strobe Time - Set/Reset Mod 8; Read Check Verifier Punch Col. 81 and States Decode), and will be stamped in the upper left hand corner in squared area. Standard Unit. B51
2. A3, B3, J0 straps used only for Mark Sense.
3. -2, -3 have strobe amplifier omitted.
4. Lamp machines 2, -4
LED machines -1, -3
5. For Model 6111, Logic Board is strapped as for 500 CPM operation.
6. For Model 2022 Mark Sense without read check option, straps N & S must be open.

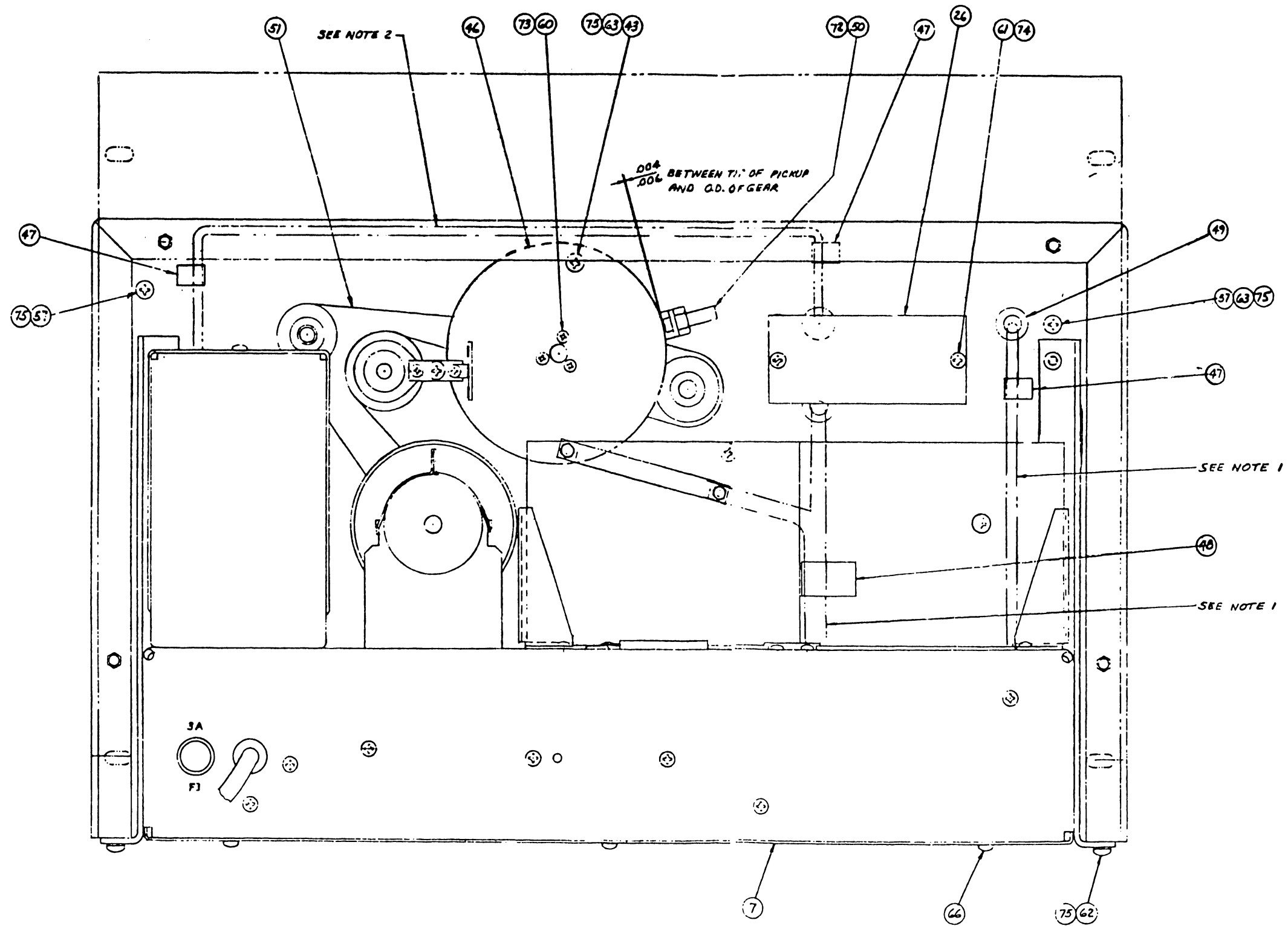


REV	DESCRIPTION	DATE	BY
1	ISSUED FOR CONSTRUCTION	11/70	R.J.J.
2	ISSUED FOR CONSTRUCTION	11/70	R.J.J.
3	ISSUED FOR CONSTRUCTION	11/70	R.J.J.
4	ISSUED FOR CONSTRUCTION	11/70	R.J.J.
5	ISSUED FOR CONSTRUCTION	11/70	R.J.J.



PERFORMANCE		PERIPHERAL DYNAMICS INC.	
QUANTITY	1	DATE	11/71
DESIGNED BY		DESIGNED BY	R.J.J.
APPROVED BY		APPROVED BY	
TITLE	CARD READER, MOD 3085		
DATE	6-24-71	PROJECT NUMBER	3-1105-330-X

REV	DESCRIPTION	DATE	BY
1	REVISED		
2	REVISED		
3	REVISED		
4	REVISED		



TOLERANCES UNLESS OTHERWISE SPECIFIED	PERIPHERAL DYNAMICS INC.		
1	SCALE	1/1	DRAWN BY R.T.J.
2	TITLE	CARD READER, MOD 3055	
3	DATE	6-24-71	3-1105-330-X

PART

III

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SECTION

1

INTRO-

DUCTION

SECTION 1

INTRODUCTION

1.1 SCOPE

This manual contains supplementary information for those automatic readers equipped with the PDI Asynchronous RS232-C Serial Interface. This supplementary information, when used in conjunction with the information contained in the Operation/Maintenance Manual for the basic card reader, provides complete operation and maintenance information.

1.2 GENERAL DESCRIPTION

The PDI RS232 automatic card readers are self-contained units capable of reading 80-column length cards at a maximum rate determined by the basic reader (see basic reader manual). The readers accept cards punched in Hollerith format, reading the data continuously column-by-column. Data is detected photoelectrically, converted as read to logic levels, and presented to the self-contained RS232-C interface. The RS232-C asynchronous serial interface converts the normal PDI card reader TTL level, parallel output data lines to an RS232-C level serial bit stream suitable for use with data communications equipment. The interface is wholly contained within the card reader electronics package. Half or full duplex operation is available. The following nine standard baud rates are switch selectable: 110 - 150 - 300 - 600 - 1200 - 1800 - 2400 - 3600 - 4800. Baud rates from 150 baud through 4800 baud are provided by a crystal controlled oscillator; whereas the 110 baud clock is generated by a separate linear timer. Optionally available is a double-frequency crystal, whereby selectable baud rates up to 9600 baud may be obtained. An external clock input switch position is also provided. Hollerith to ASCII data conversion is standard as well

as a full 80-column buffer, which allows for retransmission of the previous card's data as often as requested. Variable record length is standard, allowing for trailing zeros (blank columns following all pertinent data) to be suppressed. Transmission of the parity bit is strap selectable, with "ODD", "EVEN", "NONE", or "MARKS" provided.

A 25-pin connector (Cannon, DBM-25S or equivalent) labelled J3 provides the interface connections as defined by the EIA standard for terminal equipment and data communications equipment employing serial binary data interchange. J3 allows connection to a modem, or directly to a CPU. All interchange signals at the connector are at EIA levels, and communications are accomplished in bit-serial mode.

Two additional logic boards are provided to implement the RS232-C interface, and are located in the electronics component shelf area. This circuitry is in addition to the basic logic provided with the standard parallel interface reader.

The RECEIVER/TRANSMITTER board, located in connector slots J7 and J8, provides the following circuitry necessary for the serial communications interface: receiver/transmitter UART, command decoders and storage, pick control circuitry, crystal-controlled, and linear oscillators, baud rate counters and selection circuitry, receive/transmit mode control circuitry, full/half duplex switching, format elimination circuitry, transmission sequence counter, clock generators and synchronizers, data strobe counter, trailing zero suppression circuitry, and TTL/EIA level conversion circuitry.

The Hollerith to ASCII buffer board, located in connector slot J11 provides the following circuitry: Hollerith compression circuitry, Hollerith to ASCII converter, 80 character shift register buffer, transmit data multiplexer, format character generators and non-blank data decoder.

An additional modular, regulated power supply is provided to power the EIA driver chips, as well as the MOS circuitry used in the RS232-C

interface. This supply provides ± 12 volts regulated power at 200 ma. The supply is bracket-mounted beneath the chassis, directly under the unregulated power supply. The regulated 5V power for all the TTL logic in the RS232-C interface is provided from the standard 5V supply in the card reader.

SECTION

2

INSTAL-

LATION

SECTION 2
INSTALLATION

2.1 GENERAL

This section of the RS232-C supplementary manual covers only those points of difference between the RS232-C units and the standard series of parallel interface readers with which the serial interface is associated. Where there are no differences in specific areas, the reader will be referred to the basic reader manual.

2.2 UNPACKING AND HANDLING

Refer to the reader manual.

2.3 OPERATIONAL CHECKS

Refer to reader manual, observing the following substitutions:

- a. All logic boards should be examined to determine that they are properly seated in their correct connector locations, with the component side of each board to the rear of the reader.
- b. Refer to reader manual.
- c. Refer to reader manual.
- d. Refer to reader manual.
- e. Hold input hopper switch down with finger, and operate RESET switch; motor should run, RESET lamp should extinguish, and READY indicator should light. Release input hopper switch; motor should stop, RESET lamp should light, and READY lamp should extinguish after approximately .7 seconds.
- f. Refer to reader manual.

- g. Turn off power, and place ON LINE/OFF LINE toggle switch, located on the rear component shelf, in the OFF LINE position. Connect pins 4 and 5 of interface connector J3 together (paper-clip jumper will suffice). Hold input hopper switch down as before, and operate POWER switch: Motor should run, and reader should attempt to pick three times and stop; similarly, the motor should start and the reader should attempt to pick three times each time the RESET switch is operated.
- h. With power on and reader still set as in step g, load deck of cards into input hopper and place card follower on top of cards. Operate RESET switch: Reader should pick and stack deck of cards at variable rate, depending upon individual card density. When input hopper empties, unit should stop picking, motor should stop, RESET lamp should light, and READY lamp should extinguish.
- i. Refer to reader manual. Interface paddle connector diagram, shown for parallel interface readers, should be ignored.
- j. Refer to reader manual.
- k. Turn off power to the card reader. Place reader back in ON-LINE mode, with toggle switch on rear component shelf, remove shorting clip on pins 4 and 5 of interface connector, and replace front and rear covers as required.

2.4 INSTALLATION REQUIREMENTS

All details in the reader manual apply, with the following exceptions and substitutions:

- a. Power requirements in paragraph 2.4.2 are 185 watts maximum.
- b. In paragraph 2.4.3, references to data controller requirements are to be ignored. Requirements are simply that all interface connections must conform to EIA STANDARD RS232-C specifications; must operate in asynchronous mode with either full or half duplex convention; and, all system components must employ the same baud rate and parity.

- c. In paragraph 2.4.3.2, it is to be remembered, that only internal logic signals are at TTL levels. All interface levels conform to EIA standard.
- d. With respect to paragraph 2.4.3.3, the serial interface readers will operate either in single pick-on-command mode or in continuous-pick mode at up to the maximum throughput rate of the reader, dependent upon data density, and transmission baud rate. To pick, read and transmit a single card's data, either the remote terminal or CPU (through the modem communications link), or the local terminal or CPU must issue a serial ASCII DC1 command (octal 021) to the reader. Retransmission of the previous card's data from the reader buffer may be obtained by issuing a serial ASCII DC2 command (octal 022) to the reader. In half duplex mode, half duplex convention must be observed in that a new DC1 command must not be issued until the carriage return character (octal 015) is received from the reader, following transmission of the last card's data. In full duplex, the reader will also operate in single pick-on-command mode as mentioned above. Since, however, in full duplex the reader may receive and transmit simultaneously, a new DC1 or DC2 command may be issued to the reader at any time. The reader has, however, the ability to store only a single new command, while operating on a previous command. Care should be exercised in not overloading this input command storage faster than the reader throughput and transmission baud rate allow these commands to be processed.

In the standard configuration, the reader is usually strapped for either full or half duplex operation on the RECEIVER/TRANSMITTER board (C-1 for full duplex; C-2 for half duplex). Optionally available is a slide action switch replacing this jumper on the RECEIVER/TRANSMITTER board, or a front panel illuminated alternate-action switch-indicator.

The reader may also be operated in continuous-pick mode as mentioned above. This is accomplished by issuing a serial ASCII DC3 command (octal 023) to the reader. Upon receipt of a DC3 command, the reader will commence to pick, read and transmit card data continuously until either: The input hopper empties, the HALT button is depressed, or the reader receives a DC4 command. Receipt of a serial ASCII DC4 command (octal 024), will terminate the continuous-pick mode, and again place the reader on a pick-on-command basis. This type of DC3/DC4 toggling, for bursts of continuous picking should only be employed in full duplex mode, since in half duplex, under continuous-pick, the reader may not remain in receive mode long enough to properly process an incoming DC4 command. In half duplex mode, if DC3 is employed for continuous pick, it should remain in effect until either the input hopper empties, or the HALT button is depressed.

Note: The card reader will also pick and transmit continuously in the OFF-LINE mode with J3 pins 4 and 5 connected together. This type of operation is usually reserved for test purposes, however, since the reader will no longer be under external control.

- e. Signal interface input and output lines specified for the parallel reader interface are to be ignored.

The following EIA RS232-C interface lines have been implemented at the 25-pin output connector:

- Pin 2 - BA - transmitted data (from reader)
- Pin 3 - BB - received data (from data communications equipment)
- Pin 4 - CA - request to send (from reader)
- Pin 5 - CB - clear to send (from data communications equipment)
- Pin 7 - AB - signal ground
- Pin 8 - CF - carrier present (from data communications equipment)
- Pin 20 - CD - data terminal ready (from reader)

NOTE: If clear to send line (CB) is not implemented, Pin 5 must be tied to Pin 4.

2.5 INSTALLATION CHECKS

2.5.1 Procedure

The following procedure is presented as a guide to check out the operation of the card reader after installation. The checkout is discussed in a general manner to illustrate typical operating conditions.

- a. Initial conditions: No cards in hoppers and read station clear.
- b. Set card reader baud rate select switch (located in upper right hand corner of RECEIVER/TRANSMITTER board) to proper baud rate required by system.

SWITCH POSITION	BAUD RATE
1	110
2	150
3	300
4	600
5	1200
6	1800
7	2400
8	3600
9	4800
0	External Clock

- c. Set ON-LINE/OFF-LINE switch to ON-LINE position.
- d. Connect reader to MODEM; to local terminal; or to a local CPU, using the reader interface connector J3.
- e. Operate reader POWER switch: POWER indicator should light, and RESET lamp should light.
- f. Load cards into input hopper and then operate RESET switch: motor should run; RESET lamp should extinguish; and READY indicator should light, indicating that the DATA TERMINAL READY output line (CD) of the reader is ON. Reader may now be placed under remote control.
- g. If a modem is used, dial-up a remote CPU through modem. When line connection is completed, remote CPU may now issue pick commands (ASCII DC1 characters), or a continuous pick command (ASCII DC3 character), to the reader.

- h. If a local terminal is used, issue ASCII DC1 commands (control Q) from terminal keyboard to reader. Reader should pick and transmit data from a single card, which will be printed at the terminal.
- i. Continue to issue DC1 commands; waiting each time until receipt of a carriage return character (octal 015) from the reader, signifying an end of each card's data transmission.
- j. Issue an ASCII DC3 command (control S), from terminal keyboard to reader. Reader should pick and transmit card data continuously until entire deck is read. At the conclusion of transmission for the last card in the deck, an ASCII EOT character (octal 004) will be sent, following transmission of carriage return for that card. At this time, the reader motor will shut off, the RESET indicator will light, and the READY indicator will extinguish.

SECTION

3

OPERA-

TION

SECTION 3

OPERATION

3.1 GENERAL

This section contains a description of the operating controls and a discussion of normal operating procedures.

3.2 OPERATING CONTROLS AND INDICATORS

Most of the operating controls and indicators for the card reader are located on the upper left-hand corner of the front panel of the unit. These controls consist of three pushbutton switch-indicators which function as follows:

- a. POWER - An alternate-action pushbutton switch-indicator that turns power on and off to the unit. This switch has a white indicator panel that is illuminated when power is on.
- b. RESET/LT. CHK. - A momentary-action pushbutton switch-indicator that is used to reset the logic functions. This switch has a split indicator; the top half is illuminated white for a HOLD condition (when the check conditions are not satisfied), and the bottom half is illuminated red for LT. CHK. failure.
- c. HALT/READY - A momentary-action pushbutton switch with a split indicator. When DEPRESSED, this switch places the card reader in the HOLD condition, and turns off the motor. The lower indicator indicates a "READY" condition, and is illuminated yellow. In the READY condition, the motor is up to speed and the DATA TERMINAL READY line (CD) is ON.

Additional operator controls which are located elsewhere in the reader, are as follows:

- a. BAUD RATE select switch, which is a crowbar switch located on the RECEIVER/TRANSMITTER board. In it's lowest position (position 1), baud rate is 110 baud. In the highest position (position 0), an external clock must be supplied to the reader. See Section 2.5 for other baud rates.
- b. ON-LINE/OFF-LINE toggle switch located on the rear component shelf of the reader. In the ON-LINE position, the reader will accept normal commands on the serial received data line (BB). In the OFF-LINE position, the reader accepts NO commands, and will instead function solely as a transmitting device, i.e., picking and transmitting the cards that are in the input hopper in succession, one after the other.

NOTE: OFF-LINE operation is usually reserved for test purposes, since in this condition, the reader is no longer under external control.

- c. Two potentiometers (R11 and R15) are components of the two baud rate clock oscillators, and are located at the top of the RECEIVER/TRANSMITTER board. These pots are factory adjusted, and should not be re-set unless required by some oscillator component replacement. R15, located adjacent to the crystal, controls the frequency of oscillation of the 110 baud timer. This pot is adjusted to provide a .568 millisecond/period square wave at module 7, pin 3. R11, located adjacent to the HALF/FULL duplex strap, controls the biasing of the crystal oscillator, to provide self-starting of this clock at power turn-on. It is adjusted to the middle of the range at which self-starting of the oscillator is observed at module 18, pin 6.

3.3 OPERATING INSTRUCTIONS

3.3.1 Normal Operation

Refer to Section 2.5 for typical operating conditions. Note, reader interface connector pin assignments are those as specified for terminal equipment in the EIA Standard. As a result, the card reader will interface to modem-type equipment directly, using a one-to-one cable. If interfacing is desired between the reader and other terminal-type equipment, care must be taken to guarantee that output lines from the reader drive only input lines to the terminal, and vice-versa. That is, certain cross-over pin connections between reader and terminal will be required. Furthermore, it must be noted that if the terminal or other device to which the reader is interfacing does not have the ability to turn ON CLEAR TO SEND, in response to a reader REQUEST TO SEND, that pins 4 and 5 at the reader interface connector (J3), must be tied together.

3.3.2 Mispicks

Refer to reader manual for description of correction of mispick problem. If mispick occurs, motor will shut-off, READY light will extinguish, and DATA TERMINAL READY line (CD) will go OFF. After correction of problem, when RESET switch is depressed, reader will again become "READY", but DC1 or DC3 command must again be sent to initiate "PICK" process.

3.3.3 Loading and Unloading On-the-Fly

Refer to reader manual for a description of loading and unloading on-the-fly.

SECTION

4

PRINCIPLES OF

OPERATION

SECTION 4
PRINCIPLES OF OPERATION

4.1 GENERAL

For Principles of Operation of both the mechanics and electronics for the basic reader, refer to the reader manual. The signals which had been described as interface lines for the parallel reader in that manual, are used as inputs to, and outputs from the RS232-C interface, whose operation will be described in this section.

4.2 EIA LEVELS AND IMPEDANCES

The EIA voltage levels and impedances which are present at the interface connection J3 are as follows:

For the transmitted data line (BA), with a 3K ohm termination, a mark will typically measure -6.0 volts with respect to signal ground (AB). A space will typically measure +6.0 volts with respect to (AB).

For the request to send line (CA), and the data terminal ready line (CD), both with 3K ohm terminations, the ON level will typically measure +6.0 volts with respect to (AB), and the OFF level will typically measure -6.0 volts with respect to (AB). For the input lines to the card reader, from the data communications equipment, or from the terminal, the input resistance will range between 3K ohms and 7K ohms, and each line can withstand ± 25 volts.

For the card reader received data line (BB), from either the terminal or the modem, a mark is defined as any voltage more negative than -3.0 volts (not to exceed -25 volts) with respect to (AB); a space is defined as any voltage more positive than +3.0 volts (not to exceed +25 volts) with respect to (AB).

For the clear to send line (CB) and the carrier present line (CF), the ON level is defined as any voltage more positive than +3.0 volts (not to exceed +25 volts) with respect to (AB), the OFF level is defined as any voltage more negative than -3.0 volts (not to exceed -25 volts) with respect to (AB).

<u>Notation</u>	<u>Interface Voltage</u>	
	<u>Negative</u>	<u>Positive</u>
Binary State	1	0
Signal Condition	MARK	SPACE
Function	OFF	ON

4.3 GENERAL TRANSMISSION FORMAT

On the data interface lines, transmitted data (BA) and received data (BB), if no parity is chosen, all data characters will be composed of: (a) one start bit (space), (b) followed by 8 ASCII data bits, LSB first; (c) followed by one stop bit (mark). One stop bit will be supplied at all baud rates except 110 baud. At 110 baud, 2 stop bits will be supplied. If either odd, even or marks parity is chosen, all data characters will be composed of: (a) one start bit (space); (b) followed by 7 ASCII data bits; (c) followed by 1 parity bit; (d) followed by one or two stop bits as above. In marks parity, the parity bit is always a mark (negative voltage). The data interface lines will remain in the marking mode when no data is being exchanged.

The transmission format of the transmitted data line (BA), for each card read and transmitted, or for each card retransmitted will be: first, LINE FEED; second, a variable record length of card data from 1 to 80 characters in length with trailing zeros (blanks in card data field) suppressed; third, CARRIAGE RETURN; and fourth, in the event that the card read is the last card in the deck, END OF TRANSMISSION (EOT).

4.4 OPERATION OF BASIC RS232-C INTERFACE

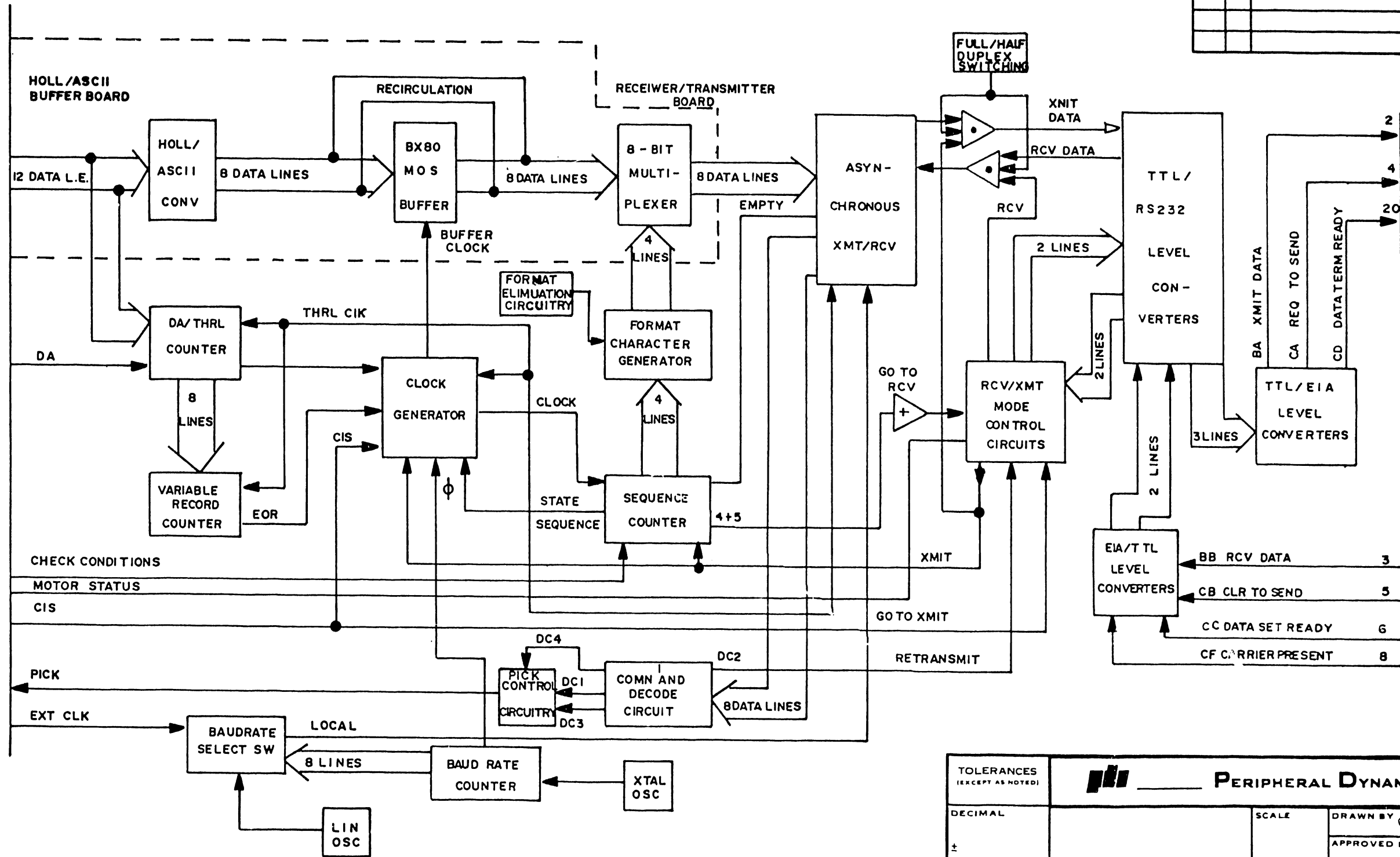
This subsection describes the operation of the basic RS232-C interface, which includes the operation of the RECEIVER/TRANSMITTER board, and the operation of the HOLLERITH/ASCII BUFFER board.

A block diagram of the RS232-C interface is shown in Figure 4-1, and should be referred to for ease in understanding the text.

The serial RS232-C interface is designed for use with either PDI's punched card OR optical mark sense card readers, and may be added as an integral part of the electronics package in either reader. Nine separate baud rates are internally selectable, with provision for an external clock input. Both the receiver and transmitter sections of the interface must be operated at the same baud rate. The internally selectable baud rates are derived from a 921.6 KHz crystal-controlled TTL oscillator, which is counted-down to derive the various baud rate clocks from 150 baud to 4800 baud. The 110 baud clock is derived from a separate 1.76 KHz square wave oscillator, whose frequency is pot-adjustable. Serial word length will be composed of 1 start bit, 8 character bits, or 7 character bits + parity, and 1 stop bit (except on 110 baud, where 2 stop bits are provided). Parity is strap-selectable (odd, even, none, or marks).

Typical operation of the serial RS232-C interface is as follows: When the card reader is turned on, or the reset button is pushed, the reader is placed in pick-on-command mode, and the interface is placed in the receive mode. When the card reader motor comes up to speed (CHECK CONDITIONS line is low), the interface will turn on the DATA TERMINAL READY line (CD) and light the READY lamp. When the CARRIER PRESENT line (CF) from the communications equipment goes on, the RECEIVED DATA line (BB) will be enabled, and the interface, in the receive mode, will search for either of three serial words (either a single pick command (DC1 - octal 021), a retransmit command (DC2 - octal 022) or a continuous-pick command (DC3 - octal 023)).

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



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DECIMAL	SCALE	DRAWN BY CCJ/r	
±		APPROVED BY	
FRACTIONAL	TITLE		
±	SIMPLIFIED BLOCK DIAGRAM RS232-C FULL/HALF DUPLEX		
ANGULAR	DATE	DRAWING NUMBER	
±	4-16-78	3-1138-1960-1	

If a pick command DC1 is received, a card is picked and read, a Hollerith to ASCII conversion is performed on the data, and the ASCII card data is clocked into the buffer storage register by the card reader \overline{DA} pulses.

As the card is being read on a column-by-column basis, the input Hollerith data lines are monitored, the individual data column count is recorded by the DA/TRHL counter, and the variable record counter is updated by the DA/THRL counter, to reflect the last card column in which punched or written data is detected. If less than 80 \overline{DA} pulses are recorded, as would be the case in the 40-column mode with the mark sense reader, the additional buffer clock pulses required to place the card data in the correct buffer locations are supplied at 115 KHz, by the shift clock generator, at the trailing edge of the card. Once the complete card has been read (at the trailing edge of \overline{CIS}), the RCV/XMT FF is placed in the transmit mode, the buffer is placed in the recirculation mode, and the REQUEST TO SEND line (CA) is turned on, if the CLEAR TO SEND line (CB) is off (request to send cannot be turned on with clear to send on). Up to this point in time, the sequence counter, a 6-stage shift counter which controls the transmission sequence, has remained in the 0-state. This counter is used to control an 8-bit multiplexer which feeds the parallel inputs to the transmitter. When the CLEAR TO SEND line (CB), from the data communications equipment, is turned on, the sequence clock generator indexes the sequence counter to state 1, in which state, the multiplexer will load the LINE FEED character (octal 012) into the transmitter holding register, under the direction of the transmitter holding register clock generator. If the transmitter register is empty, the line feed character is automatically transferred from the transmitter holding register into the transmitter register, and is serially transmitted, LSB first, on the TRANSMITTED DATA line (BA), with start, stop and parity (if selected) bits added.

When the transmitter holding register is emptied of the line feed character, the sequence counter is indexed to state 2, which allows the multiplexer to connect the outputs of the buffer storage register to the inputs of the transmitter holding register. The buffer is then emptied into the transmitter by the transmitter holding register clock generator (THRL clk. gen.). The THRL clk. gen. in state 2, is under the control of the variable record counter, which decrements to allow transmission of the buffer data up to the last card column in which punched or written data was detected.

At the same time (state 2) in which buffer data is being transmitted, it is also being recirculated in the buffer, to allow the data to again be available in the event of a retransmission request. Any additional clock pulses which may be necessary to place the information in the correct buffer location, as a result of the trailing zero suppression, are supplied by the THRL clock generator, at 115 KHz, under the control of the DA/THRL counter.

When all of the buffer data has been transmitted, and recirculated back to its correct buffer locations, the sequence clock generator indexes the sequence counter to state 3. In state 3, the multiplexer will load the CARRIAGE RETURN character (octal 015) into the transmitter holding register, with the THRL clock generator. When the carriage return character has been transferred into the transmitter register, and is in the process of being transmitted, the sequence clock generator will index the sequence counter to state 4. In state 4, the CHECK CONDITIONS line will be interrogated to determine if the previous card had been the last card in the deck, and if the motor has shut down.

If the last card has been read, the multiplexer will load the EOT character (octal 004) into the transmitter holding register, with the THRL clock generator. When the EOT character has been transferred from the transmitter holding register to the transmitter register, and is in the process of being transmitted, the sequence clock generator will index the sequence counter to state 5. In state 5, the interface will wait until the stop bit of the EOT character has been transmitted, then will return the RCV/XMT FF to the receive mode.

Since, as stated above, the last card in the deck has been transmitted, and the interface is back in the receive mode, a delay will be initiated, during which the interface will wait for a retransmit command for the last card. This delay will be approximately .7 seconds. At the end of this delay, if no retransmit command has been decoded, the data terminal ready line (CD) will be turned OFF, and the READY lamp will be extinguished.

If, however, when the CHECK CONDITIONS line was interrogated in state 4, the motor was not shut down, and there still remained additional cards to be read in the input hopper; the interface would go to the receive mode, the sequence counter would be set back to state 0, and in half duplex, the REQUEST TO SEND line (CA) would be turned OFF, as soon as the stop bit for the carriage return character had been transmitted. (In full duplex, once turned ON, REQUEST TO SEND stays ON, until DATA TERMINAL READY goes OFF.) The interface would then begin again to search for a new pick command (DC1), for a retransmit command (DC2) or for a continuous-pick command (DC3). If a new pick command is received, the sequence would start again, and proceed as stated above. If, however, a retransmit command (DC2) were decoded, the interface would immediately go to the transmit mode, turn on the REQUEST TO SEND line (CA), in half duplex, and repeat the sequence of transmitting, first LINE FEED, then the DATA READ from the previous card, then CARRIAGE RETURN, finally returning again to the receive mode. In this manner, the previous card's data may be retransmitted as many times as desired.

If anytime during operation, the reader decodes a continuous-pick command (DC3), the reader will commence to pick, read and transmit card data continuously. That is, the pick and transmission cycle as described above, for the DC1 command, would be repeated continuously without further commands to the reader until either: The input hopper empties, the output hopper fills, the front panel HALT button is depressed, or the reader receives a DC4 continuous-shut off command. If a DC4 is received, the reader will complete the transmission of the last card read, will then terminate the continuous-pick mode, and again enter the pick-on-command mode. As mentioned previously, this type of DC3/DC4 toggling, for bursts of continuous picking should only be employed in full duplex operation, since in half duplex, continuous-pick, the reader will be in receive mode, only for short periods during the read cycle. This may not allow enough time, especially at the lower baud rates, to properly process an incoming DC4 command. In half duplex mode, if DC3 is employed for continuous picking, this mode of operation should be maintained until the entire deck is read, or the HALT button is depressed.

If, when a pick command is received, or if the reader is in continuous-pick mode, either a mispick or a card jam occurs, the motor will shut down, the data terminal ready line (CD) will be turned off, and the READY lamp will be extinguished. The trouble must then be cleared, and the reset button pushed to restart the motor and place the reader in a ready condition. When the reset button is pushed, under these circumstances, the reader will be placed in pick-on-command mode. The reader must then be sent a new DC1 or DC3 command to commence picking.

A test switch is provided on the back component shelf of the reader for OFF-LINE testing. The two switch positions are labelled "ON-LINE" and "OFF-LINE". For normal ON-LINE operation, whereby the reader will respond to the DC1, DC2,

DC3, and DC4 commands on the RECEIVED DATA line (BB), this switch must be in the ON-LINE position. In the OFF-LINE switch position, the reader will not respond to any commands; it will, however, proceed to pick and transmit the entire deck, in its normal format, as soon as the reader is placed in the READY state (motor up to speed, hopper switches not activated), and pin 4 (REQUEST TO SEND) is shorted to pin 5 (CLEAR TO SEND) on the J3 connector. This OFF-LINE switch position is useful for monitoring the transmission capabilities of the reader for test purposes. It must be remembered, however, that for the reader to function in its normal mode of picking or retransmitting on command, that this test switch be placed in the "ON-LINE" position.

4.5 READER CODES

The PDI automatic readers employ two standard codes for reading and communications. Cards that are to be read must conform to American National Standard ANSI X 3.26-1970 Hollerith punched card code (see Figure 4-2 for Hollerith code). Card data as read is converted to American Standard Code for Information Interchange extended to 8 bits (ASCII-8). All communications take place using the ASCII Code (see Figure 4-3 for ASCII Code). Other communications codes, such as EBCDIC, Compressed Hollerith, and Binary Image are available as options.

4.6 STRAPPING FUNCTIONS

For user convenience, straps are provided on the RECEIVER/TRANSMITTER board, which will allow elimination or inclusion, of any or all of the standard formatting characters; that is, LINE FEED, CARRIAGE RETURN, and EOT. In addition, straps allow an interchange of functions of the DC3 and DC4 command decoders, and allow trailing blanks suppression to be included or eliminated in the transmission of card data. These, and the functions of the other straps contained on the boards are shown in Figure 4-4.

	12				12	12		12	12				12	12		12	
		11				11				11				11		11	
			0		0			0					0		0		
	&	-	∅	SP	{	'	}	11/10	10/8	11/1	11/9		12/3	12/10	13/1	13/8	8-1
1	A	J	/	1	a	j	~	13/9	SOH	DC1	8/1	9/1	10/0	10/9	9/15	11/11	9 -1
2	B	K	S	2	b	k	s	13/10	STX	DC2	8/2	SYN	10/1	10/10	11/2	11/12	9 -2
3	C	L	T	3	c	l	t	13/11	ETX	DC3	8/3	9/3	10/2	10/11	11/3	11/13	9 -3
4	D	M	U	4	d	m	u	13/12	9/12	9/13	8/4	9/4	10/3	10/12	11/4	11/14	9 -4
5	E	N	V	5	e	n	v	13/13	HT	8/5	LF	9/5	10/4	10/13	11/5	11/15	9 -5
6	F	O	W	6	f	o	w	13/14	8/6	BS	ETB	9/6	10/5	10/14	11/6	12/0	9 -6
7	G	P	X	7	g	p	x	13/15	DEL	8/7	ESC	EOT	10/6	10/15	11/7	12/1	9 -7
8	H	Q	Y	8	h	q	y	14/0	9/7	CAN	8/8	9/8	10/7	11/0	11/8	12/2	9 -8
9	I	R	Z	9	i	r	z	14/1	8/13	EM	8/9	9/9	NUL	DLE	8/0	9/0	9-8-1
8-2	[	]	\	:	12/4	12/11	13/2	14/2	8/14	9/2	8/10	9/10	14/8	14/14	15/4	15/10	9-8-2
8-3	.	\$	,	#	12/5	12/12	13/3	14/3	VT	8/15	8/11	9/11	14/9	14/15	15/5	15/11	9-8-3
8-4	<	*	%	@	12, ;	12/13	13/4	14/4	FF	FS	8/12	DC4	14/10	15/0	15/6	15/12	9-8-4
8-5	(	)	_	'	12/7	12/14	13/5	14/5	CR	GS	ENQ	NAK	14/11	15/1	15/7	15/13	9-8-5
8-6	+	;	>	=	12/8	12/15	13/6	14/6	SO	RS	ACK	9/14	14/12	15/2	15/8	15/14	9-8-6
8-7	!	^	?	"	12/9	13/0	13/7	14/7	SI	US	BEL	SUB	14/13	15/3	15/9	15/15	9-8-7

1 may be "1"

2 may be "7"

NOTE: The entries of Form A/B refer to the column/row assignments of the unassigned locations in the right hand side of the ASCII Table (bit E₈ = 1) designated for specialist use (See National Bureau of Standards Technical Note No. 478)

HOLLERITH CODE

Figure 4-2

<u>STRAP</u>	<u>NAME</u>	<u>CONNECTION</u>	<u>FUNCTION</u>
A	Control	A-Open (Standard)	- (not used) Reserved for elimination of data transmission, following the detection of a control character.
B	Stop Bits	B-Open	- Provides 2 stop bits at all baud rates.
		B-1	- Provides 1 stop bit at all baud rates.
		B-2 (Standard)	- Provides 2 stop bits at 110 baud, 1 stop bit at all other baud rates.
C	Full/Half Duplex	C-1	- Full duplex operation.
		C-2	- Half duplex operation.
D	Continuous-Off Decode	D-1 (Standard)	- DC4 provides continuous-off function.
		D-2	- DC3 provides continuous-off function.
E/O	Parity	E-1	- NO Parity
		E-2 } -	- EVEN Parity
		0-1 } -	
		0-1 } -	
		0-2 } -	- ODD Parity
F	Continuous-Off Control	F-1 (Standard)	- Permits DC3/DC4 to control continuous-off function.
		F-2	- (not used) Reserved for external continuous-off-control.
G	Continuous-On Control	G-1 (Standard)	- Permits DC3/DC4 to control continuous-on function.
		G-Open	- (not used) Reserved for external continuous-on control.
H	Marks Parity	H-1	- Permits E/O parity strapping to generate ODD-EVEN-NONE parity.
		H-2	- Generates MARKS parity, in conjunction with C-GND jumper on Hollerith/ASCII Buffer board.
J	Continuous-On Decode	J-1 (Standard)	- DC3 provides continuous-on function.
		J-2	- DC4 provides continuous-on function.
K	Zero Suppression	K-1 (Standard)	- Permits trailing blanks in the card data field to be suppressed.
		K-Open	- Transmits 80 characters of data regardless of the data field content.

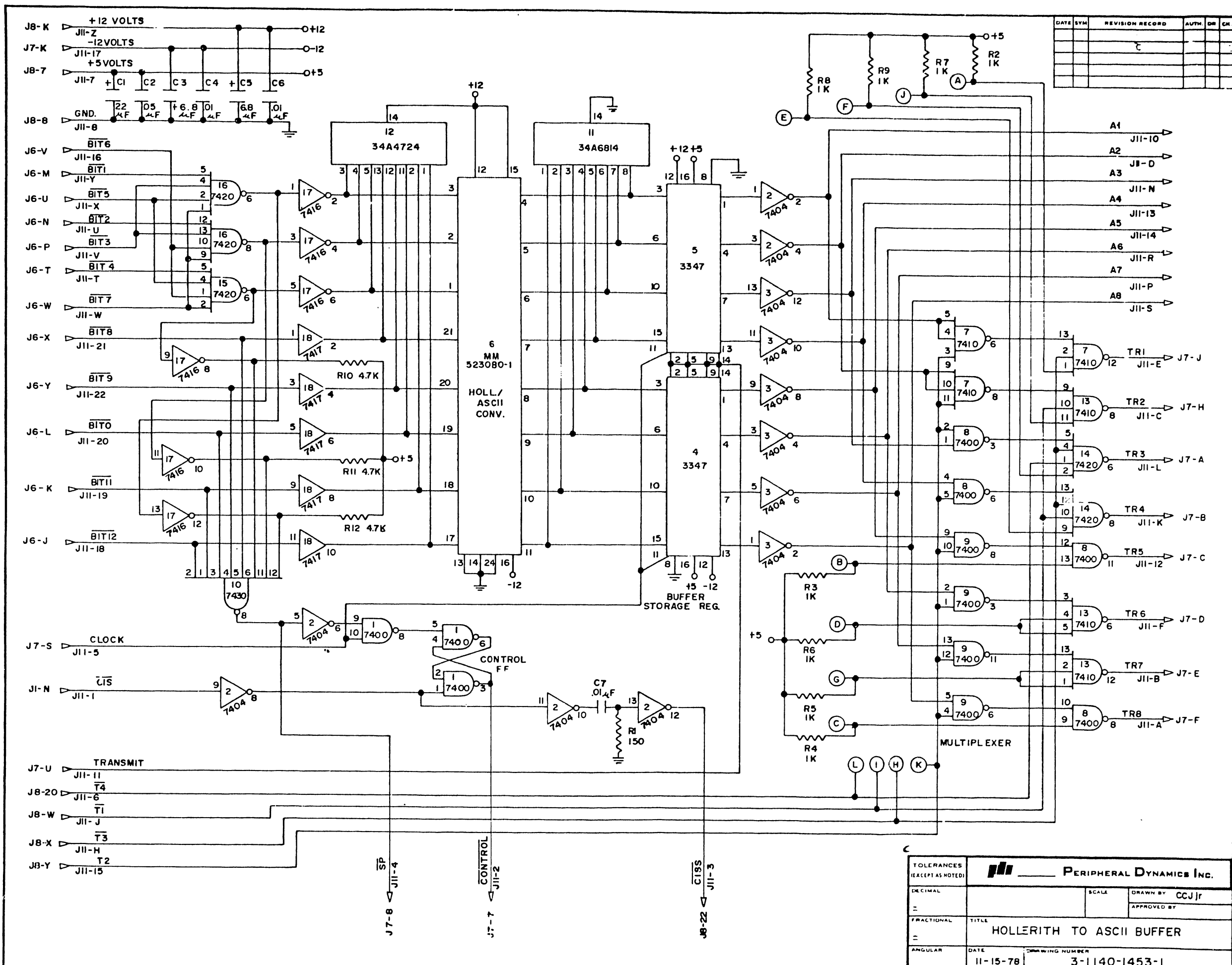
STRAPPING FUNCTIONS

Figure 4-4

L	Ready Control	L-1	- Permits card reader CHECK CONDITIONS line to control DATA TERMINAL READY output.
		L-2 (Standard)	- Permits card reader MOTOR STATUS line to control DATA TERMINAL READY output.
M	Format Control	M-1 (Standard)	- Disables format elimination jumpers and allows reader to transmit standard format characters (LF, CR and EOT) for card data transmission.
		M-2	- Permits format elimination jumpers to function, thus eliminating one or more format characters.
N/S	Format Elimination	N-All	- This jumper in conjunction with M-2 jumper eliminates all format characters, such that only data characters are transmitted.
		N-LF	- This jumper in conjunction with M-2 jumper eliminates the LF preamble character.
		N-CR	- This jumper in conjunction with M-2 jumper eliminates the CR post-amble character.
		N-EOT	- This jumper in conjunction with M-2 jumper eliminates the EOT character for the last card in the deck.
		N-LF S-CR	- These jumpers in conjunction with M-2 jumper eliminates both LF and CR characters.
P/R	Carrier/Ready	P-Open (Standard)	- These jumpers are not used, but are reserved such that when jumpered together, the DATA TERMINAL READY output line is controlled by the CARRIER PRESENT INPUT.
		R-Open (Standard)	

STRAPPING FUNCTIONS

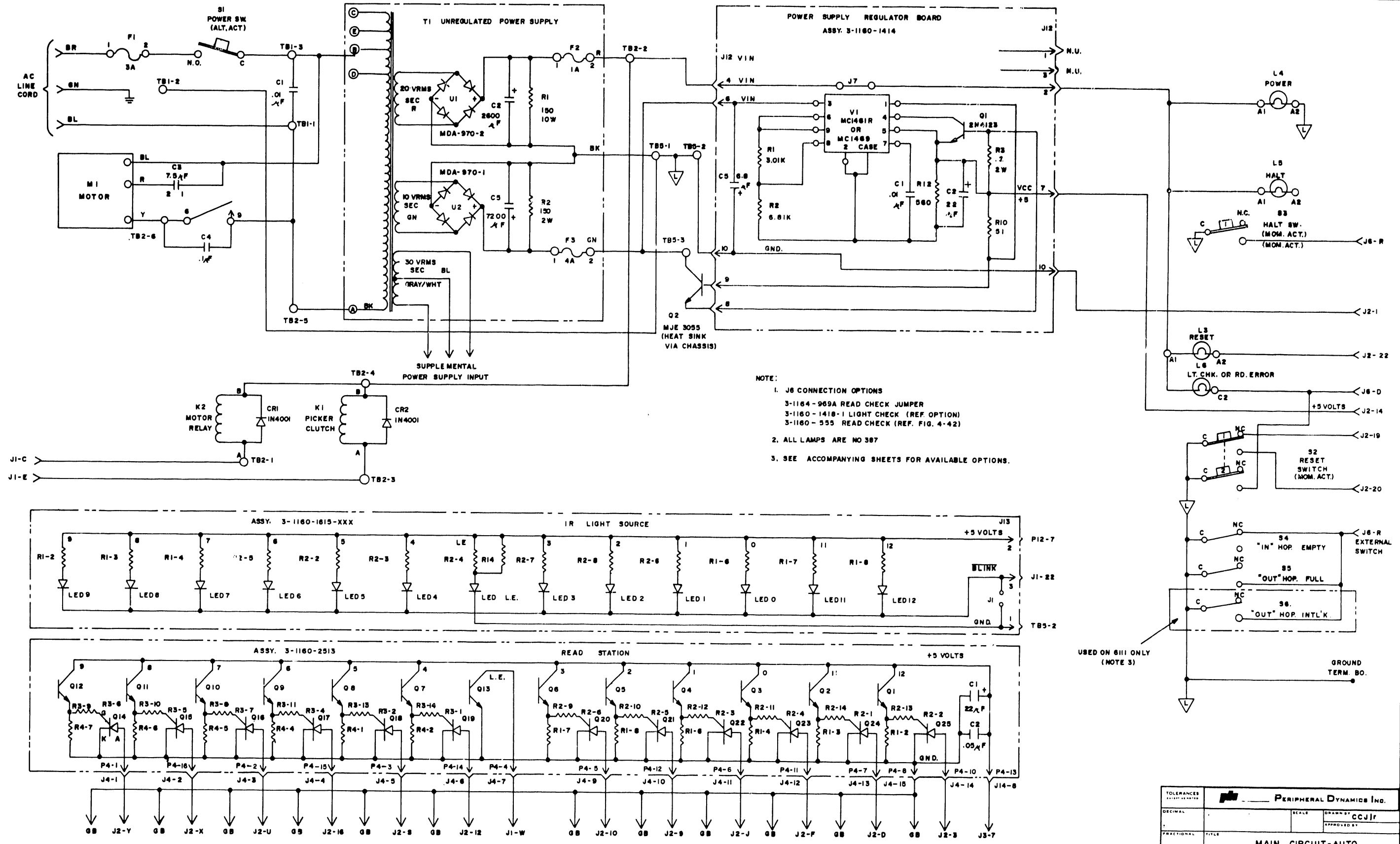
Figure 4-4



DATE	SYM	REVISION RECORD	AUTH	DR	CK

TOLERANCES (EXCEPT AS NOTED)		PERIPHERAL DYNAMICS INC.	
DECIMAL		SCALE	DRAWN BY CCJjr
FRACTIONAL			APPROVED BY
ANGULAR		TITLE	HOLLERITH TO ASCII BUFFER
	DATE	DRAWING NUMBER	
	11-15-78	3-1140-1453-1	

REV	DATE	REVISION RECORD	AUTH	BY	CR



NOTE:

- J6 CONNECTION OPTIONS
 3-1184-989A READ CHECK JUMPER
 3-1180-1418-1 LIGHT CHECK (REF. OPTION)
 3-1180-555 READ CHECK (REF. FIG. 4-42)
- ALL LAMPS ARE NO 387
- SEE ACCOMPANYING SHEETS FOR AVAILABLE OPTIONS.

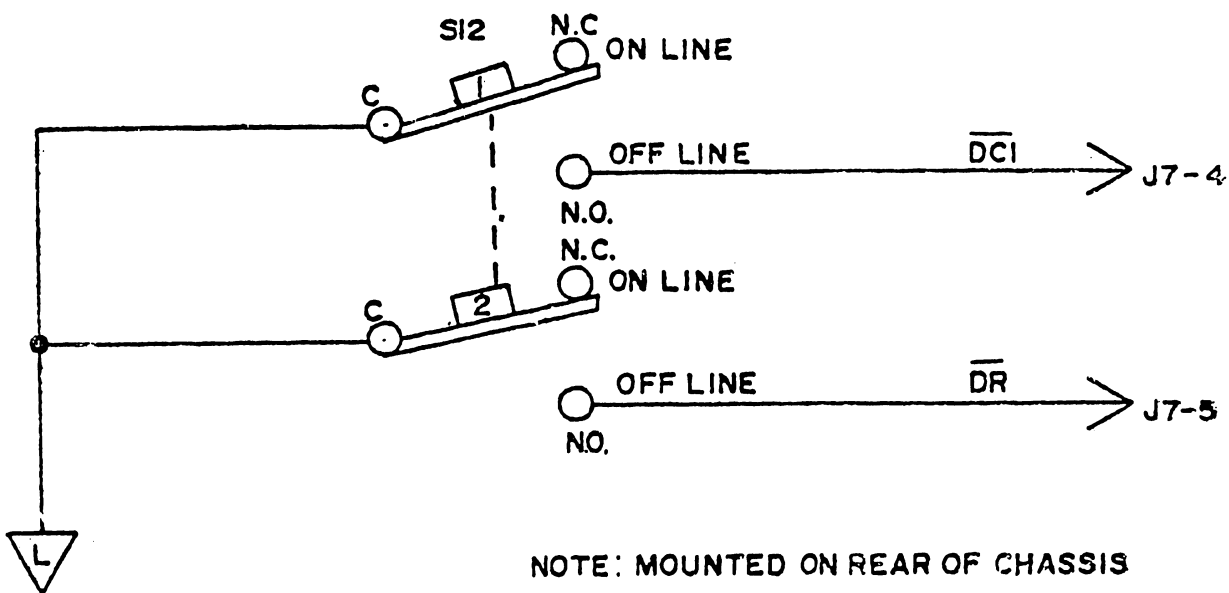
USED ON 8111 ONLY (NOTE 3)

TOLERANCES UNLESS OTHERWISE SPECIFIED		PERIPHERAL DYNAMICS INC.	
DECIMAL	SCALE	DRAWN BY CCJ/r	
FRACTIONAL	TITLE	APPROVED BY	
ANGULAR	DATE	DRAWING NUMBER	
	12-26-79	3-1140-2684	
MAIN CIRCUIT-AUTO			

FIGURE 4-6 4-15

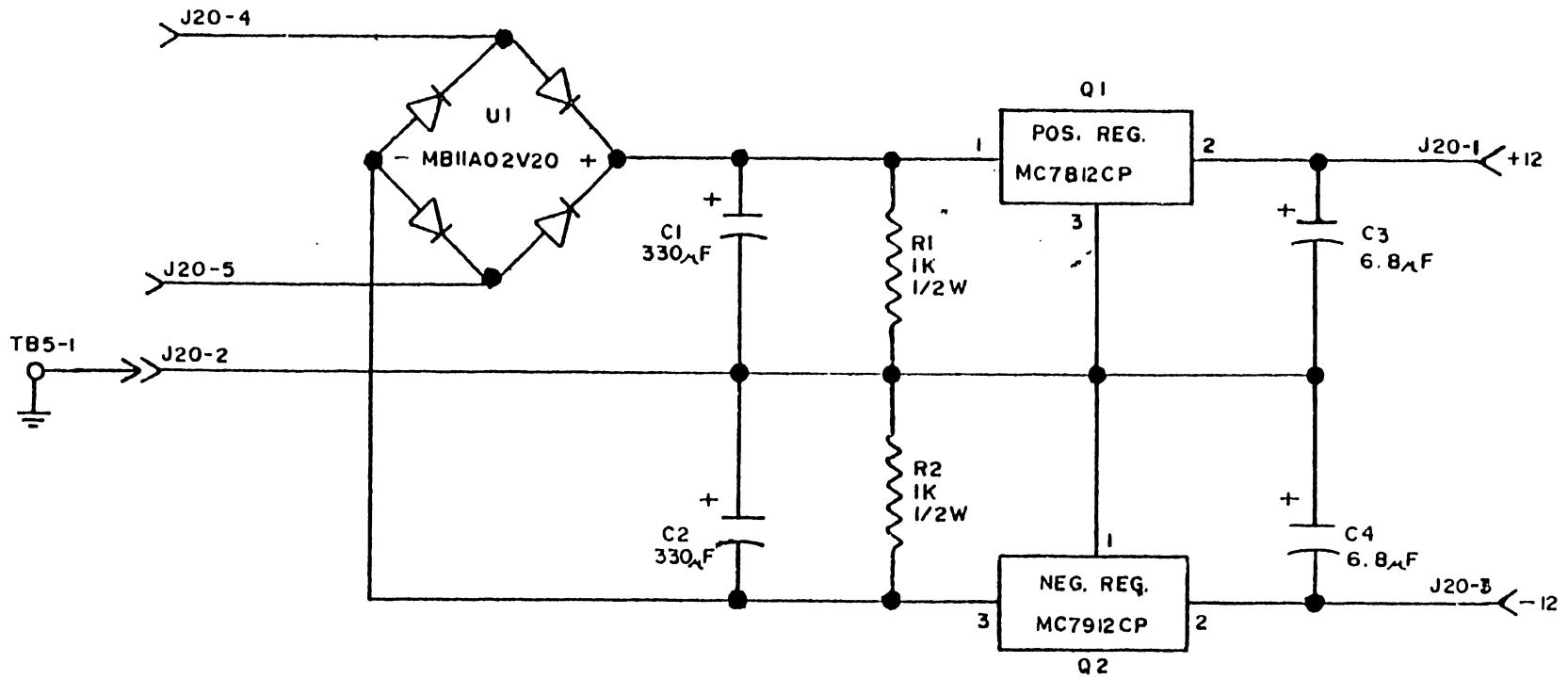
ON LINE-OFF LINE SWITCH OPTION

RS232-C READER



NOTE: MOUNTED ON REAR OF CHASSIS

FOR TRANSMIT ONLY OPTION:
S121-C JUMPER TO S121-NO
S122-C JUMPER TO S122-NO



± 12 VOLT POWER SUPPLY

ASSY. 3-1160-1979



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