COMPUTER PERIPHERALS INC.

805/806 READER/PUNCH

(684 NCR)

TRAINING MANUAL

PRELIMINARY MANUAL

RECORD of REVISIONS

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Address comments concerning this manual to:

Computer Peripherals, Inc.
Technical Publications
2621 Van Buren Avenue
Norristown, Penna. 19401

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PREFACE

This manual contains a general description, operating instructions, and a detailed explanation of the principles of operation pertinent to the Reader/Punch. The manual has been prepared as a training guide and as a reference for field service personnel. Two associated documents complete the manual set; i.e., the Field Service Manual 49760000 which contains installation, checkout, and maintenance information and the Parts Data Manual 49761000 which contains all necessary parts data.

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SECTION I

GENERAL DESCRIPTION

Section I - GENERAL DESCRIPTION

1-1. INTRODUCTION

This section contains basic specification information plus a general and physical description of the Reader/Punch Unit.

1-2. GENERAL DESCRIPTION

The Reader/Punch (Figure 1-1) is a data system, input/output peripheral device, When placed in the 'read' mode, the read elements of the unit sense the presence or absence of data indicative holes, as previously punched on tabulating cards, and inputs this data to a controller unit. The controller may be externally located or can be provided as an internally contained (optional) sub-unit. During read operations, data cards are processed at a maximum rate of 500 cpm.

When placed in the 'punch' mode, the punch elements of the unit are activated and blank data cards are punched in accordance with controller issued instructions. The unit punches a full 80 columns of data at a rate of 100 cpm. This rate increases in inverse proportion of columns to be punched to number; i. e., maximum rate of 460 cpm for single column punch.

Data cards are transported to both the read and punch stations via a common, entrain, transport mechanism. This mechanism consists of five card stations as reflected by Figure 1-2; i. e., read ready, read, punch ready, punch, and routing. Card decks are inputted via a hopper feeder and processed cards are collected, in input order, by a stacker tray. Regardless of the mode of operation; i. e., read or punch, the cards are moved through the several stations in the order previously described. Control logic circuits, responding to controller instructions, direct the selection and timing of the read or punch operation. Data read from a card is output in row parallel/column serial format to the interface connector in accordance with internal timing considerations.

Off-line operation of the Reader/Punch, for the purpose of performing maintenance procedures, is possible through the use of an optionally available Maintenance Board Assembly. A physical description of the

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Figure 1-1. Card Reader/Punch

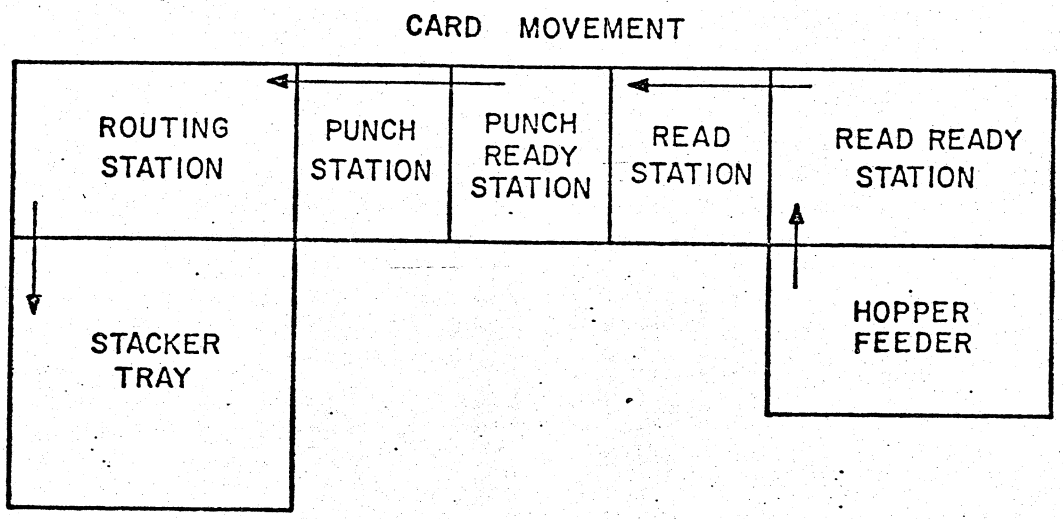

Figure 1-2. Card Flow - Hopper to Stacker

unit and related identification of major components and assemblies is provided by paragraph 1.4.

1-3. LEADING PARTICULARS

Table 1-1 lists and defines the operating characteristics and performance specifications of the Reader/Punch.

Table 1-1. READER/PUNCH SPECIFICATIONS

CHARACTERISTICS	SPECIFICATIONS
Punch Card	
Columns	80
Rows	12
Holes	Rectangular
Limitations	USA Standard X3.11-1966 USA Standard X3.21-1967
Corner Cut	0.25 inch, 0.022 - 0.008 radius
Scored and Burst Cards	Will not read scored or burst cards that emit light within the normal field of punching.
Hole Density	960 per card
Card Processing Rate	
Read Mode	500 cpm
Punch Mode	100 cpm punching 80 columns 460 cpm punching column 1 only.
Card Velocity	125 in/sec nominal at Read Station.
Read Method	Serial by column, using phototransistor light sensing, performs light/dark check between each card for proper phototransistor operation. Read recheck error detection logic is optional.
Punch Method	Single column, solenoid operated interposer punching. Echo monitoring error check (optional).
Physical Dimensions	
Height	48.5 inches (123.1 centimeters)
Width	33.0 inches (83.8 centimeters)
Depth	27.5 inches (69.6 centimeters)
Weight	515 pounds (233 kilograms)

Table 1-1. READER/PUNCH SPECIFICATIONS (Cont'd)

CHARACTERISTICS	SPECIFICATIONS
Environmental	
Temperature: (Operating)	60° F to 90° F (with a maximum gradient of 0.2° F per minute).
(Non-Operating)	-30° F to 150° F (with a maximum gradient of 20° F per hour).
Humidity: (Operating)	26% to 75% RH (no condensation)
(Non-Operating)	5% to 95% RH (no condensation)
Altitude: (Operating)	1000 feet below sea level to 8,000 feet above sea level.
(Non-Operating)	1000 feet below sea level to 15,000 feet above sea level.
Heat Dissipation	2380 BTU/HR (maximum)
Electrical	
Primary Input Power	$60 \begin{smallmatrix}+0.6\\-1.0\end{smallmatrix}$ Hz 120 VAC (104-127) 10 amps (maximum)
	$50 \begin{smallmatrix}+0.5\\-1.0\end{smallmatrix}$ Hz 120 VAC (104-127) 10 amps (maximum)
Connector	To be supplied by customer.
Power Cord Connection	Power cord is hard wired inside relay box by the customer. Refer to Section I of Field Service Manual.
Power Supply Voltages (Output)	+5 ± 0.25 VDC +24 ± 2.4 VDC 5 VAC 24 VAC
D. C. Ripple	± 0.5% peak to peak (maximum)

1-4. PHYSICAL DESCRIPTION

Components of the Reader/Punch (Figure 1-3) are housed within or upon a steel frame cabinet that is provided with castered rollers. The card transport mechanism is mounted along the upper rear main frame mem-

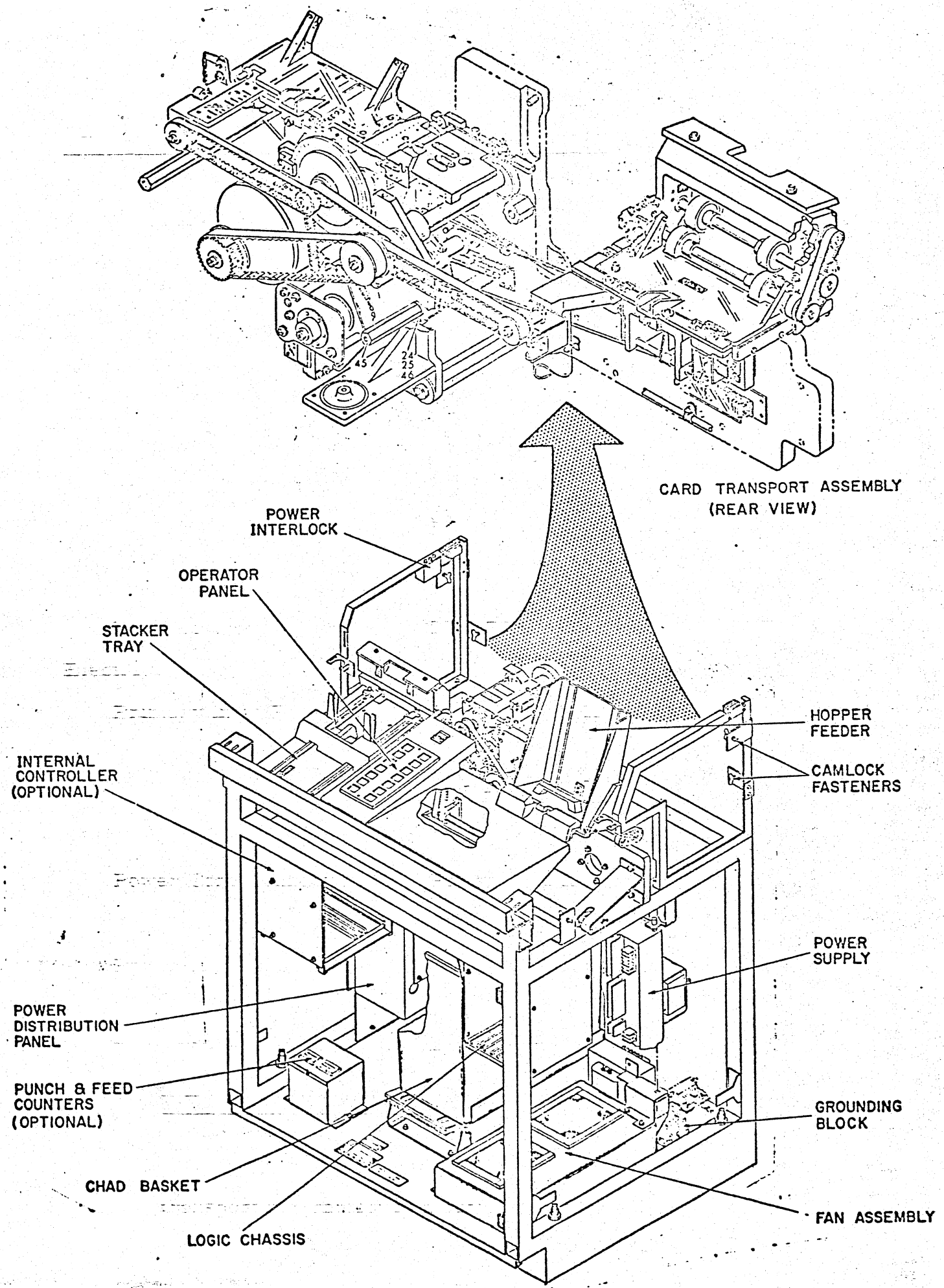

Figure 1-3. Reader/Punch - Component Location

bers and is protected by a magnetically latched life-off type decorative cover. A power interlock switch interrupts unit operation when this panel is removed during unit operation.

Side and rear decorative panels are removable via CAMLOC disconnects located on the innerside of the main frame members (transport panel removed and front access door open to gain access). The full width front access door is hinged (left side) and closes against magnetic latches. All operator controls are located upon a single panel assembly that is situated between the hopper feeder (card input) and stacker tray (card output) at the front of the unit. Control electronic circuits are provided upon plug-in type printed circuit boards contained within an internally mounted logic chassis. Figure 1-3 identifies and locates the major components and assemblies of the Reader/Punch.

1-5. DIFFERENCE DATA

The Reader/Punch is available in two options; the 806 as a Punch only unit and the 805 as a Reader/Punch unit. A controller is available in the bottom of the 805 unit. The description in this manual describes the operation of the 805 Reader/Punch. The operation of the 806 is the same except for the lack of the reader subsystem. The basic Reader/Punch is considered a 500 cpm reader and 100 cpm (80-column) punch, operating at an input frequency of 60 Hz. A 50 Hz option is available from the factory or may be modified in the field. Table 1-2 lists the assemblies necessary to modify a unit to obtain 50 Hz compatibility.

Table 1-2. 50 Hz COMPATIBILITY DATA

ASSEMBLY	PART NUMBER (50 Hz)
Pulley Assembly	49242700
Pulley Assembly	49291800
Belt Timing	92755061
Motor Assembly	49545503

Also available, with respect to both 60 Hz and 50 Hz units, are the following options:

a. Punch error checking provisions.

b. Read recheck error detection provisions.

c. Chip box missing or full - an indication provision.

d. Running time meter.

e. Maintenance PC board - a troubleshooting assist provision.

f. Isolation transformer.

g. Card counters (feed and punch)

This manual incorporates appropriate operational and theory descriptive information concerning the foregoing options.

1-6. INTERFACE CHARACTERISTICS

1-6.1 CONTROLLER REQUIREMENTS

The Reader/Punch is designed for interface adaptation to a variety of commercial digital data systems. This may be accomplished through the employment of a compatible, external controller unit or via an optionally available, internally contained controller. Specifications, describing compatible external controllers, are available upon request. For units incorporating the internal controller, the following interface data is noted:

Logic Levels are:	INPUT	OUTPUT
	Logical "1" +2 VDC min.	+2.0 VDC min.
	Logical "0" +0.7 VDC min.	+015 VDC min.

Logic Type (Controller): TTL, dual-in-line packs

Logic Load: 2.0 ma, max.

Propagation Delay: 40 na, max.

User Terminations: +5V through 1K ohm resistor at receiver

Driver Capacity: 15 feet into terminated lines

Figure 1-4 illustrates the arrangement of data transfer, control, and unit status lines that exist between the Reader/Punch and the associated controller. The relationship of the controller to the data system is reflected by Figure 1-5.

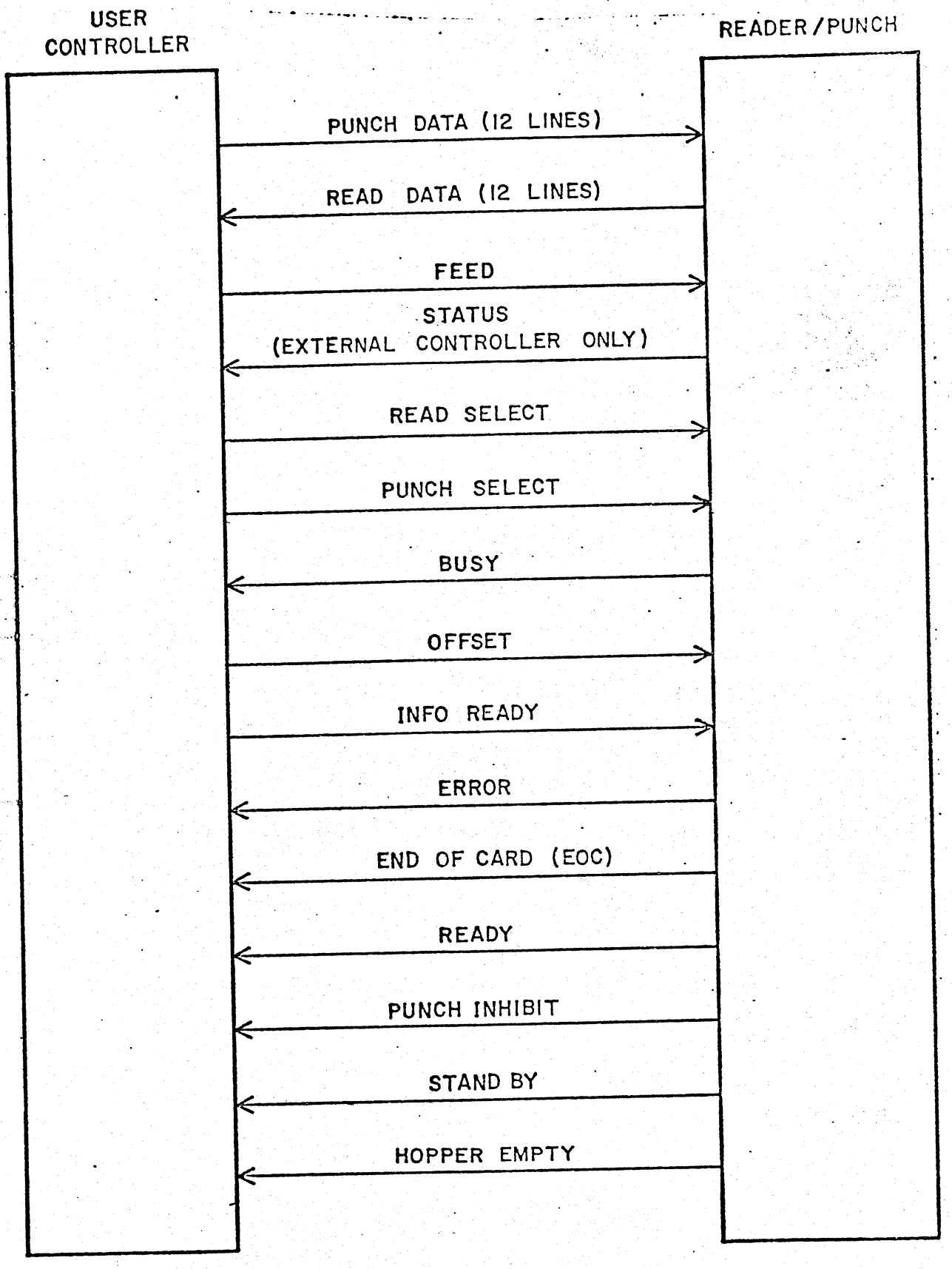

Figure 1-4. User Interface Signal Lines

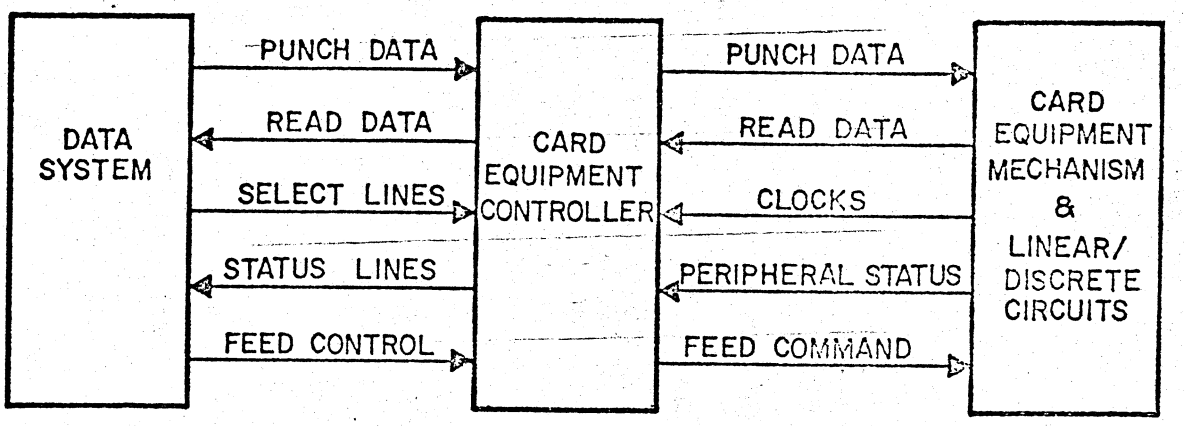

Figure 1-5. System Block Diagram

1-6.2 REQUIREMENTS INTERNAL TO READER/PUNCH

Controller inputs consist of status and timing signals derived within the Reader/Punch linear/discrete circuits, as well as the externally received command and control signals input by the data system. A description of signals, comprising the internal interface, is provided by Table 1-3.

Table 1-3. INTERNAL INTERFACE SIGNALS

ITEM	SIGNAL	FUNCTION/LEVEL/DURATION
1	Start Feed Cycle Command (1 line)	Initiates feed cycle. Logic ZERO 20 milliseconds (nominal)
2	Offset Command (1 line)	Causes a card to be 'offset' stacked. Logic ZERO 100 milliseconds
3	Punch Step Command (2 lines, used alternately)	Causes a card, positioned in the punch station, to be advanced one column. Logic ZERO 12 milliseconds

Table 1-3. INTERNAL INTERFACE SIGNALS (Cont'd)

ITEM	SIGNAL	FUNCTION/LEVEL/DURATION
4	Punch Data (12 lines)	Causes punching to occur when individual line is selected. Logic ZERO 2.2 milliseconds
5	Motor Enable (1 line)	Causes drive motor to run. AC line voltage as required.
6	Read Ready Station Acknowledge (1 line)	Indicates a card is present at the read ready station. Transition - Logic ZERO to ONE
7	Leading Edge Detector	Indicates the time for lead edge light check. Transition - Logic ONE to ZERO
8	Punch Ready Station Acknowledge (1 line)	Indicates a card is present at the punch ready station. Transition - Logic ZERO to ONE
9	Routing Station Acknowledge (1 line)	Indicates a card is present at the routing station. Transition - Logic ZERO to ONE
10	End of Card/Feed Command Acknowledge Signal	1. When signal goes from Logic ZERO to ONE, indicates the start of transport cycle. 2. If signal returns to Logic ZERO, indicates a Feed command may be executed for next card cycle. 10 milliseconds
11	Echo for Punch Strobe (1 line)	Enables synchronization of punch cycle. Transition - Logic ONE to ZERO 250 μseconds
12	Stacker Full (1 line)	Indicates a stacker full condition. Logic ZERO Duration of stacker full condition.
13	Stacker Jam (1 line)	Indicates a stacker jam condition. Logic ZERO Duration of stacker jam condition.
14	Punch Echo (Optional) (12 lines)	Indicates which of the 12 punch armatures has been restored on the previous cycle. Logic ZERO 0.5 milliseconds

Table 1-3. INTERNAL INTERFACE SIGNALS (Cont'd)

ITEM	SIGNAL	FUNCTION/LEVEL/DURATION
15	Punch Reset Strobe (1 line)	Indicates time to de-energize selected punch coils. Logic ZERO 250 μseconds
16	Stepper Strobe (2 lines)	Enables the Stepper command. Logic ZERO 250 μseconds
17	Interlock (1 line)	Indicates that cabinet lid and/or front door is open. (OPTIONAL INDICATIONS: Chip Box full or missing) Logic ZERO Duration of condition.
18	Data Signal (12 lines)	Data transmittal. Logic ZERO 450 μseconds (nominal)
19	Read Timing (1 line)	Strobes data as read into unit logic squarewave pulse train. Excursion from Logic ZERO to ONE. 22.5 microseconds 45 microseconds (16 pulses are generated for each hole, center to center).

NOTE

Pin number connections for all interface connectors are provided within Section I of the associated Field Service Manual.

SECTION II

OPERATING INSTRUCTIONS

Section II - OPERATING INSTRUCTIONS

2-1. GENERAL

Routine operation of the Reader/Punch involves only those brief procedures required to bring the unit to a powered-up status and place it in on-line operation; i.e., under control of the internal or external controller. Thereafter, the unit responds to system demands and executes read or punch operations with respect to operator loaded, tabulating cards.

A manual mode of off-line operation is possible which is strictly limited to checking the card feed and transport functions of the unit. In this mode, a single card is selected from the hopper feeder for each activation of the front panel feed switch, and is then moved through the processing stations (Figure 1-2) by successive switch closures. Procedures for indicating this mode of operation are provided by paragraph 2-3.3.

Units, equipped with the maintenance board option, are capable of executing complete maintenance routines (card processing) while operating in an off-line status. Use and operation of the maintenance board is discussed within Section II of the associated Field Service Manual.

2-2. CONTROLS AND INDICATORS

The primary controls/indicators, associated with the operation of the Reader/Punch, are located on the Operator Control Panel, paragraph 2-2.1.

Circuit breakers, used to activate primary and operating power and to provide overload protection, are covered under paragraph 2-2.2.

2-2.1 OPERATOR CONTROL PANEL (Figure 2-1)

Table 2-1 describes the function of the control switches and status indicators located on the operator control panel. All of the control switches, with the exception of the POWER switch, are of the 'no-motion' type. These switches are touch sensitive; i.e., switch is closed while finger contact is maintained - reverts to the open condition upon release. The signal level, produced by a 'no-motion' switch, is stored by internal

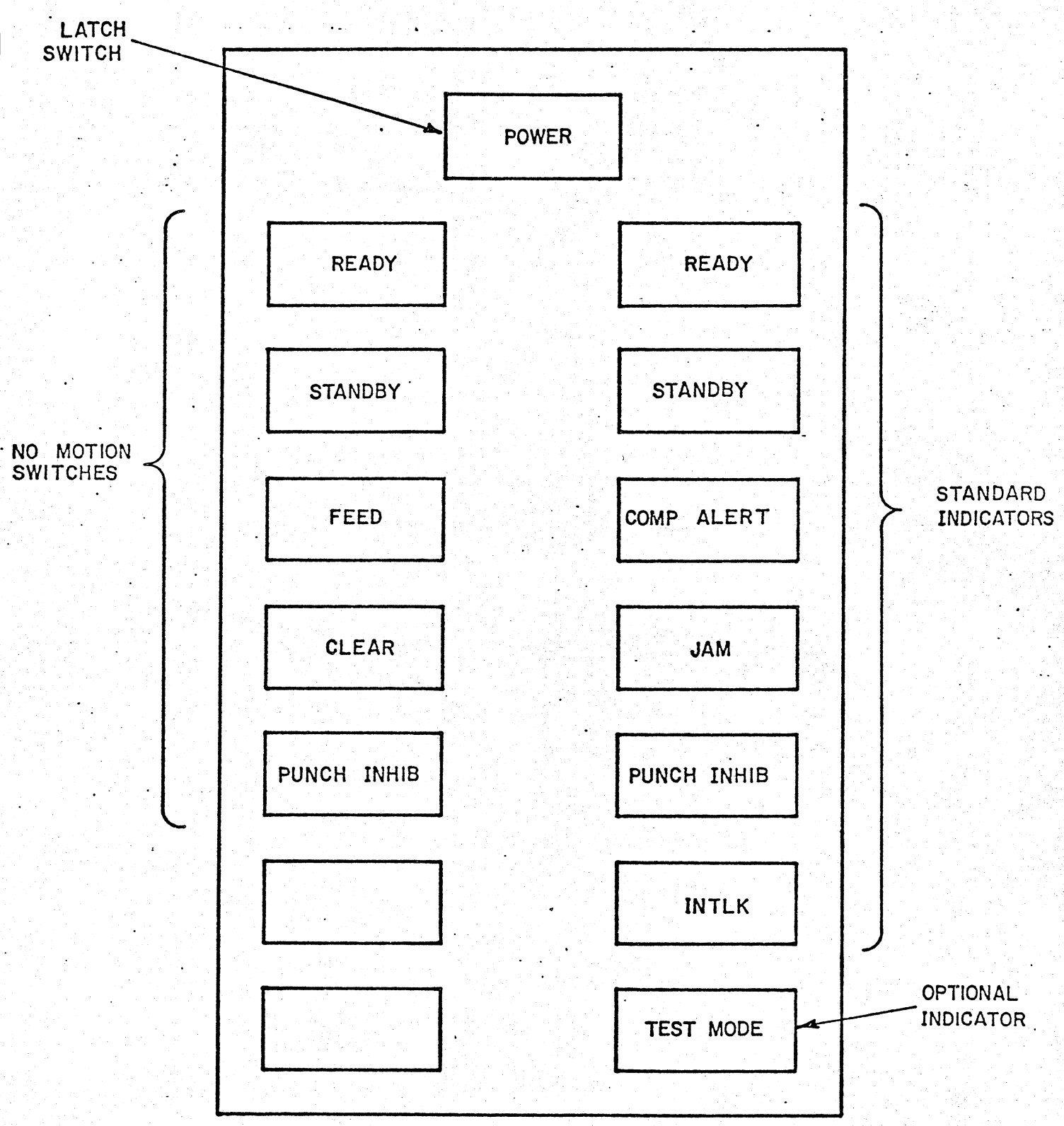

Figure 2-1. Operator Control Panel

logic, thus maintaining the required functional control. The POWER switch is a latch type control; i.e., either ON (contacts closed) or OFF (contacts open) and operates in alternate action sequence.

2-2.2 POWER CONTROL - CIRCUIT BREAKERS

Overload protection for primary power, the cooling fans, and the transport motor is provided by circuit breakers located on the Distribution Panel which is situated behind the rear cabinet access panel (right hand side when facing rear of unit). Two additional circuit breakers (on DC power supply - left rear of unit) protect the logic elements from DC overloads. The nomenclature and function of these elements is provided below:

MARKING	FUNCTION
MAIN	Opens primary power AC line (120V 50 or 60 Hz).
CTL BLWR	Opens AC line to cabinet blowers.
MTR	Opens AC line to transport drive motor.
5V	Opens 5 volt bus line to logic circuits.
24V	Opens 24 volt bus line to logic circuits.

NOTE

The foregoing circuits protective elements are generally left 'on' during periods of sustained operation.

Table 2-1. OPERATOR CONTROL PANEL SWITCH/INDICATOR FUNCTIONS

NOMENCLATURE	SWITCH FUNCTION	INDICATOR FUNCTION
POWER	'On' - Activates power generation/distribution, clears logic.	Lamp 'on' (red lens) indicates power-up status in effect (Figure 2-1).
	'Off' - Deactivates power circuits.	Lamp 'off' indicates unit powered-down.

Figure 2-1. Operator Control Panel

Table 2-1. OPERATOR CONTROL PANEL SWITCH/INDICATOR FUNCTIONS (Cont'd)

NOMENCLATURE	SWITCH FUNCTION	INDICATOR FUNCTION
READY	Establishes unit in on-line status; i.e., 'ready' to accept controller issued instructions.	Lamp 'on' (green lense) indicates completion of ready logic cycle (Figure 3-20).
	NOTE A jam condition deactivates ready lock-up, extinguishes lamp, and places READY I/O in false state.	
STANDBY	Removes unit from Ready status; establishes in 'off-line' operation (local control). Enables FEED and PUNCH INHIB switches and TEST MODE operation.	Lamp 'on' (yellow lense) indicates: 1. Power-up complete and READY not selected, or 2. STANDBY selected and READY status terminated.
FEED	Initiates single cycle card feed when unit is in STANDBY status (Figure 3-19).	No associated indicator.
CLEAR	Resets hopper empty, stacker full, and/or misfeed and jam circuits	No associated indicator; See JAM indicator, below.
	NOTE A stacker jam condition requires that the jam be cleared before 'reset' can be accomplished. (Paragraph 2-4.1)	
JAM	Indicator only.	Lamp 'on' indicates misfeed, card jam, hopper empty, or stacker full condition.
	NOTE READY I/O line drops false (logic 1) for associated conditions. Requires operator intervention (para. 2-4.1).	

Table 2-1. OPERATOR CONTROL PANEL SWITCH/INDICATOR FUNCTIONS (Cont'd)

NOMENCLATURE	SWITCH FUNCTION	INDICATOR FUNCTION
PUNCH INHIB (No motion-alternate action)	Activates punch inhibit logic that precludes inadvertent punch operation during read cycles. Unit must be in STANDBY mode to activate. I/O line goes to logic "0" in active state.	Lamp 'on' (off-white lense) indicates prohibit function is selected.
INTLK (Interlock)	Indicator only.	Lamp 'on' (yellow lense) indicates transport cover* is open or ajar and chip box missing or full. *Motor operation inhibited for cover discrepancies.
COMP ALERT (Compare Alert)	Indicator only.	Lamp 'on' (red lense) for any one or more of the following conditions: 1. Photosensor checking has detected a "Light or Dark Strobe Error". (Read-Punch or Read-Only units) 2. Optional - Read recheck Read Error occurred. Extinguishes at Read EOC. 3. Optional - Echo Check Error occurred during Punch mode. Extinguishes on next card feed.
TEST MODE (Optional)	Indicator only.	Lamp 'on' (yellow lense) whenever optional maintenance test features are activated. Unit must be in STANDBY.

2-3. OPERATING PROCEDURES

Operating procedures, as covered hereunder, should not be attempted until all installation and checkout procedures (Section I of Field Service Manual) have been satisfactorily completed.

2-3.1 POWER-UP TO STANDBY

a. Place all circuit breakers (paragraph 2-2.2) in the 'on' position.

b. Activate the front panel POWER switch.

Termination of the power-up sequence places the unit in the STANDBY mode. Observe that the POWER switch lamp illuminates upon switch activation. Approximately two to five seconds are required for completion of power circuit lock-up, at which time, the STANDBY lamp should turn 'on'.

2-3.2 CARD LOADING

Prior to loading, fan the card deck from both ends to break any bond between cards. Align cards by joggling prior to placing in the input hopper. Cards are to be loaded into the input hopper face down with nine edge toward rear. A maximum of 1200 cards can be initially loaded and can be inserted in the hopper during machine operation; however, the card weight should not be removed when card supply is less than 100 cards.

2-3.3 OFF-LINE/MANUAL FEED

This mode of operation (See Description, paragraph 2-1) is entered from the STANDBY mode.

a. Load card deck, paragraph 2-3.2.

b. Place unit in the STANDBY mode, paragraph 2-3.1.

c. Touch and release FEED switch to select and feed one card into the read ready station. Each successive control activation feeds an additional card and advances previous card(s) in order; i.e., (1) read ready to (2) punch ready to (3) output stacker.

2-3.4 ON-LINE OPERATION

This mode of operation places the unit on-line; i.e., available to respond to system demands.

a. Load card deck, paragraph 2-3.2.

b. Place unit in STANDBY mode, paragraph 2-3.1.

NOTE

If the punch inhibit function is to be selected, this must be accomplished in the STANDBY mode. Touch the PUNCH INHIB control and observe that the associated indicator lamp comes 'on'.

c. Touch READY switch. If all enable conditions are met (See Figure 3-20), the unit should cycle to the Ready mode and the first card of deck should be fed to the read ready station. The READY lamp should turn 'on'.

NOTE

Should a card already exist in the read ready station (as when previous operation was interrupted), the feed function does not occur.

2-3.5 CARD UNLOADING

Cards enter the output stacker in the same order as initially loaded into the input hopper. A maximum of 1300 cards can be stacked in the output stacker. Card feeding is stopped automatically when the output stacker is full. Cards can be removed from the output stacker during operation with the exception of the last 100 cards to be fed.

2-4. OPERATOR MAINTENANCE

Operator maintenance requirements are limited to (1) clearing card jam conditions and (2) executing general cleaning procedures after each 20-hours of continued operation. See appropriate instructions; i.e., paragraphs 2-4.1 and 2-4.2, respectively.

2-4.1 CARD JAM CLEARANCE

Premature interruption of read or punch operations may be caused by a card jam condition and should be indicated by the Operator Panel Indicator JAM lamp; i.e., lamp 'on' condition. The following procedures should be followed:

a. Press POWER switch - associated lamp should extinguish as unit assumes powered-down condition.

b. Remove lift-off dust cover that protects Transport Assembly (See Figure 1-3).

c. View all card stations to locate point of jam. Cards, caught in any of the three access doors (Figure 2-2), are generally easily removed by opening the appropriate door and lifting card free.

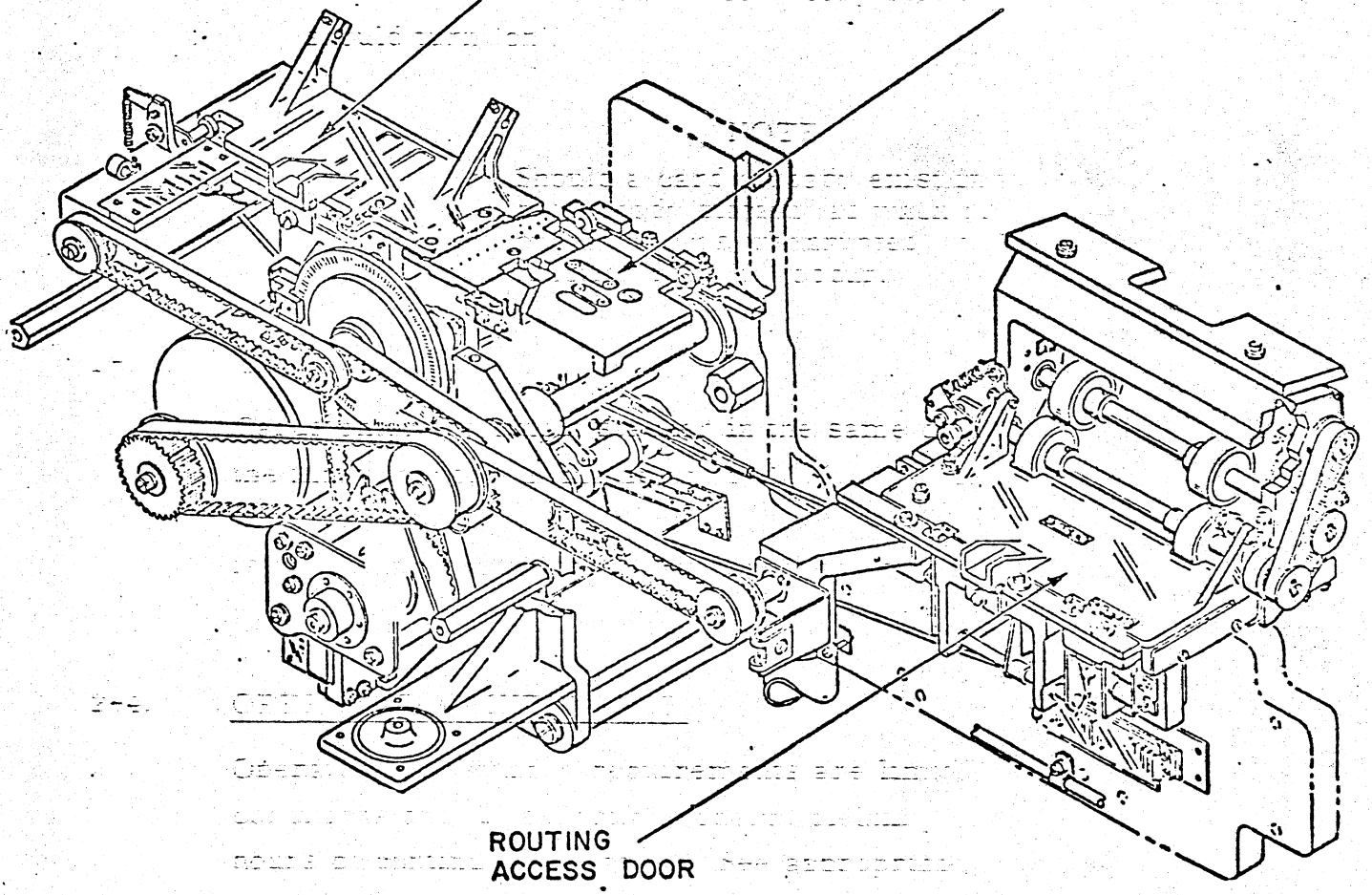

Figure 2-2. Transport Access Doors

d. Inspect punch head entrance and exit throats for evidence of internal jam. If a jam condition exists, proceed as follows:

1. Rotate punch head hand wheel (Figure 2-3) two or three revolutions to ensure that punch pins are restored.

2. Remove the Bed Assembly by unthreading the knurled release knob (captive screw) and drawing the bed rearward and free of guide flanges.

3. Grasp card at input or exit throat while lifting the punch head pinch rollers via the actuator handle (Figure 2-3). Attempt to pull free of the assembly. Should card tear during the removal process, work pieces free by passing a whole card in and out of input throat while maintaining the pinch rollers in the lifted position.

4. Replace Bed Assembly.

CAUTION

Under no circumstances should the operator place a tool or other object (with exception of another card) between punch guide and die. The special tool used for severe punch head jams is provided for authorized maintenance personnel only.

e. Inspect input hopper for evidence of card jam. If evidence exists, proceed as follows:

1. Retrieve a partially fed or jammed card by pulling rearward (gently) through the input hopper throat. Should a card tear in this process, rotate the punch head hand wheel and remove card remnants through the read ready access door.

f. Close all card access doors, Figure 2-2. Replace Transport Assembly cover and attempt a manual card feed (paragraph 2-3.3) prior to returning to ON-LINE, 'Ready'.

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Figure 2-3. Punch Head - Access Points and Controls

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Figure 2-3. Punch Head - Access Points and Controls

2-4.2 CLEANING

The following procedure should be followed after each 20-hour period of unit operation. Cleaning operations should be conducted with the unit totally powered-down; i.e., all circuit breakers in the 'off' position. Proceed as follows:

a. Remove lift-off cover from Transport Assembly and open all card access doors, Figure 2-2.

b. Use soft, nylon or camel hair brush to remove all card dust or foreign material from entire length of transport path; i.e., hopper to stacker. Ensure that photocells and the read head are completely free of dust.

c. Remove the Bed Assembly by unthreading the knurled release knob (captive screw) and drawing free of guide flanges. Clean the bed surface thoroughly using a clean, lint-free cloth.

d. Use a soft brush to remove card dust from underside of punch head.

e. Raise the punch head pinch rollers by turning actuator shaft handle (CW). With rollers raised, insert a clean card into punch head throat and remove dust and/or foreign matter.

f. Vacuum all card path areas and pan (lower bed) of the Transport Assembly.

g. Wipe stacker rails and other external surfaces clean with a clean, dry, lint-free cloth.

h. Empty chad basket, Figure 1-3.

i. Lower 'access' covers, replace punch bed and Transport Assembly, and execute a short, manual mode card run (paragraph 2-3.3) to insure operational integrity.

Figure 2-[illegible] Punch Head - Access Points and Cleaning

SECTION III

THEORY OF OPERATION

Section III - THEORY OF OPERATION

3-1. GENERAL

Information, provided by this section, describes the principles of operation for both the mechanical and the electrical functions of the Reader/Punch.

Mechanical operations are described at two levels of detail. Paragraph 3-2 (FUNCTIONAL DESCRIPTION) presents a simplified description of major assembly/component operation for the benefit of operators and non-technical personnel. Paragraph 3-3 (FUNCTIONAL ANALYSIS) covers mechanical operations through the subassembly level. Information is provided in sufficient detail to support the requirements of maintenance personnel.

Electrical functions and logic operations are covered under paragraphs 3-4 and 3-5, respectively. This information is written to the level of training or maintenance personnel familiar with this or similar equipments.

3-2. FUNCTIONAL DESCRIPTION

The Reader/Punch provides in a single unit configuration for the recovery of data (read operation) or the transcription of data (punch operation) from or upon standard 80-column cards. Unit operation is related to seven distinct functional areas of the equipment. These are represented by the following assemblies and/or components:

a. Card Transport Assembly
b. Read Station
c. Punch Station
d. Logic Chassis
e. Distribution Panel
f. Power Supply
g. Cabinet Cooling System

Items b and c are assembled to and function in-line with item a, the Card Transport Assembly. Figure 1-3 reflects the physical location of the foregoing components and/or assemblies. A brief functional description of each is carried by subordinate paragraphs.

3-2.1 CARD TRANSPORT ASSEMBLY (Figure 3-1)

Cards are fed from the input hopper and conveyed to the operation performing elements of the unit (read and punch stations) by the mechanical components of the Card Transport Assembly. Upon completion of either the read or punch operation, cards are delivered and stacked in the output stacker tray. Card motion (station-to-station, See Figure 1-2) is accomplished by such mechanical components as drive and pinch rollers, pushers, positioning arms, etc. These components are largely actuated, and their functions are timed to occur by a main camshaft that is belt-coupled to a 1/3 hp drive motor via a solenoid operated clutch. The clutch solenoid responds to logic generated commands and engages and turns the camshaft whenever card feed and transport is required. A single complete (360°) rotation of the camshaft produces the following actions:

a. The first (or next successive) card is picked from the input hopper and moved into the read ready station.

b. Any card, existing in the read ready station, is moved through the read station and into the punch ready station, regardless of selected mode; i.e., read or punch.

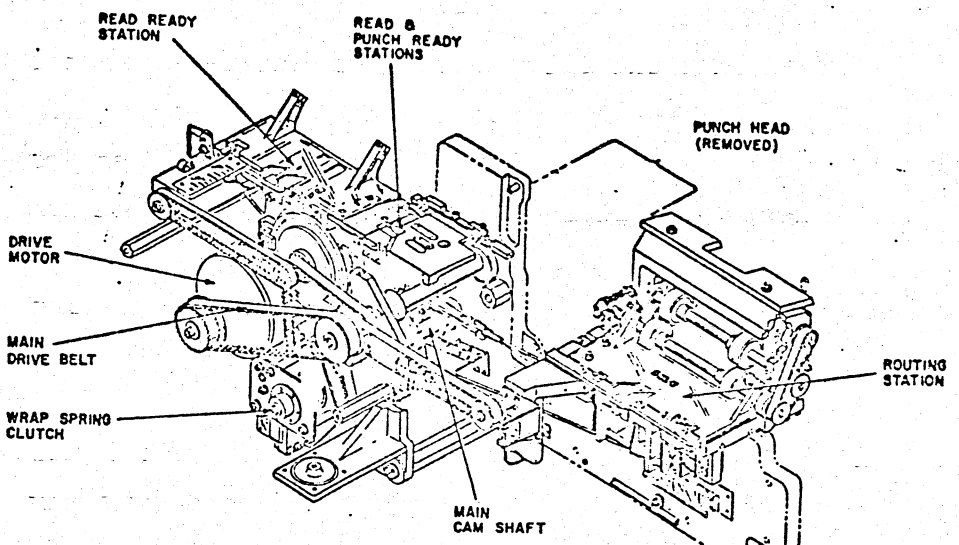
c. A card, existing in the punch ready station and awaiting a punch operation, is stepped through the punch station (Punch Head Assembly) or a card, existing in the punch ready station during read operations, is driven directly through the punch station. It is then picked up and passed on to the output stacker tray by the routing station rollers.

d. A card, exiting the punch station during punch mode operation, is passed on to the routing station as for step c, above.

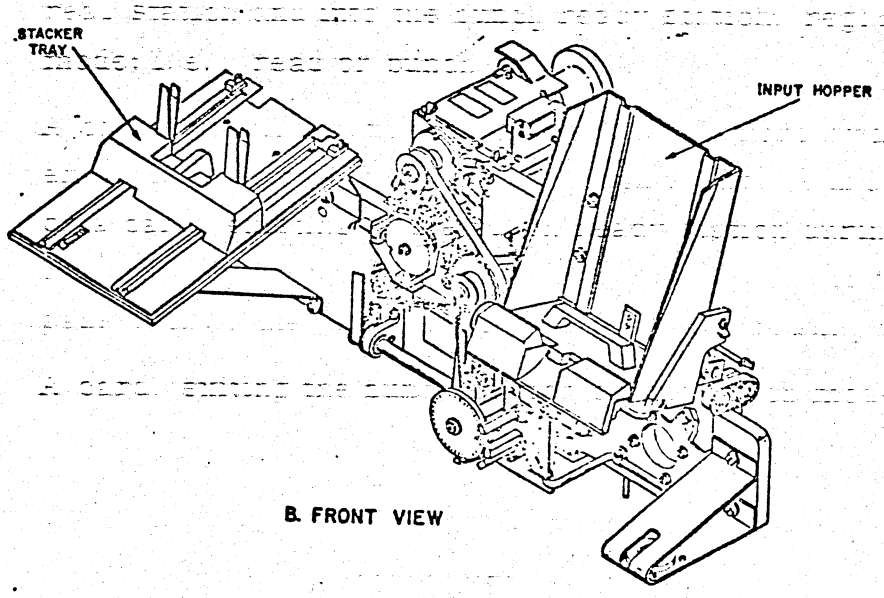
From the foregoing, it is seen that three revolutions of the camshaft are required to transport a single card from input hopper to output stacker, regardless of operating mode. A more complete description of mechanical operations is provided by paragraph 3-3 and subordinate text.

3-3.2 READ STATION (Figure 3-2)

Card data is read immediately upon exiting the read ready station (Figure 3-1) as the card passes over the light ports in the read station plate.



A. REAR VIEW



B. FRONT VIEW

Figure 3-1. Card Transport Assembly

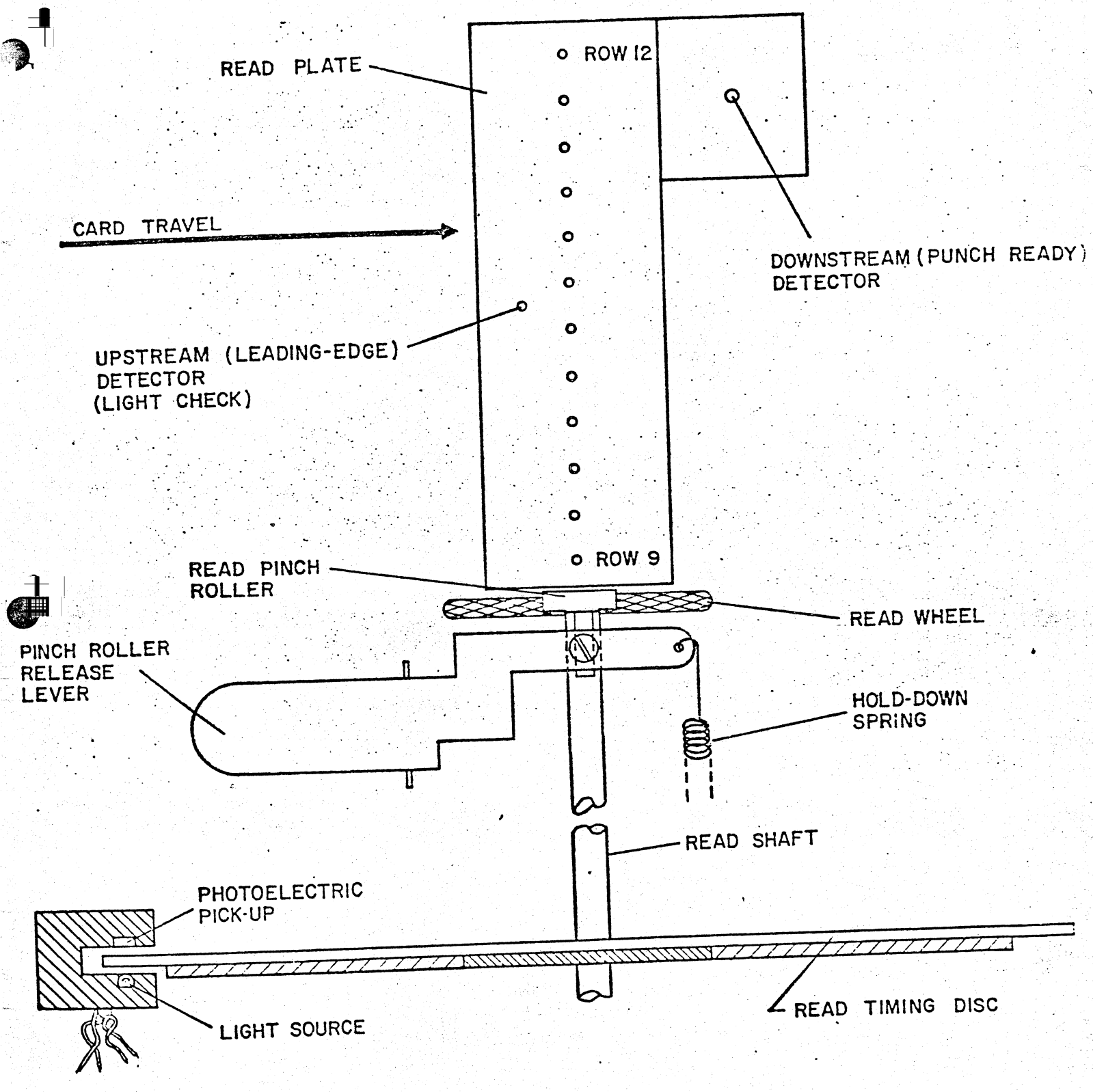


Figure 3-2. Read Station (Light Guide Block Removed)

Twelve light emitting diodes (LED) and associated phototransistors are situated beneath the read plate and sense the reflection or non-reflection of light; i. e., the punched hole or no hole condition.

Two additional sensors detect the leading and trailing edge passage for the benefit of the control logic and timing circuits. Column-to-column timing, as required for data interface control, is established by a timing disc, light source, and photoelectric pickup arrangement. The disc is physically attached to the constantly driven read drive shaft. A carborundum wheel, attached to the read shaft, operates with a punch roller to drive a card through the read station.

3-2.3 PUNCH HEAD

Punching is accomplished as a serial operation; i. e., column by column. The punch head is arranged as a single column die, carrying a row of twelve punches. The punch card is stepped, one column at a time, through the punch head by two solenoid actuated pawls, working in association with a drive rachet wheel.

Punching force is provided by a continuously rotating punch ram cam. A spring-loaded bail rides on the surface of this cam. The ramming action is transferred to the punches when a solenoid controlled interposer is placed between the bail and the punch. Therefore, it is the interposer position which determines whether a hole is punched in the card.

Punch error detection is accomplished by monitoring the movement of the punch interposer called Echo Checking (optional).

3-2.4 LOGIC CHASSIS

The logic chassis (See Figure 1-3) contains the TTL logic elements that:

a. Translate controller commands into internal, operational control signals.

b. Provide column-to-column sequencing for both read and punch operations.

c. Strobe the read data output to the interface receptacle.

d. Provide appropriate unit status signals to the controller unit.

Logic flow diagrams and related descriptions, appropriate to the various functions of the unit, are presented under paragraph 3-5.

3-2.5 DISTRIBUTION PANEL

The Distribution Panel (See Figure 1-3) provides for the following functions:

a. Logic operations associated with power-up/power-down sequences; i.e., via discrete relays and a logic circuit board.

b. Primary (AC) power distribution to the DC power supply, blower fans and transport drive motor.

c. Operating (DC) power distribution to logic PC boards, the Operator Panel and Card Transport Assembly.

d. A Power Driver Board that acts as an electrical interface with the Punch Head Assembly.

3-2.6 POWER SUPPLY

Provides +5 vdc and +24 vdc for logic chassis, operator panel, and mechanism (See Figure 1-3).

3-2.7 CABINET COOLING

Cabinet cooling is provided by ac motor-driven fans; one is located on the top of the Distribution Panel and one is directly beneath the logic chassis on the cabinet floor.

3-3. FUNCTIONAL ANALYSIS

The following paragraphs provide a detailed analysis of the operating principles associated with Reader/Punch mechanical components and assemblies. Material is organized to agree with the order of treatment presented under paragraph 3-2, FUNCTIONAL DESCRIPTION.

3-3.1 CARD TRANSPORT AND PUNCH POSITIONING

a. Main Camshaft and Clutch (Figures 3-1, 3-3, and 3-4)

Card movement from station to station and card positioning in the

punch card ready station is controlled by the main camshaft. The main camshaft (Figure 3-1) is driven by a belt connected to a 1/3-hp drive motor through the solenoid-controlled wrap spring clutch (Figure 3-3). Each time the clutch solenoid is energized, the main camshaft is engated and rotates one full revolution. The camshaft makes one revolution in 120 milliseconds.

Cam followers and pull rods, actuated by the main camshaft, provide the mechanical control necessary for transporting and positioning the cards during each revolution (cycle) of the camshaft. The punch operation is independent of the main camshaft.

The solenoid-controlled wrap spring clutch (Figure 3-3) connects the constantly driven drive wheel to the main camshaft. As long as the solenoid is de-energized, the inner wrap spring of the clutch is held unwound by action of the stop arm and the drive pulley turns freely without driving the camshaft. When the stop arm solenoid is energized, the stop arm assembly is pulled down, releasing the stop collar and allowing the inner spring to grip the camshaft. The camshaft is then driven through one or more revolutions or until the stop arm again contacts the stop collar.

One of the functions of the main camshaft is to drive the feeder cam that actuates the picker knives in the input hopper (Figure 3-5). Since the feeder cam follower is spring loaded, the energy which is stored in these (2) heavy springs could be translated to the main camshaft and result in a possible overspeed condition. This possibility is prohibited by the action of the anti-overrun spring that is internal to the input hub of the clutch assembly. This spring is manufactured to close tolerances. It allows the input hub to rotate while the main camshaft is stationary; i.e., clutch in the latched condition. However, in the unlatched condition, the main camshaft and input hub rotate at the same speed. If the main camshaft instantaneously rotates faster than the input hub (due to feeder spring action), the anti-overrun spring is caused to expand. The expanding spring grips the inner diameter of the input hub while maintaining tight contact with

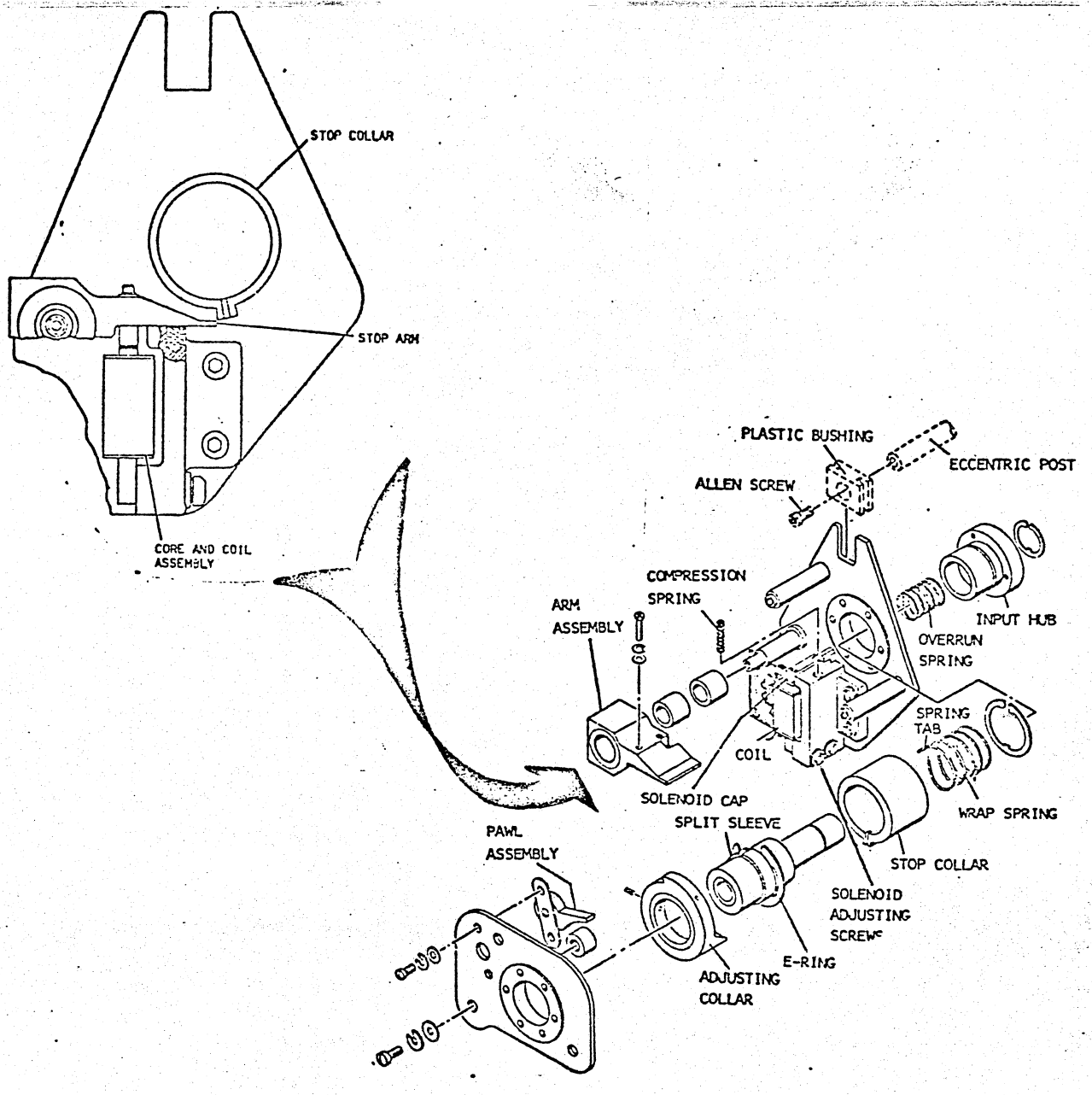


Figure 3-3. Clutch

the main camshaft. The result of this action is to lock the main camshaft to the input hub; i.e., a breaking function.

Since all transport functions of the Reader/Punch are timed with respect to main camshaft rotation, it is vital that key angular positions of the camshaft be appropriately signaled to the control logic circuits. This is accomplished by a magnetic slug that is imbedded in the indicator disc located on the front end of the main camshaft. Two reed switches, located around the outside of the disc, sense the slug as it passes the two critical points of 321 and 0 degrees. (The 0 degree

switch remains closed while the clutch is latched.) The signal, generated at 321 degrees, locks out Feed commands until the clutch latches and indicates that the punch pinch rollers are down and that a card may be stepped through the punch station. The transition of the 0 degree switch from "0" to "1", as the camshaft approaches 0 degrees, indicates the end of a feed cycle and is used by the control logic as a Feed Command Acknowledge.

A natural delay period is associated with the initial activation of the clutch/camshaft; i.e., there is a delay of approximately 10 milliseconds after a Feed command while the magnetic field builds, the clutch arm pulls, the clutch engages, and then the camshaft starts turning. This delay is eliminated on subsequent cycles, provided that the Feed command is received prior to 321 degrees of camshaft rotation. Feed commands are not accepted after 321 degrees to prevent damage to the clutch stop or clutch arm. The maximum feed rate is achieved by energizing the magnet prior to 321 degrees of camshaft rotation.

The following mechanical operations are performed by direct or indirect linkage with the main camshaft:

1. The picker knife camshaft in the hopper feeder assembly is driven directly by a timing belt from the main camshaft.
2. The closing of the inject wheel pinch roller in the Read Ready Station is sequence controlled.
3. Movements, derived from the main camshaft, cause card positioning and alignment in the Punch Ready Station.
4. The pressure rollers of the punch steppers are lowered and raised.
5. The skip-through pinch roller in the Punch Ready Station and the skip-through pinch roller and pushers in the Routing Station are cam controlled.

Figure 3-4 illustrates the timing operation of these cam-controlled elements along the card path.

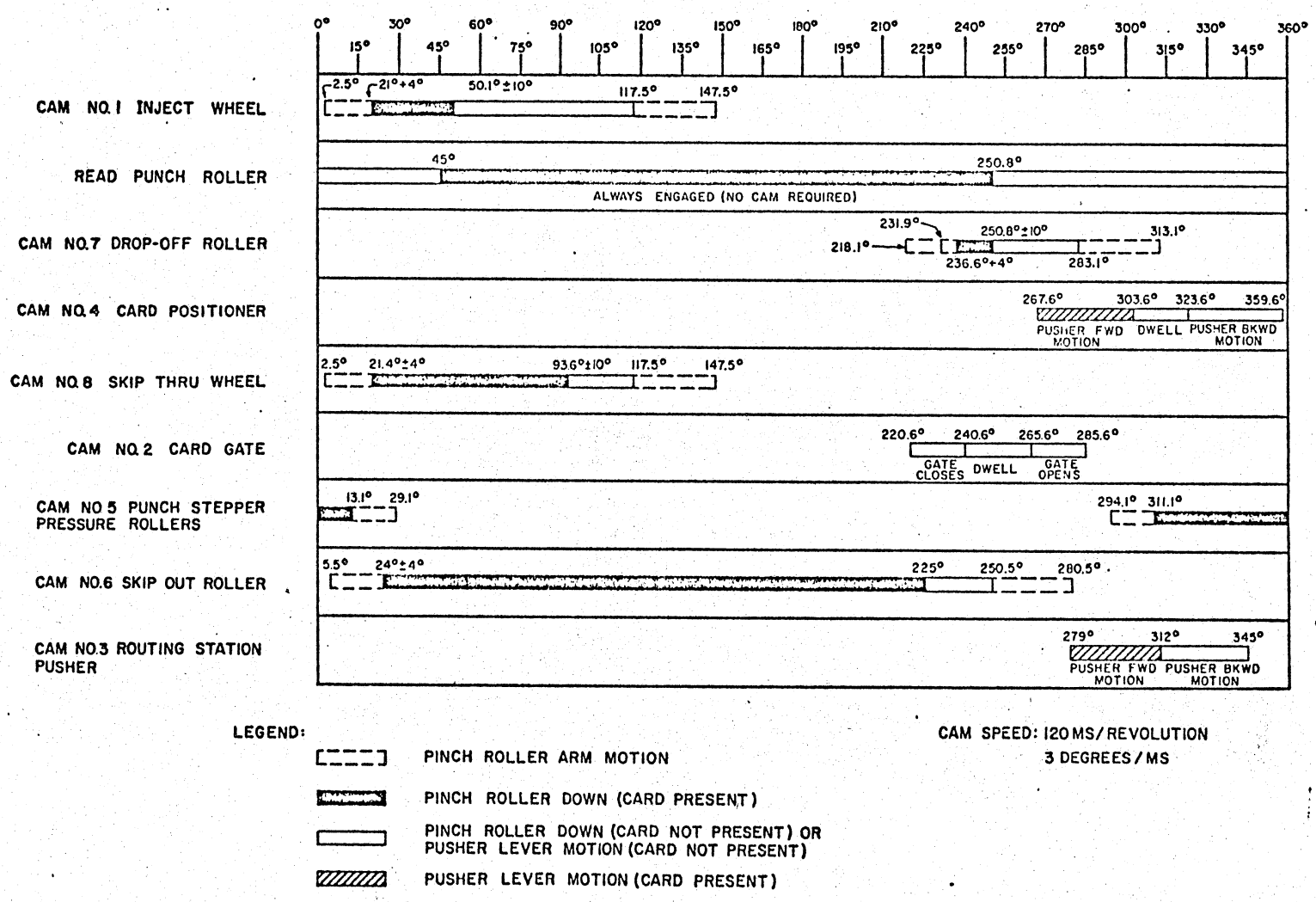


Figure 3-4. Main Camshaft Timing

b. Hopper Feeder Assembly (Figures 3-1 and 3-5)

The Hopper Feeder Assembly accepts the input card deck and feeds cards one at a time to the Read Ready Station on command from the controller. Card picking is accomplished by two cam-driven picker assemblies that push the bottom card from the hopper into contact with constantly driven feed rollers. The picker camshaft is driven by a timing belt from the main camshaft. It is the only mechanism driven off the main camshaft by a timing belt that requires a timing adjustment.

A single card is picked during each revolution of the picker cam. When the picker cam starts turning, the picker knives are behind the rear card edge guide clear of the card deck. When the cam moves the picker arms forward, the picker knives push against the edge of the bottom card and move it through the metering throat (row 9 first) into the feed rollers. The throat knife is set to pass only one card at a time.

The leading edge of the card is gripped between an idler roller (top feed roller) and the first of two sets of constantly driven rollers. The feed rollers drive the card faster than the picker, pulling it through the metering throat. The leading edge of the card is guided in a curved path, down and then up, to the second drive roller. The two sets of drive rollers are belt-coupled to turn at the same speed.

The card is held against the second drive roller by spring loaded nudge pawls and passes over three anti-backup arms as it enters the Read Ready Station (Figure.3-6). If a card was previously in the Read Ready Station, that card has moved about half way through the Read Station and the entering card is guided beneath it.

When the entering card is about half way into the Read Ready Station, the exiting card is completely out. As the trailing edge of the fed card is released by the first roller, the second drive roller continues to drive the card until it is completely into the Read Ready Station. Upon clearing the second drive roller, the nudge pawls close and the anti-backup arms hold the 12-edge of the card up against a step in

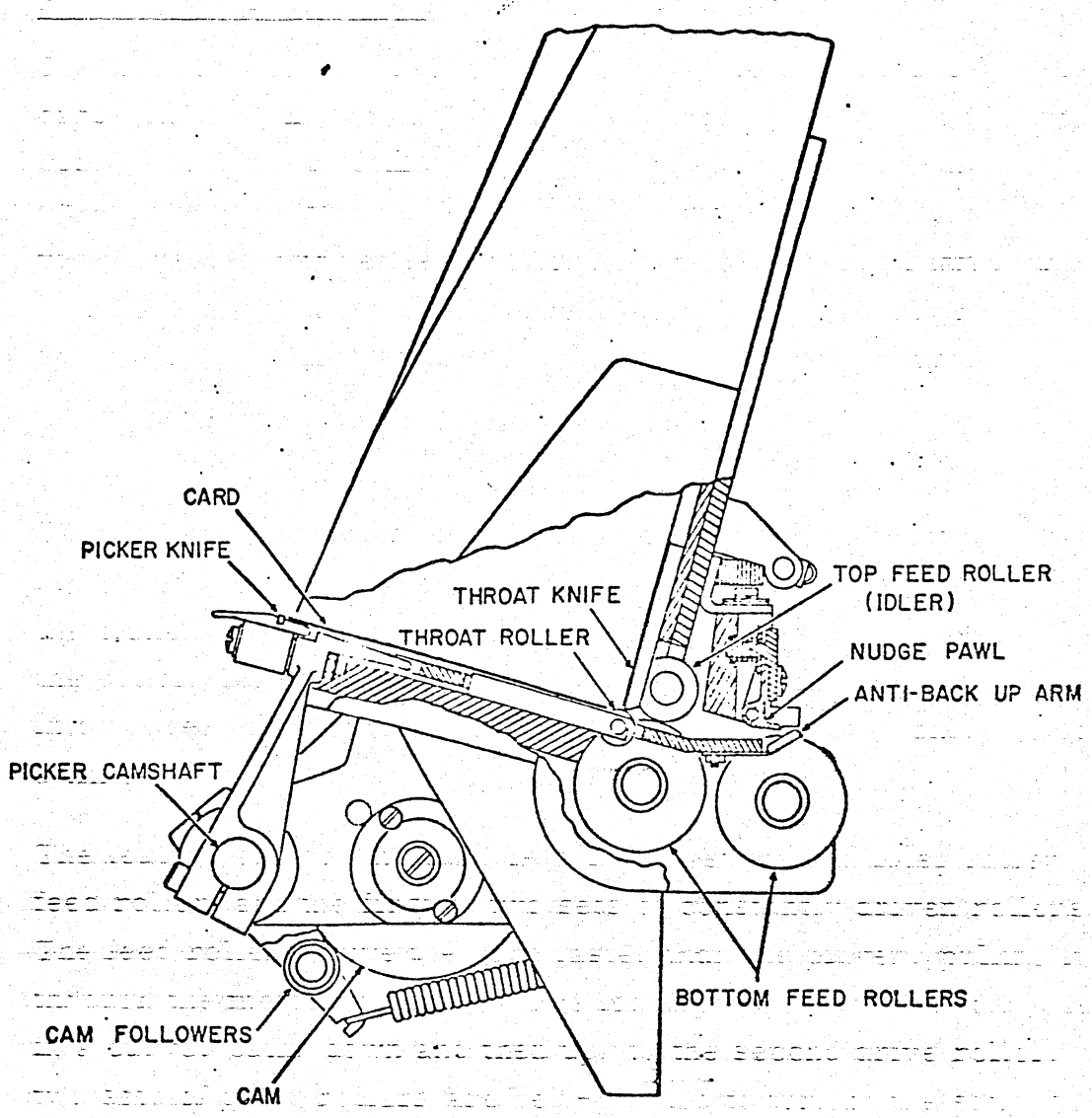


Figure 3-5. Picking and Feeding Mechanisms

the card guide bar. The anti-backup arms prevent the card from rebounding back into the rollers after it contacts the edge guide in the Read Ready Station. The card remains in the Read Ready Station until the next Feed command.

c. Read Ready Station (Figure 3-6)

The Read Ready Station holds a card in readiness for reading until a Feed command is received. Upon receipt of a Feed command, a

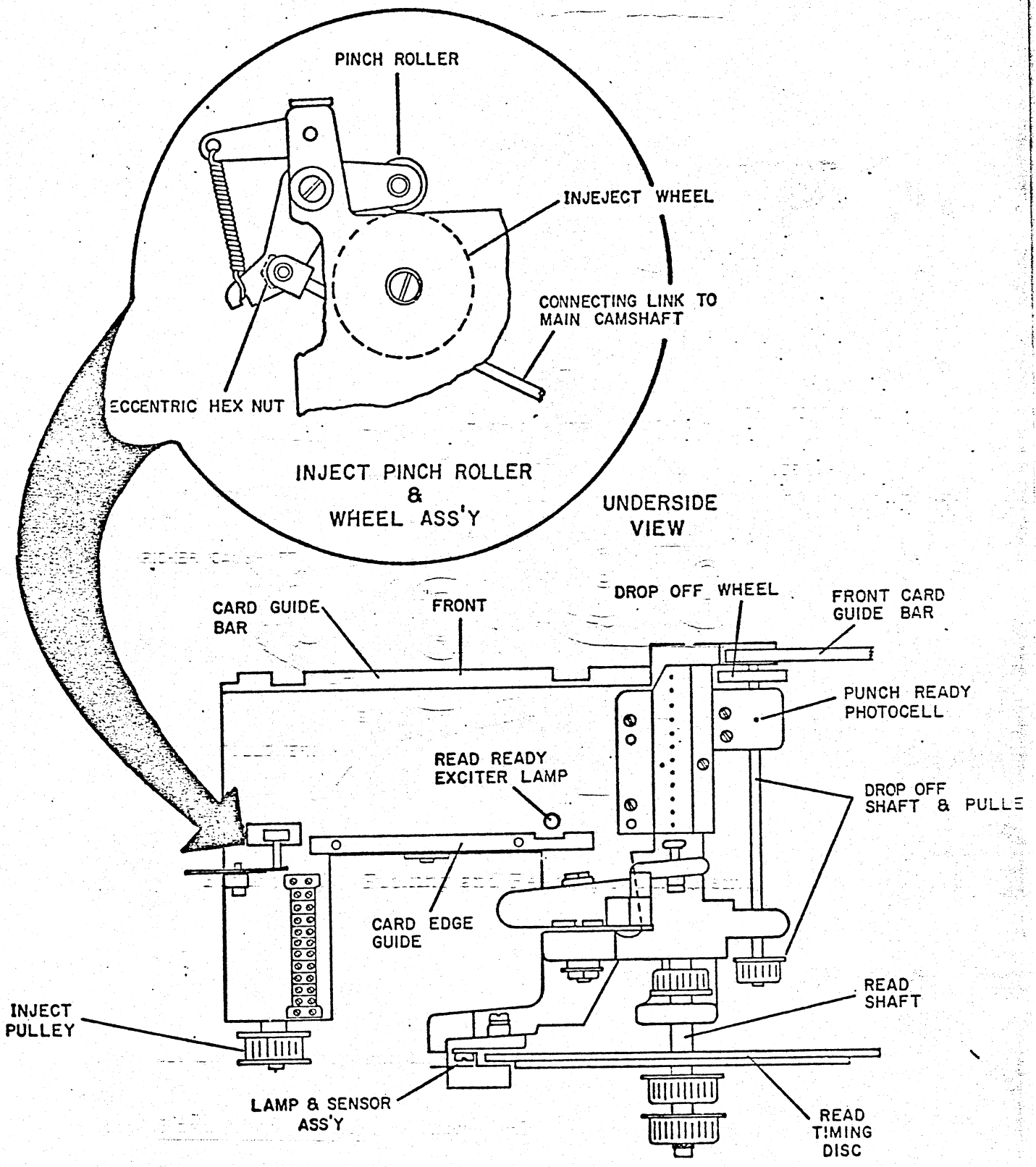


Figure 3-6. Read Ready and Read Stations - Mechanical Arrangement

cam actuated pinch roller (Figure 3-6) is pulled down as a result of cam action to force the card against the inject wheel.

The inject wheel drives the card to the read drive wheel in the Read Station. The inject and read drive wheels are constantly driven and belt coupled to drive at a common speed. The inject wheel assembly drives the card for only approximately 1/2 inch before it is gripped and driven by the read wheel.

As the read wheel begins to drive the card, the inject roller is raised (by cam action) and the read wheel sustains card movement through the Read Station into the Punch Ready Station.

A read ready exciter lamp (Figure 3-6) is used to monitor card transition through the Read Ready Station. The following conditions are sensed:

1. If the photocell output did not change during a feed cycle, the currently contained card did not leave the Read Ready Station.
2. If the photocell output changed but did not return to the original state, a new card did not enter the Read Ready Station.

In either case, a signal indication of the error condition is input to the controller.

d. Punch Ready Station (Figure 3-7)

The Punch Ready Station aligns and positions a punch under under the punch head for the start of the punching operation. A card enters the Punch Station during the middle of a transport cycle and is precisely positioned at the end of the transport cycle. With respect to any single card, this would occur during the second rotation of the main camshaft; i.e., following its initial 'feed' cycle.

Card movement into the Punch Station is initiated as its trailing edge leaves the read wheel of the Read Ready Station (Figure 3-6). At this time, the cam actuated drop-off roller is in the up position and does not contact the incoming punch card. As the trailing edge of the punch card leaves the read wheel, the drop-off wheel cam follower

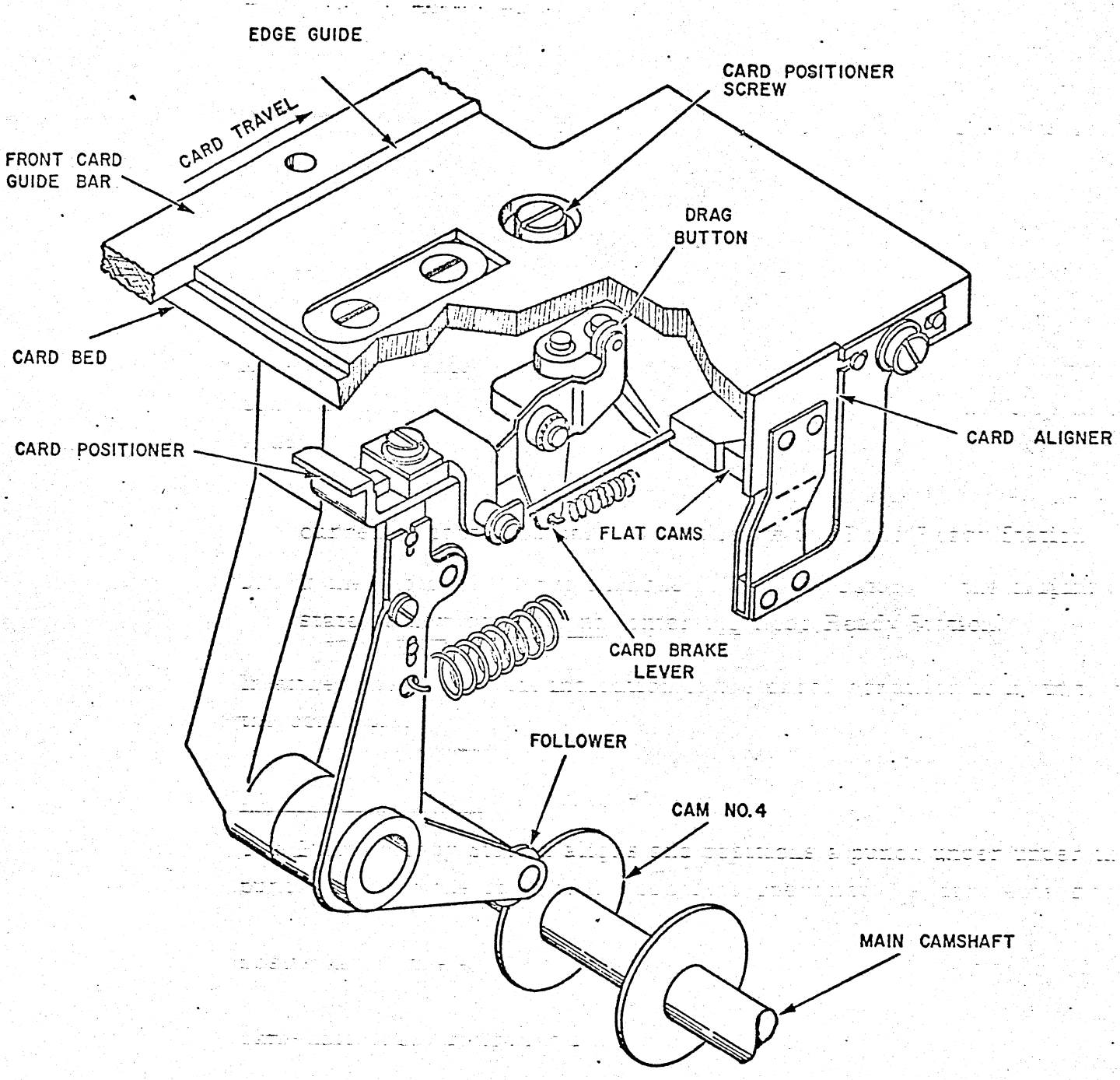


Figure 3-7. Punch Ready Station

reaches the low point of its associated cam lobe and the drop-off wheel (Figure 3-6) is lowered, driving the card forward. Simultaneously, the card gate camshaft follower raises the card gate (Figure 3-8) in the card path just beyond the punch die. The drop-off wheel drives the punch card into contact with the stop gate. The only purpose of the gate is to stop the forward motion of the punch card. The stop gate does not position the punch card for punching.

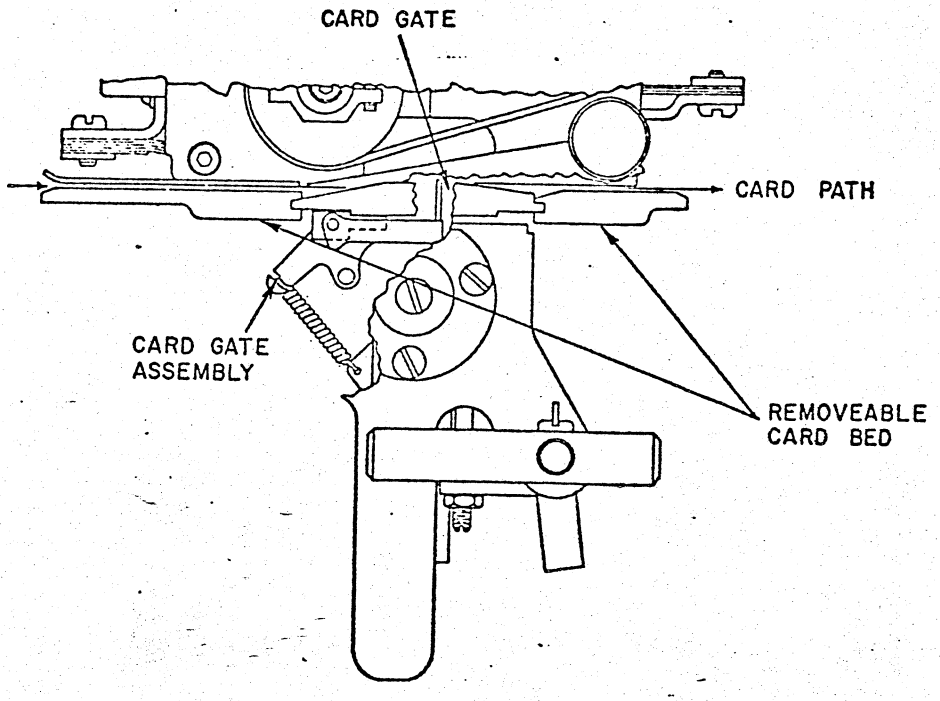


Figure 3-8. Punch Head Card Gate

Three mechanisms operate nearly simultaneously to position the card. The mechanisms are the positioner, aligner, and card brake (Figure 3-7). All three are operated by the card positioner cam follower arm which follows cam four on the main camshaft.

Cam four activates the card positioner cam follower arm and moves the punch card positioner pawl in an arc into the card path behind the card. The card positioner cam follower arm roller moves away from the card brake lever and a spring pivots the brake lever and raises the drag button toward the underside of the punch card. The positioner arm movement also drives the connecting link between the follower arm and card aligner forward. A flat cam on the connecting

link moves away from the mating cam surface on the card aligner and the card aligner pushes the card against the front edge guide.

As the positioner pawl enters the card path, it contacts the trailing edge of the punch card, driving it forward, and the drag button raises toward the bottom of the punch card. The drag button and hold-down springs (located in the access cover) prevent momentum from carrying the card too far forward. The card positioner pawl, card brake lever, and card aligner return to their original positions out of the card path. The punch card is now positioned with column one precisely aligned for punching.

When the Reader/Punch is placed in the read mode, the previously positioned punch card is not stepped through the punch head. The following action moves the punch card through the punch head.

On a clutch cycle (Feed), the skip-through pinch roller is lowered by cam action towards the constantly driven drive wheel. The punch card is driven through the Punch Station to the skip-out wheel in the Routing Station. Simultaneously, as the punch card is no longer under the driving force of the skip-through pinch roller, the skip-out pinch roller is lowered by cam action and drives the punch card into the Routing Station. Meanwhile, a punch card is entering the Punch Ready Station.

NOTE

The preceding action is also true if only the first few columns are punched and a clutch cycle initiated.

e. Routing and Stacker Assemblies (Figures 3-9 and 3-10)

When punching is complete, the card is at rest over the continuously turning skip-out drive wheel (Figure 3-9). As the main camshaft rotates during the next feed cycle, the skip-out pinch roller is pulled down by a cam action and pinches the card against the drive wheel. The card is driven length-wise to the stationary or offset card stop. A photocell in the Routing Station is covered by the leading edge of

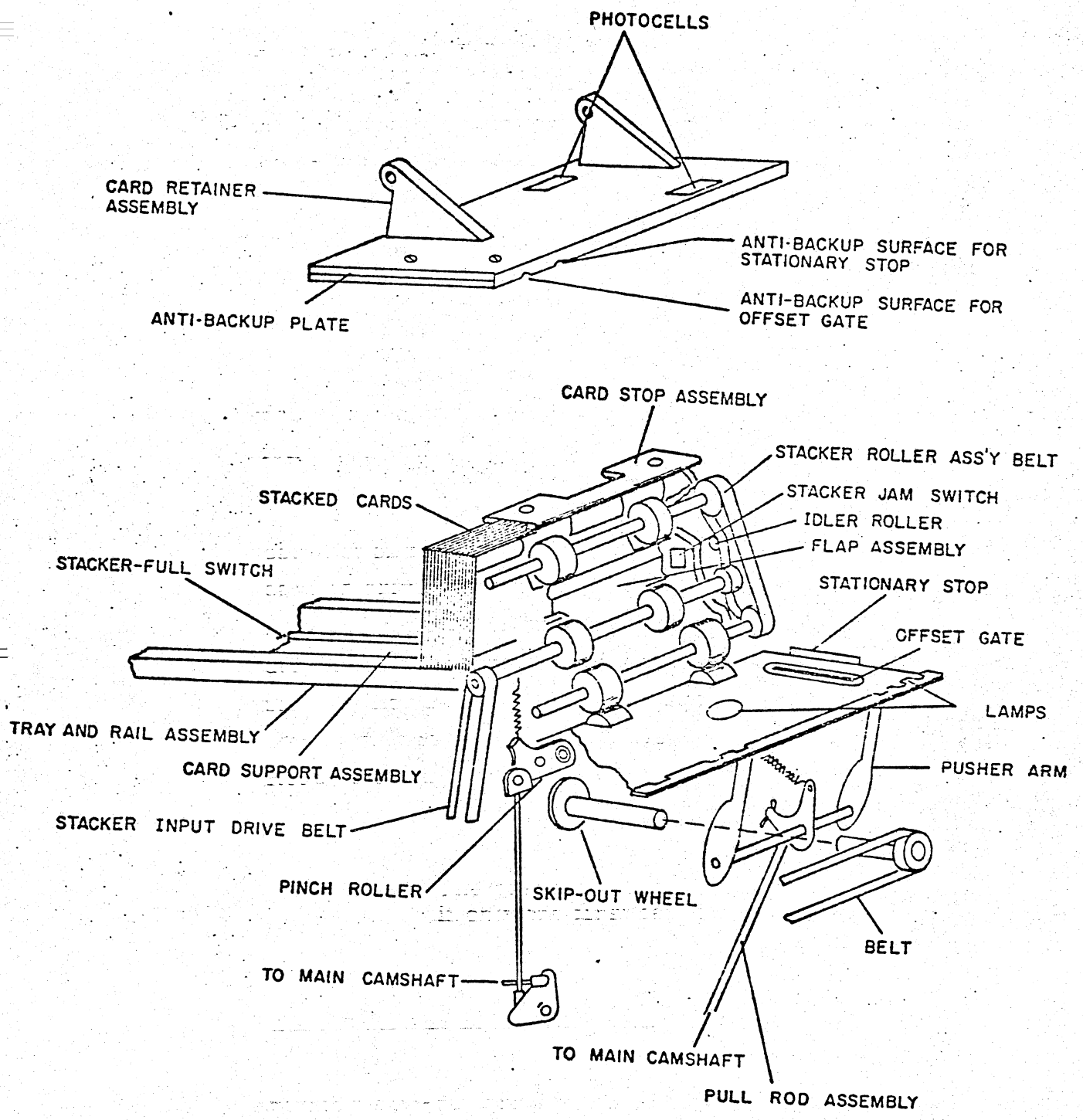


Figure 3-9. Stacker Routing Assembly, Functional Drawing

the card, as it moves toward the card stop, and indicates that the card is fully into the Routing Station. Anti-backup fingers in the card bed force the card up against an anti-backup plate in the access door to prevent the card from bouncing back out of the station. Cam three action, occurring during the same rotation of the main camshaft, moves the pusher arms to drive the card sideways (row) into the constantly driven stacker rollers.

The card is driven through the lower rollers and spring rollers and is guided upward by the card stacker guide (Figure 3-10). A second set of rollers moves the card past the nudge pawls and flat assembly. A cam jam in this area pushes the flap beyond its normal travel, thus activating the jam switch and stopping card motion. The card continues along the card support assembly to the top set of wheels which drive the card the remainder of the way into the output stacker tray. A card stop in the stacker stops the upward travel of the card.

If a card is to be offset in the output tray, the offset gap is raised as the result of an offset command and the length-wise travel is stopped approximately 3/8 inch from the normal stop. Thus, the card is stacked in the output tray with its trailing edge protruding from the normally stacked cards by approximately 3/8 inch.

When the output tray reaches the limiting capacity of approximately 1300 cards, a switch under the card tray is closed and feeding is inhibited until punch cards are removed.

All drive wheels in the Routing Station and stacking assembly are belt-driven.

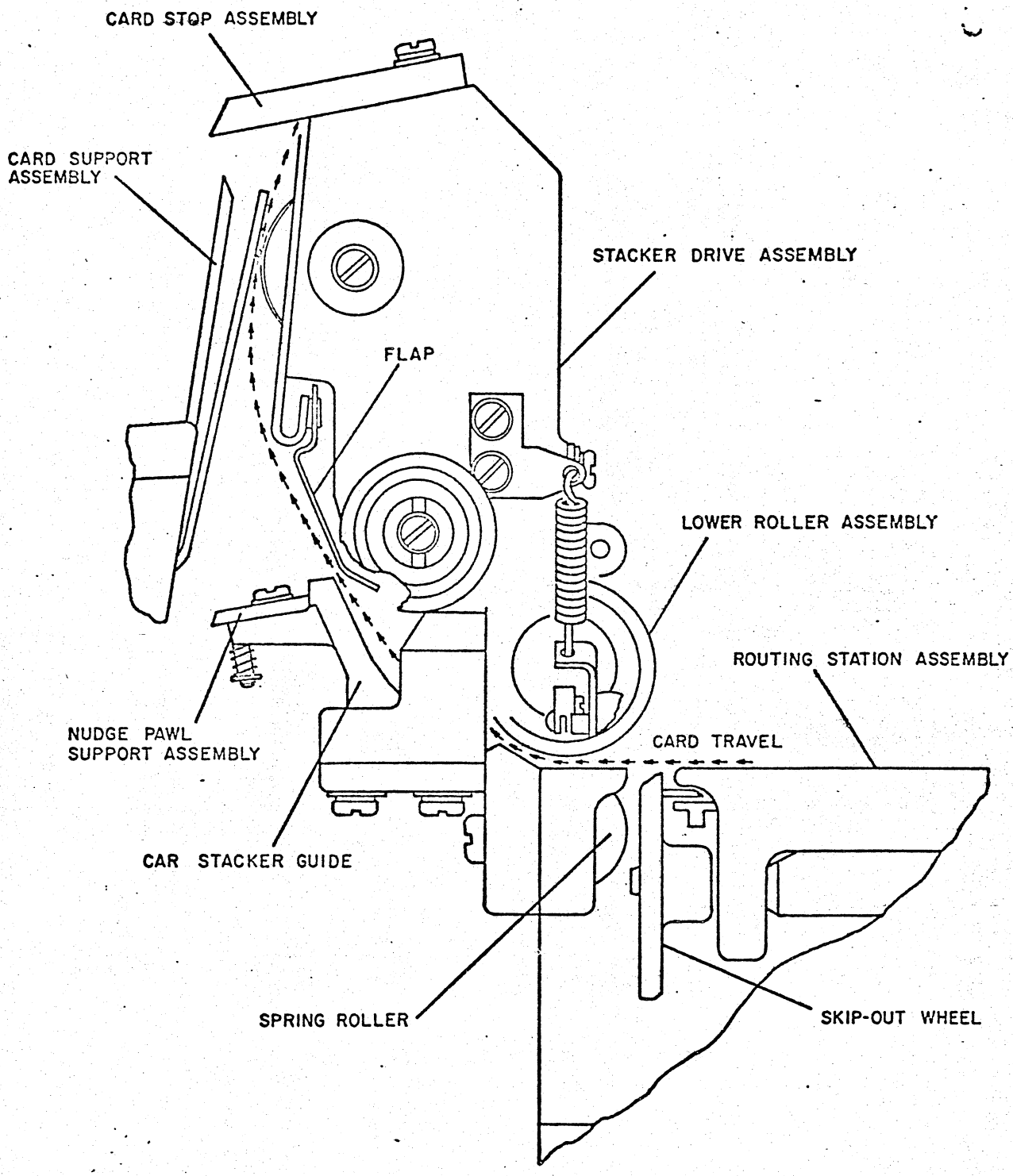


Figure 3-10. Card Travel into Stacker

3-3.2 READ STATION (Figure 3-11)

The Read Station (part of Read Ready Station Assembly) consists of a hinge-mounted read head (access door) with fourteen light emitting diodes (LED) located on the underside. The LED's provide a light source for a gating sensor, twelve data sensors, and a Punch Ready Station sensor. Other functional parts of the Read Station are the read plate, read drive wheel assembly, and timing disc with associated sensor segment.

When the read head is in the closed position, the LED's are in a direct line with the sensors located in the read plate. Also, in the read plate is an amplifier circuit for each sensor.

The twelve data sensors are column oriented and are used to read data in each of the twelve rows of a punch card. The gating sensor is located just prior to the data sensors and is used to sense when a punch card enters the Read Station. The gating sensor is positioned between the data rows in a card, therefore, will not sense holes in a card. See paragraph 3-5.3 for the logic description of a Read Operation.

The timing disc with an associated LED light source and sensor transmit pulses to the clock counter in the logic. The timing disc is belt-driven and mounted on the same shaft as the read drive wheel, therefore, card speed is synchronized with the speed of the mechanism. Sixteen pulses from the segmented disc are equal to the movement of one column on the punched card.

3-3.3 PUNCH HEAD ASSEMBLY (Figures 3-12 thru 3-16)

The Punch Head contains a single column die and a row of twelve solenoid controlled punches. Punching force is provided by a continuously rotating punch ram cam. A spring loaded bail (Figure 3-13A) rides on the surface of this cam. The ramming action is not transferred to the punches unless an interposer is placed between the bail and the punch. Therefore, it is the interposer position which determines whether a hole is punched in the card.

All interposers are held in the non-punching position by a hold coil surrounding all twelve punch solenoids. When a punch signal is received,

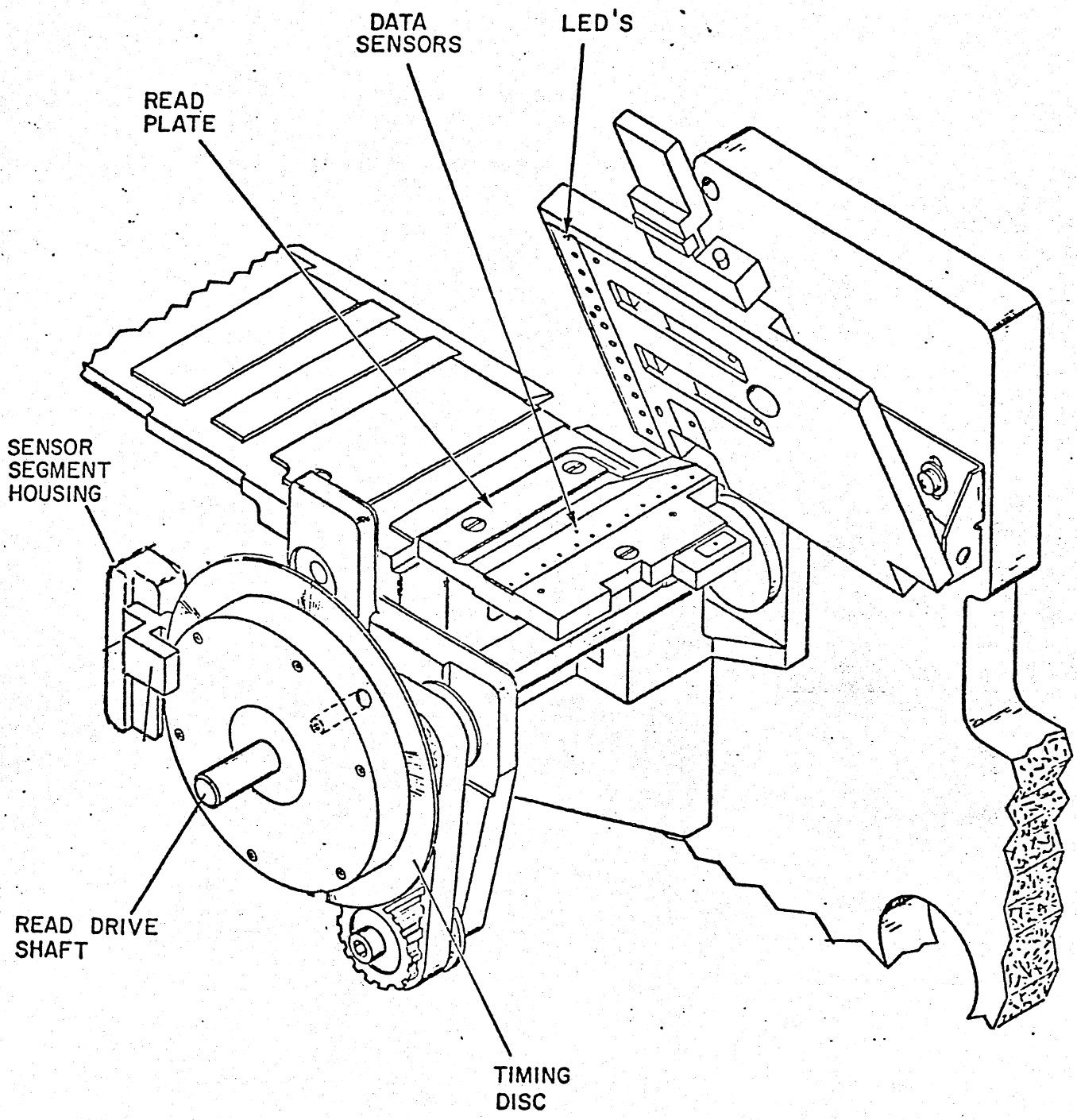


Figure 3-11. Read Station Components

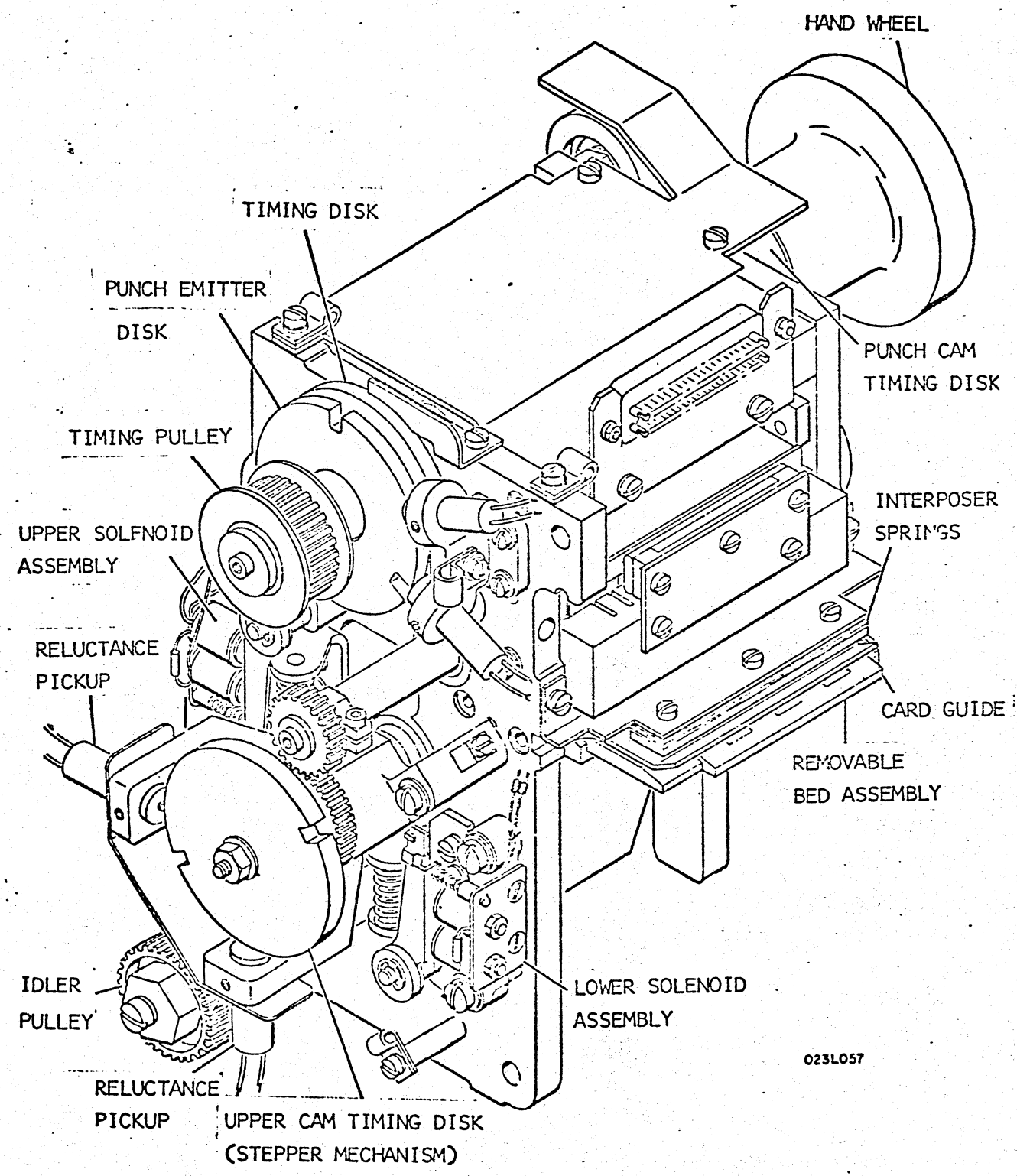


Figure 3-12. Punch Head

a particular punch solenoid is energized and the field, induced in the punch coil, opposes that in the hold coil and the respective armature assembly is released to follow the interposer cam. As the low dwell on the cam is reached, the interposer is entered between the bail and punch (by the action of the interposer spring) and a hole is punched in the card. After punching, the armature assembly is restored to the no-punch position by a rise on the interposer cam. The punch coil by now is de-energized and the armature assembly is held by the hold coil. Thus, the interposer is positively restored by the interposer cam before the next ram action. The restore motion of the armature-interposer causes a change in the magnetic field of the punch magnet. This induced signal (echo) is used by the logic circuitry for punch vertification (an equipment option).

The interposer cam is synchronized with the punch cam to prevent the interposer from moving into the bail path except when the punch ram is raised. A third cam, the punch restore cam, is also synchronized with the ram cam and causes positive restoration of the punches after punching. This assures that the punch is removed from the card before the card is stepped to the next column. When the punches are not used, they are held in the raised position by punch springs.

A drive belt supplies rotating motion to the punch ram camshaft (Figure 3-13B). On the other end of the shaft, a timing belt transfers motion to the interposer camshaft and the punch restore camshaft. This timing belt also holds the three cams in the correct relationship with each other. Also, mounted on the punch ram shaft is a pulse emitter (timing) disc. Two reluctance pickups provide synchronizing pulses for interposer release and reset.

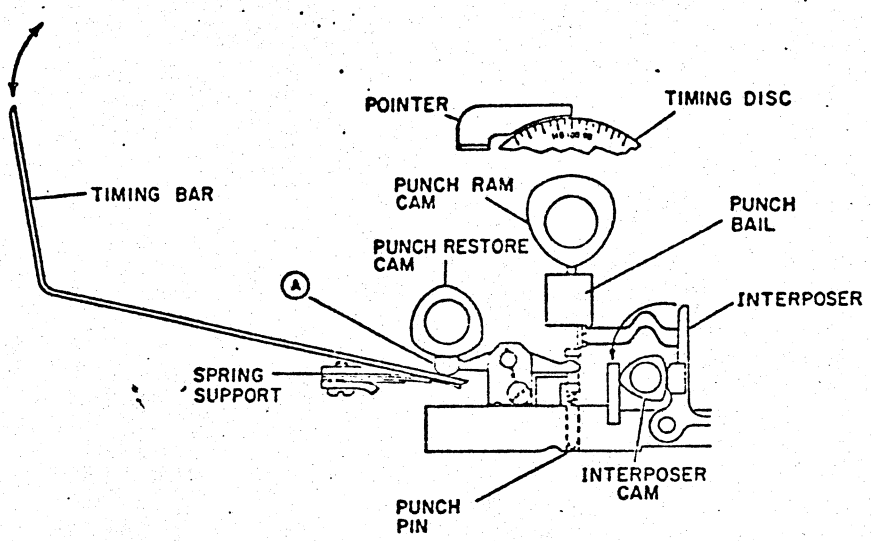
The two pulses (Figure 3-14), generated as the emitter disc rotates between the pickups, are the Punch Reset Strobe and Echo/Punch Strobe. Both pulses are shaped to 250 microseconds and appear on separate lines 2.25 milliseconds apart. These two lines determine punch solenoid voltage timing and Echo Check Strobe timing. Punch solenoid voltage is enabled 100 μsecs after the Echo/Punch Strobe. The Punch Reset Strobe cuts off solenoid voltage. The Echo Check Strobe allows the comparison of punch data requested to that of actual data punched. If they do not

compare a compare error is generated. See paragraph 3.5.4 for Echo Check logic description.

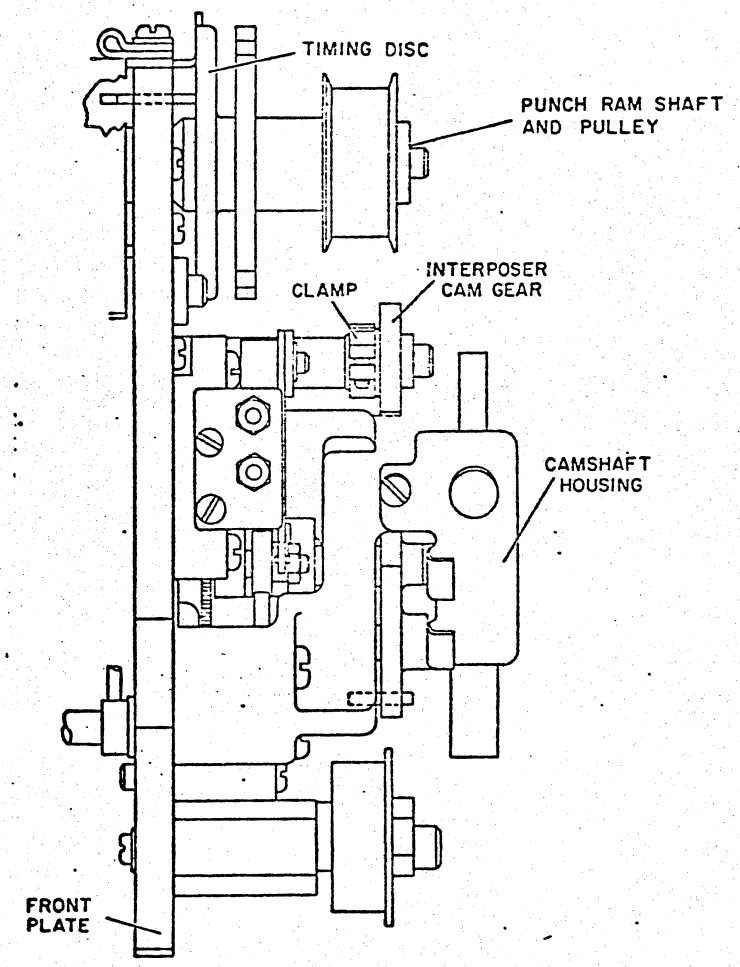
The punch stepper mechanism steps a card through the Punch Station, one column at a time, in synchronization with the punching operation. When the punch stepper is controlling card movement, the wrapspring clutch is latched and the card is moved by the punch stepper pinch rollers and drive wheel. When no punching is to take place, the punch pressure rollers are raised and card movement through the punch station is controlled by the skip-through and skip-out drive wheels, Before stepping begins, card column one is precisely positioned under the punches by the Punch Ready Station. Alignment is maintained as the pressure rollers are lowered to grip the card against the drive wheels.

The drive gears, cams and timing disc of the punch stepper mechanism are in constant motion when the drive motor is running. The stepper mechanism is driven off the interposer camshaft in the punch head. A gear on the interposer cam drives the gear on the upper cam of the stepper mechanism which, in turn, drives the eccentric shaft and the lower cam. The timing disc on the upper cam revolves between two reluctance pickups to provide timing pulses (Punch Stepper Strobes).

The punch stepper wheels are driven one step (card column) at a time by the pawl and arm assemblies in the punch stepper mechanism. The eccentric shaft drives the pawls in and out of the drive ratchet connected to the punch stepper drive wheel shaft. The ratchet doesn't move as long as the stepper solenoid is de-energized and the stepper magnet arms hold the pawl and arm assemblies. Mechanical timing is such that the associated drive pawl is engaged in the ratchet wheel when the pawl and arm assembly starts to follow the cam. The ratchet wheel and punch stepper wheels are driven through one step. When the cam reaches high dwell, the arm is latched unless the solenoid is energized. The operation of the two arms overlaps to produce stepping at a maximum rate of 167 columns per second. The enable signals to energize and de-energize the solenoid are produced form the timing disc on the upper camshaft of the stepper mechanism.

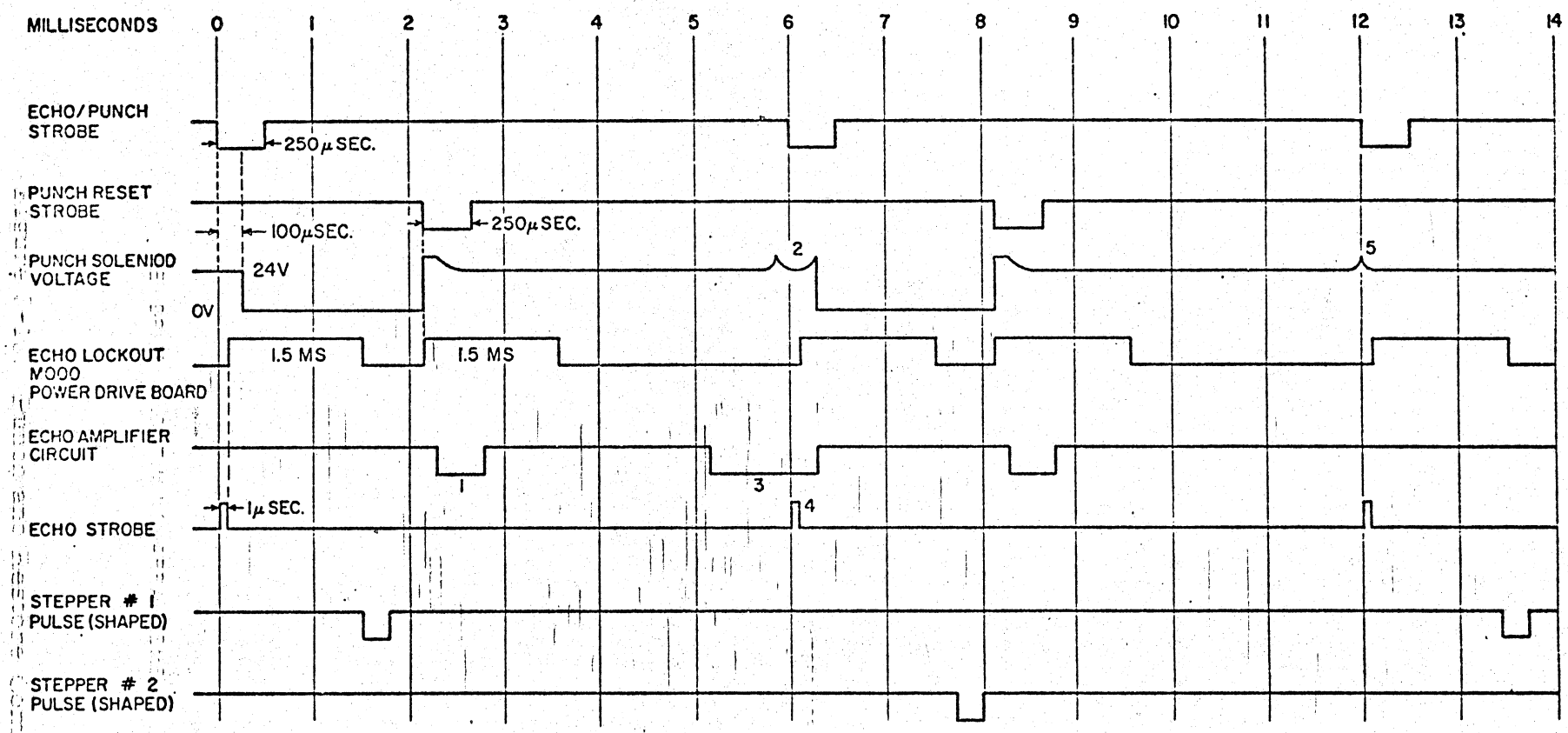


A. INTERPOSER ACTION



B. DRIVE AND TIMING ARRANGEMENT

Figure 3-13. Punch and Restore Components



1. A RESULT OF DROPPING SOLENIOD VOLTAGE. ECHO LOCKOUT PREVENTS SETTING OF ECHO LATCHES. INFORMATION NOT USED.
2. A RESULT OF INTERPOSER RETURNING TO LATCHED POSITION.
3. A RESULT OF INTERPOSER RESTORING, THE RESULT IS LATCHED.
4. TIMING IS SHOWN AS REFERENCE ONLY.
5. NO PUNCH, IF PRECEDING COLUMN WAS NOT PUNCHED SIGNAL WILL BE HELD AT A STEADY +24V.

Figure 3-14. Punch Head Timing

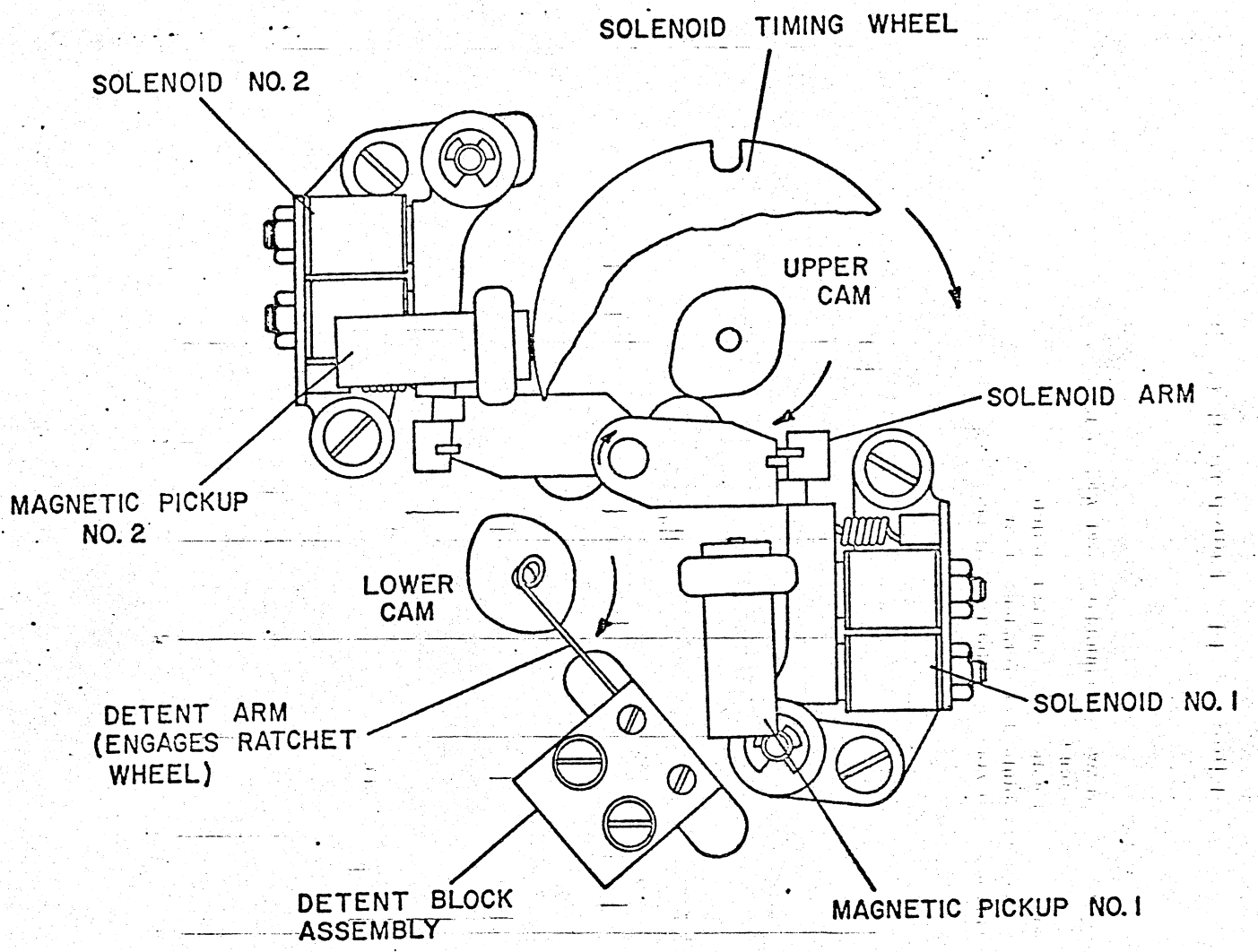


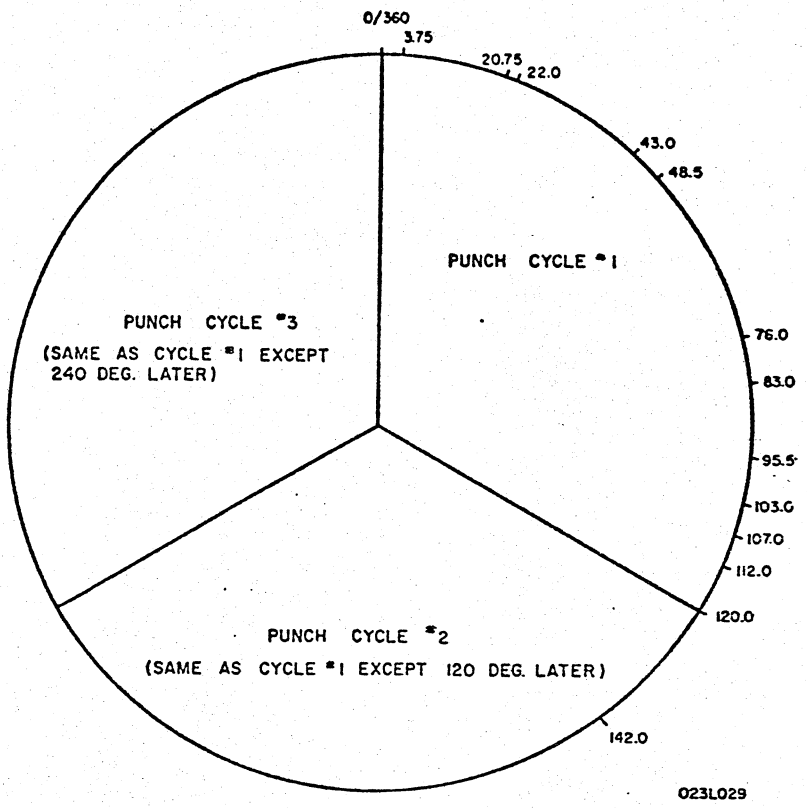
Figure 3-15. Punch Stepper Operation (Ratchet Wheel Removed)

Each reluctance pickup produces a 250 microsecond (shaped) pulse (Punch Stepper Strobe) every 12 milliseconds. Each pickup has a separate line and a pulse appears on one or the other of the lines every 6 milliseconds. Each line is associated with one of the stepper solenoids and the pulse acts as an enable signal to energize that solenoid. When punching is taking place, the first Punch Stepper Strobe after a punch signal energizes its associated stepper solenoid. It does not matter which Punch Stepper Strobe appears first, the result is the same for either; the card is stepped one column.

If another punch signal appears before the second Punch Stepper Strobe, the second stepper magnet is energized and the card is advanced a second step. The card cannot be stepped until a punch signal is present. However, both solenoids remain energized and stepping continues until no more punch signals are received. The first Punch Stepper Strobe to appear without a punch signal de-energizes its associated stepper solenoid; the other stepper solenoid is de-energized 6 milliseconds later unless a punch command is again present.

The result of this electronic timing chain is: a card is punched, stepped, and then held or punched and stepped again. A card can be held at any position until a punch signal is received. A Feed command terminates all punching and skips the card out at transport rates to Routing Station.

Figure 3-16 graphically summarizes the operational sequences and timing of the punch operation.



0 degrees	Start/end of one punch head timing disc revolution.
3.75 degrees	Punch begins to restore after punching hole in card.
20.75 degrees	Punch is clear of card path.
22.0 degrees	*Stepper #2 pawl starts initial movement for moving card one column.
43.0 degrees	Echo/Punch Strobe. Compares punch data 100μsec later enables punch solenoid voltage.
48.5 degrees	High point on Punch Interposer Cam. Interposers are now in latched position - if punch solenoid voltage is present interposer will not latch. Each interposer has its own solenoid voltage.
76.0 degrees	Stepper #1 Strobe - Initiates pulling of stepper latch.
83.0 degrees	Punch Reset Strobe pulse - Terminates solenoid voltage.
95.5 degrees	If selected, punch pin starts downward by action of interposer and Ram Cam.
102.0 degrees	Stepper #2 pawl has completed moving card one column.
107.0 degrees	Punch pin contacts card.
112.0 degrees	Low point on Interposer Cam.
120.0 degrees	Punch pin reaches maximum penetration - low point on Punch Ram Cam.
142.0 degrees	*Stepper #1 pawl starts initial movement for moving card one column.

* The position of the punch stepper solenoid wheel, in relationship to a stepper command, determines which stepper pawl will move (step) card one column.

Figure 3-16. Punch Head Functions by Degrees

3-4. ELECTRICAL FUNCTIONS

3-4.1 LOGIC CHASSIS (Figure 1-3)

The Logic Chassis is mounted behind the front cabinet door on the right of the Reader/Punch cabinet. The chassis contains 7000 Series, dual-in-line Transistor-Transistor Logic (TTL) circuit boards necessary for performing the following:

a. Sense the status of the Hopper Empty, Stacker Jam, Stacker Full, Chip Box, Interlock, and Operator Panel switches.

b. Gate the punch solenoid, clutch solenoid, stepper solenoid, and off-set gate solenoid voltages.

c. Sense and shape the pulses from the punch and stepper timing reluctance pickups.

d. Sense and shape the pulses from the main camshaft position reel switches.

e. Sense the outputs of the read photodiodes, timing photodiode, and the Read Ready photocell, Leading Edge detector, Punch Ready photocell, and Routing Station photocell.

f. Check punch reliability by using Echo Check (optional).

g. Control punch card motion throughout the transport.

See paragraph 3-5 for a detail description of the logic functions and Figure 3-33 "Logic Control Block Diagram" for general logic flow.

3-4.2 AC DISTRIBUTION ASSEMBLY (Figure 1-3)

The AC Distribution Assembly is located on the operator's left rear side underneath the Card Transport Mechanism. Access to the Distribution Box is attained by removing the left side panel and the mesh screen protecting the panel.

The main (AC) power is hard wired to TB1 on the bottom of the distribution box. Circuit breakers, located on the outside of the distribution box, provide electric overload protection for the main (AC) power, blowers (fans), and main drive motor.

The Power Sequencer Board is mounted on the outside back of the distribution box. It operates in conjunction with relays for bringing up and dropping of power to the Reader/Punch. See Flowchart Figures 3-17 and 3-18 for a detailed description of POWER ON and POWER OFF. The Sequencer Board also contains circuits for performing the following functions:

a. Energize the Feed Clutch solenoid.

b. Energize the Offset solenoid.

c. Zero and 321 degree switch debouncers.

d. Energize running time meter (optional).

e. Energize motor relay (relay mounted on board).

f. Provides path for +5V and +24V and ground.

The Power Drive Board is mounted on the outside back of the distribution box. It contains circuitry for energizing punch solenoids, stepper solenoids, latching of echo check data, hold coil current, and receivers for Echo/Punch and Punch Reset strobes.

3-4.3 POWER SUPPLY

NOTE

Power supply schematics are provided in Section IV of the Diagrams Manual.

The Reader/Punch Power Supply is mounted in a vertical position behind the logic chassis (Figure 1-3). The power supply assembly consists of an external transformer, and a 5Vdc and a 24Vdc power regulator. The transformer operates on an input voltage of 115 $\pm$ 13Vac single phase. The outputs of the transformer are 10Vac and 35Vac. The 10Vac output is connected to the input of RD-5 (5Vdc) power rectifier and the 35Vac output is connected to the input of RD-24 (24Vdc) power regulator. The input lines are protected by circuit breakers.

The following is applicable to both the RD-5 and RD-24 power rectifiers. The low input voltage is rectified by U2 and capacitors C1 thru C5. The unregulated output voltage of the rectifier circuit is the input for U1 (pin 3) I.C. Voltage Regulator. Also the unregulated voltage is placed on the collectors of Q1, Q2, and Q3 and also on the emitter of Q4.

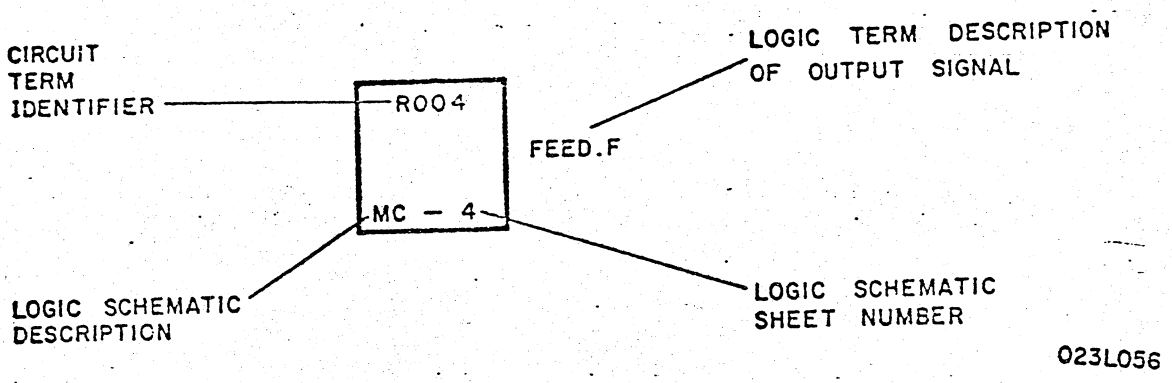
The booster output of U1 (pin 2) will turn on Q4 which will turn on Q3. The output of Q3 is applied to the base of Q1 and Q2. Q1 and Q2, pass transistors, will turn on and output a positive voltage. U1 pin 8 will monitor the output voltage for the purposes of regulation.

The silicon controlled rectifier, Q5 will clamp the output to a specified low voltage if the output voltage exceeds specification. Each output is adjustable by potentiometer R11. R11 is connected to the Feedback Circuit of U1.

3-5. LOGIC FUNCTIONS

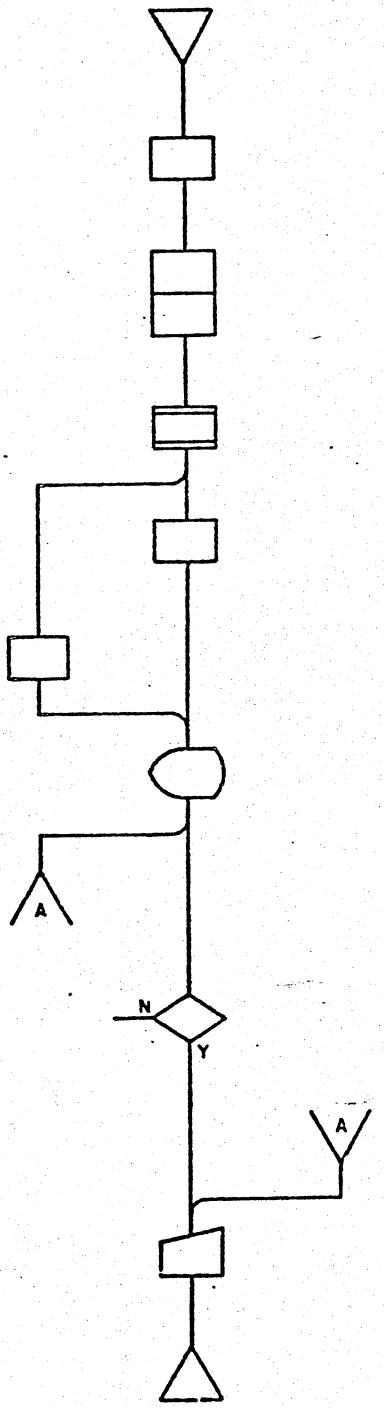
The logic functions of the Reader/Punch are described in flow charts. The MOTOR POWER UP, READY, PUNCH and READ flowcharts are accompanied by written descriptions. SYMBOL TERMINOLOGY - Table 3-1 describes the function of each symbol used in the flow charts.

The normal event symbols that show the circuit identification number (Figure 3-16A) will also show where circuit is located on the logic diagrams. The flow charts are keyed to the logic diagrams in Section IV of Diagrams Manual.



Board	Description
MC	Motion Control Board
PE	Punch and Echo Board
R	READ Board
PSB	Power Sequencer Board
PD	Power Driver Board
CC	Card Counter
DP	Distribution Panel

Figure 3-16A. Flowchart Circuit Identification



Beginning of flowchart.

Happening of a normal event.

Happening of simultaneous event. It does not indicate that one event caused the other.

Happening of a special event.

The operation of both parallel branches, not preceded by a decision block, must be completed in order to continue operation.

Indicator event-machine to operator (indicator lamp, mechanical motion etc).

Exit to another flowchart or a point on the same flowchart.

Decision block-check for condition, usually in the form of a question. Y=Yes N=No

Entry from another flowchart or from the same flowchart.

Manual input (switch keyboard etc.).

Termination of flowchart.

023L009

Table 3-1. Symbol Terminology

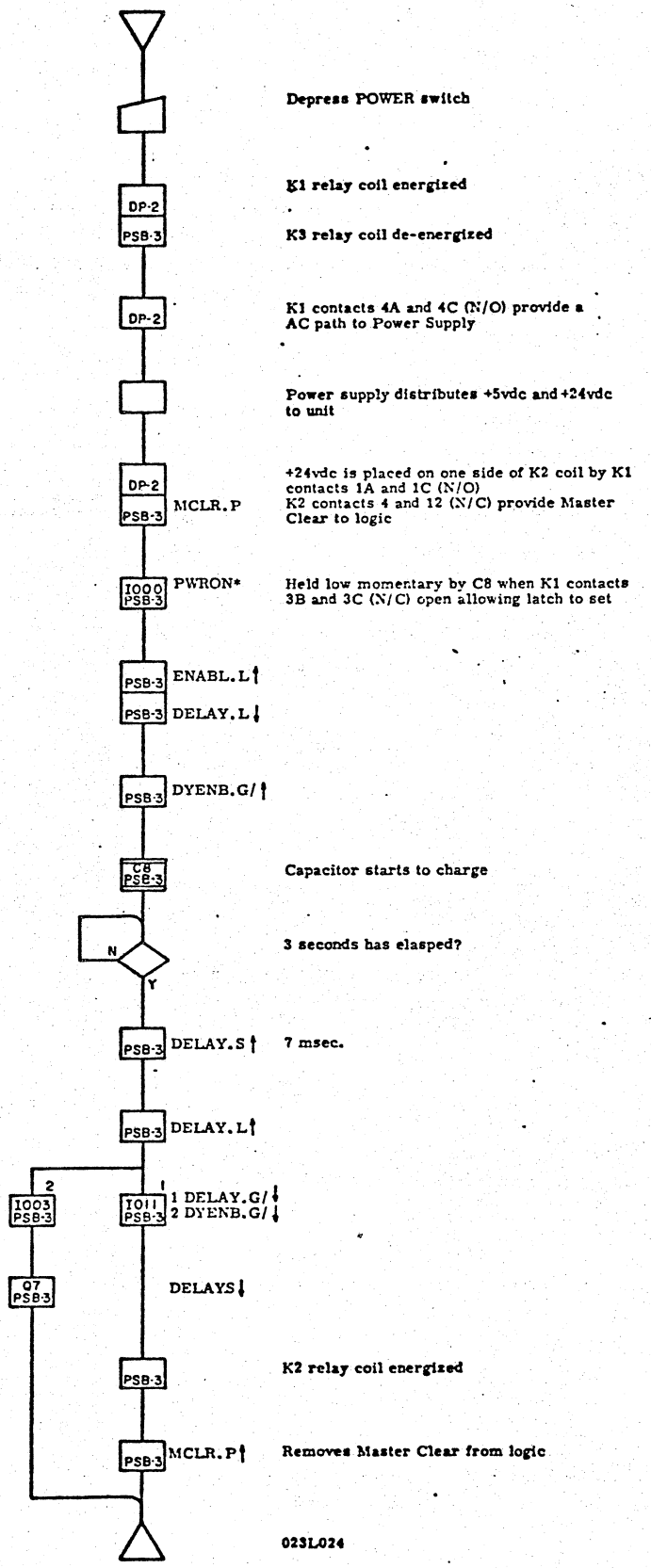


Figure 3-17. Power On Flowchart

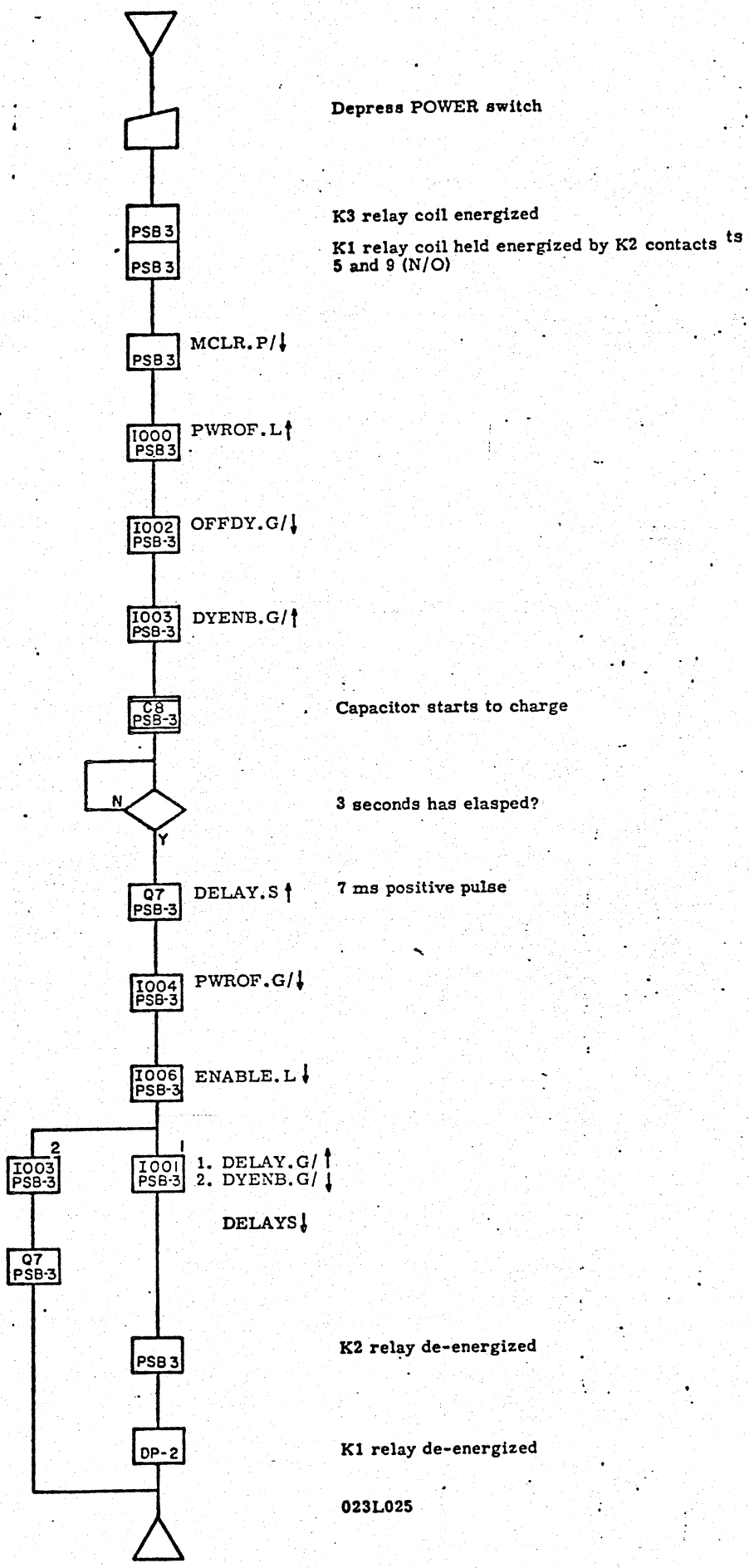


Figure 3-18. Power Off Flowchart

3-5.1 MOTOR POWER-UP

The motor can be turned on by either depressing the FEED switch or a FEED signal from the I/O.

Three preconditions to be met are: interlocks are closed, motor circuit breaker is "ON", and the JAM F/F is reset.

The MOTOR F/F can be set as follows:

a. Card not present in Read Ready Station and FEED switch depressed.

b. Card present in Read Ready Station with STANDBY F/F set.

The motor will start up and the timing disc will generate read timing pulses. This will cause the MOTOR RUNNING F/F to set. The single shot M007 will allow the motor to reach its normal operating speed the the clutch solenoid will be energized and feed a card from the Input Hopper to the Read Ready Station.

If the unit is not in STANDBY mode, then it will now go Ready. If the STANDBY F/F is set, then feeding can be controlled from the Operator Control Panel.

A FEED signal from the I/O, when the unit is Ready, will set the MOTOR F/F and turn on the motor. If a punch card is in the Read Ready Station and STANDBY F/F is reset, the motor will not turn on and the unit will go Ready.

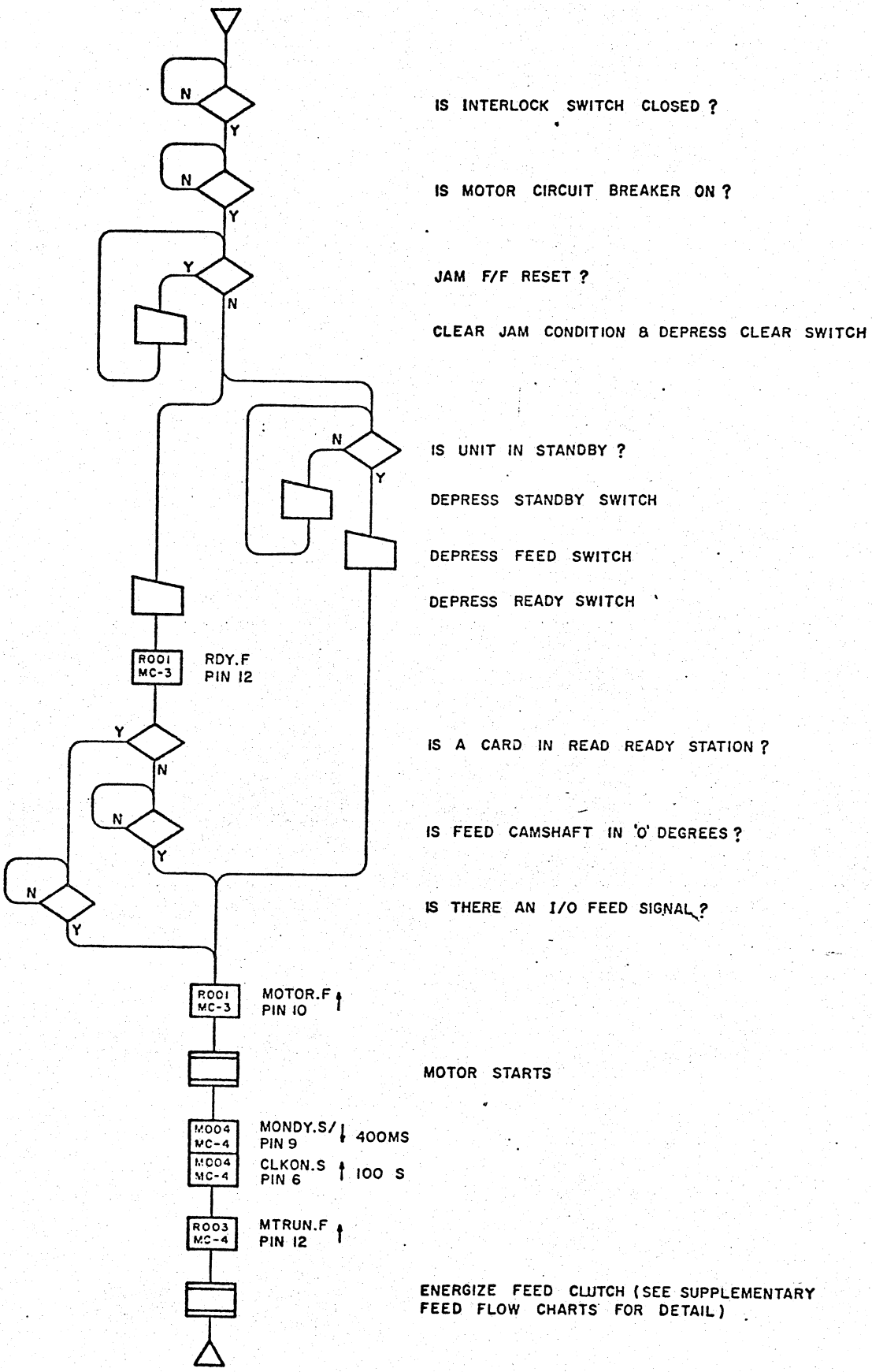


Figure 3-19. Motor Power Up Flowchart

3-5.2 READY

When the POWER switch is activated the Reader/Punch will power up in the Standby mode. The following unit status conditions must be met before a Ready mode condition occurs.

a. Interlock switch closed.

b. Punch cards in Input Hopper.

c. Stacker is not full.

d. Motor circuit breaker is in "ON" position.

e. READY switch is depressed.

If a punch card is present in the Read Ready station when the READY switch is depressed the Ready F/F (RDY.F) will set and in turn place Ready status on I/O and illuminate the READY indicator.

If a punch card is not present in the Read Ready station, when the READY switch is depressed IO32 (RDRDY.BA) will be high and IO17 (RDYFD.G/) will go low. In turn the Feed.F will set and the Motor.F will set turning on the motor. When the motor has reached full speed the IO51 (Clutch.G) goes high and the clutch is energized. A punch card is fed from the Input Hopper to the Read Ready station. IO32 will go low and the Ready F/F (RDY.F) will set. A Ready status will be placed on the I/O and the READY indicator will be illuminated.

NOTE

If a punch card is only in the Punch Ready Station the logic will perform an automatic feed sequence, although this is an illegal condition. If this condition exists it should be cleared by the operator.

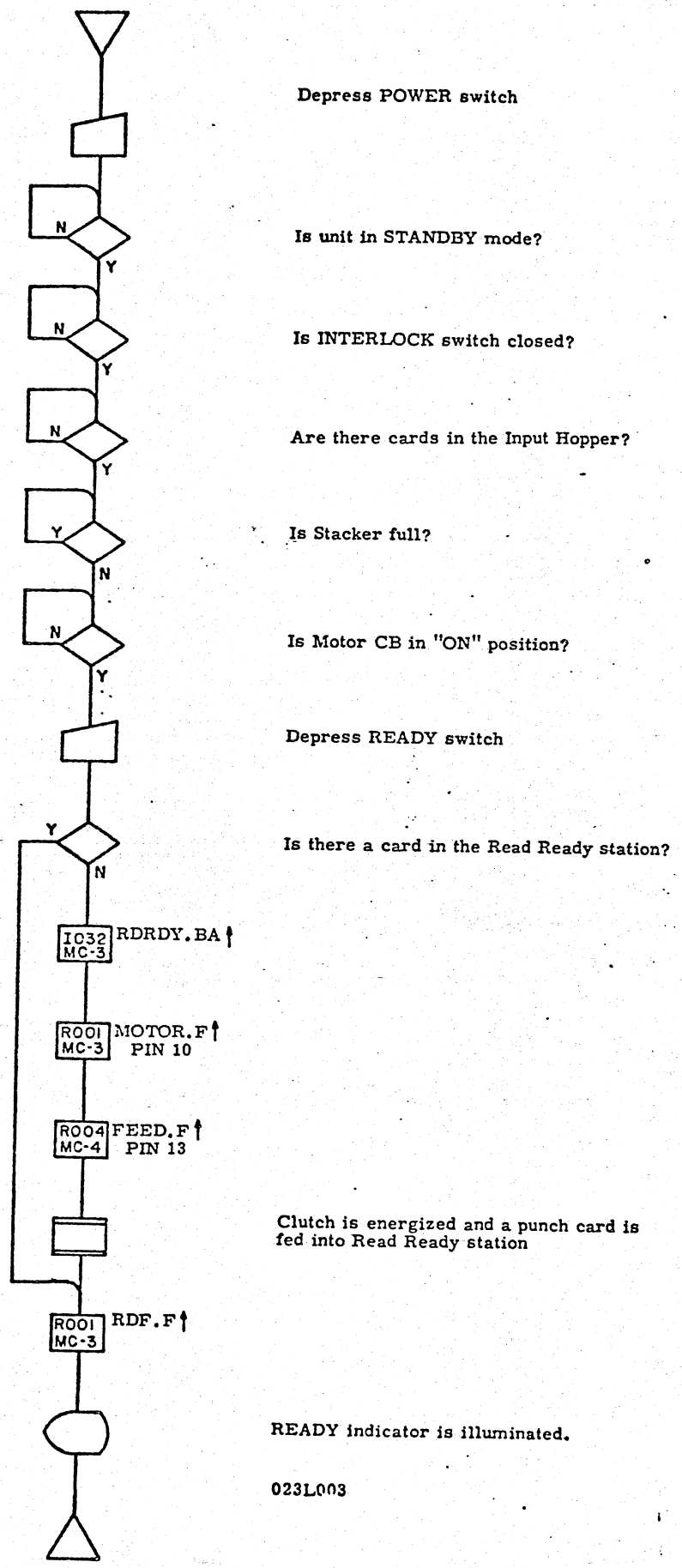
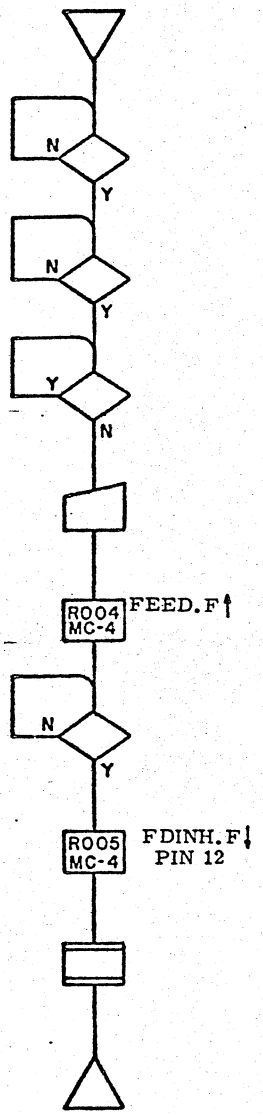


Figure 3-20. Ready Flowchart



Is unit in STANDBY mode?

Are punched cards in the Input Hopper?

Is Stacker full?

Depress FEED switch

Is "0" degree switch closed?

Clutch is energized and a feed cycle is initiated.

023L002

Figure 3-21. Manual Feed Flowchart

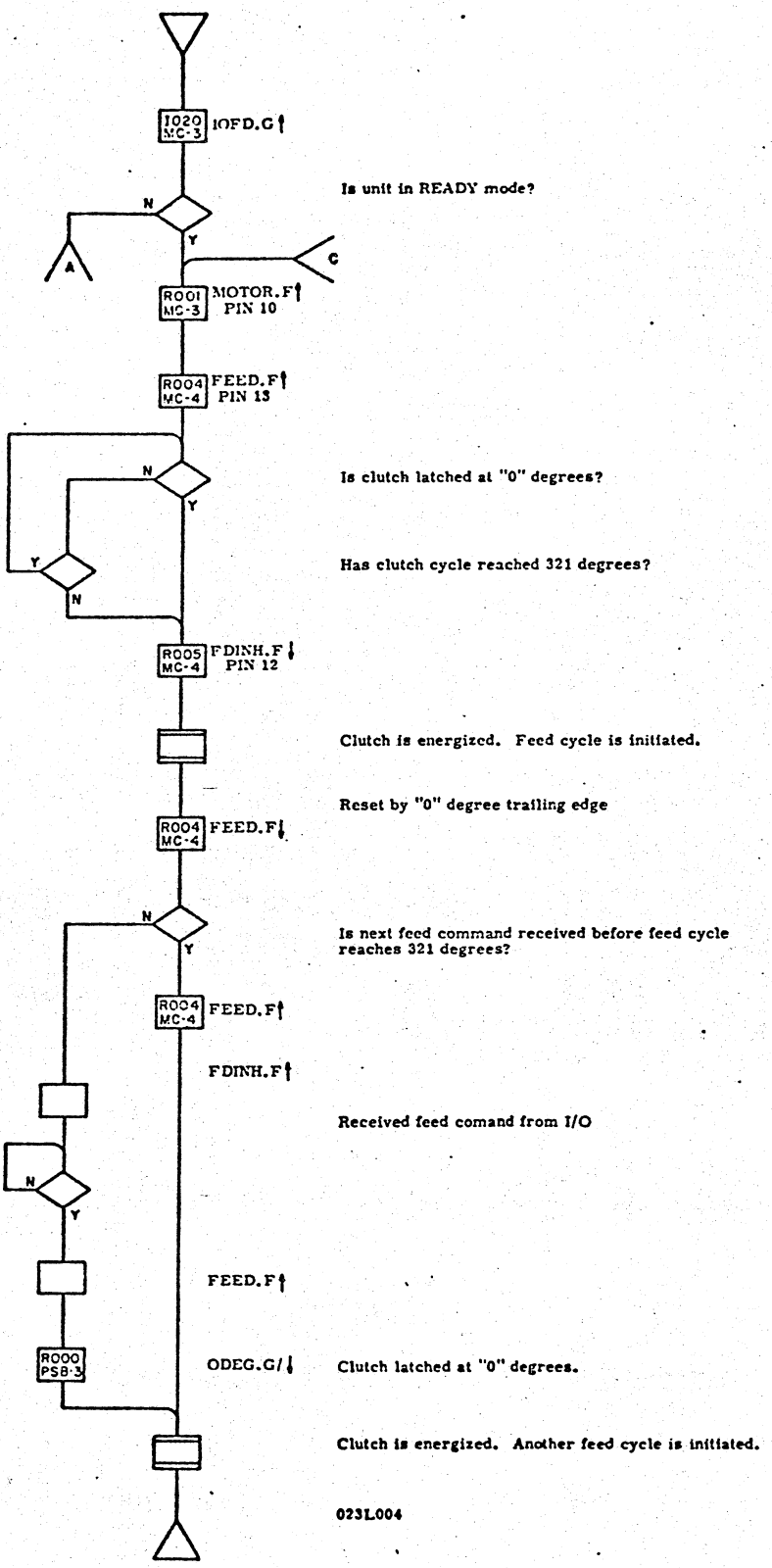


Figure 3-22. On-Line Feed and Motion Control Flowchart

FEED CYCLE WHEN CARD PATH IS EMPTY

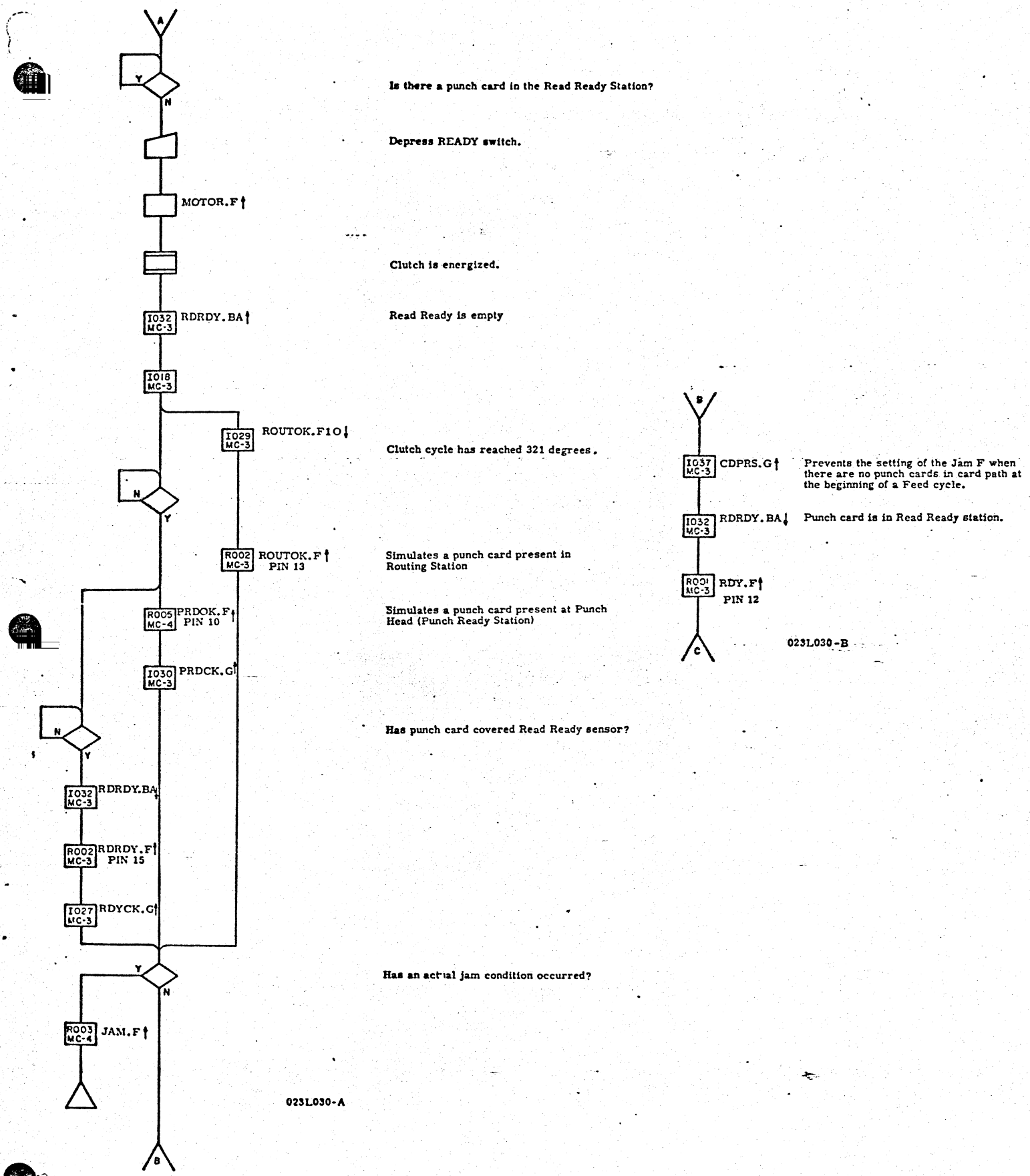


Figure 3-23. Feed Cycle When Card Path is Empty

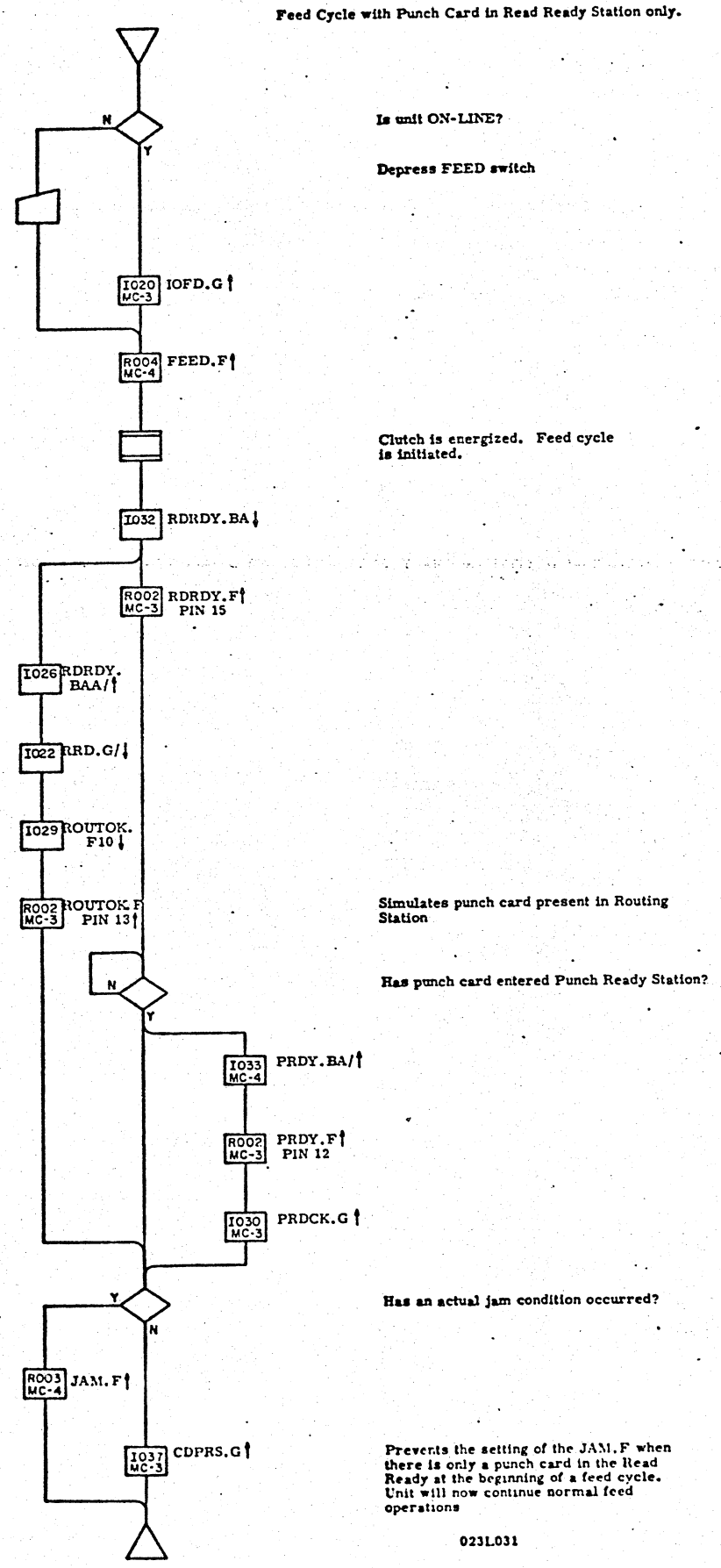


Figure 3-24. Feed Cycle with Punch Card In Read Ready Station Only

3-5.3 READ

During a normal feed cycle a punch card is moved from the Read Ready Stations through the Read Station to the Punch Ready Station. As the punch card enters the Read Station it will cover the Lead Edge sensor and the resulting signal indicates to the logic that a punch card is entering the Read Station. A light check is performed. All sensors should see light, if not, the Compare Error F will set.

When the punch card covers any data sensor (12 through 9), pulses from the timing disc are enabled and the counters C000 and D000 (sh-4) begin counting. After the first two blank columns pass through, the Read Station K001 (sh-3) resets and a dark check is performed at next AC00. At this time, all sensors should see dark, if not, the Compare F will set.

At the third count of AC10.GA the data buffer is enabled for column one. At count AC15.GA the data from the read sensors is disabled to the data registers. At the next count of AC00.G/ a compare pulse is generated and if any sensor see light that it did not previously see during load time then the Compare F on the punch board is set. (AC10 to AC15) The preceding procedure is repeated for each of the next 79 columns.

After the 80th column B counter advance pulse is generated, the Column 80 F/F is set and Data Load F/F (R000-sh-3) is reset, thus inhibiting further loading of data. On successive column pulses, END1.F and END2.F are set. On the 83rd column pulse, END1.F resets and a second light check operation is performed. If all sensors do not sense light then the Compare F is set. The 84th column pulse will reset END2.F and the punch card is now out of the Read Station. The Read Column 84th pulse then enables the transfer of column 80 data to the I/O and resets the read logic.

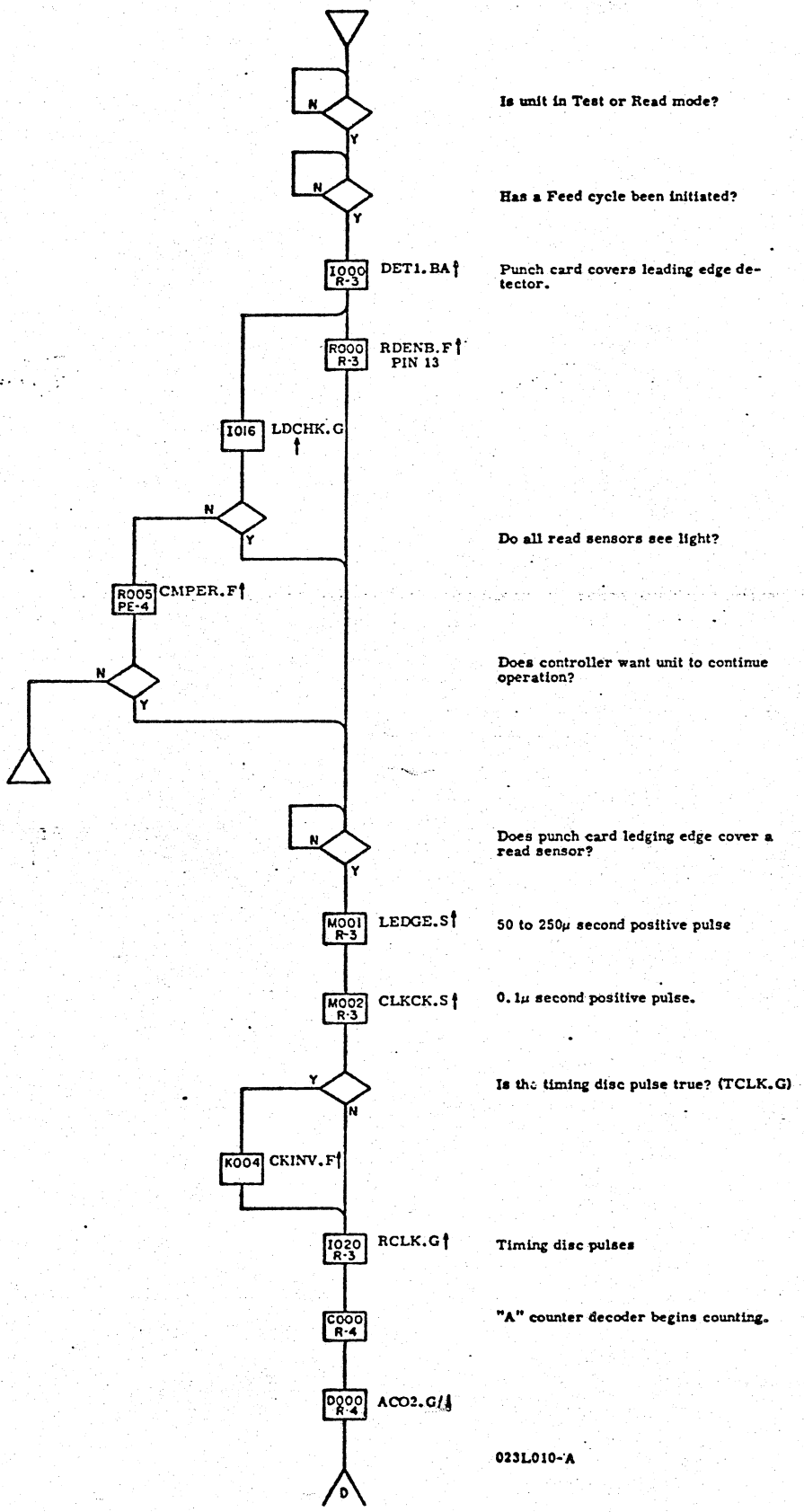


Figure 3-25. Read Lead Edge and Data Sensing (Sheet 1)

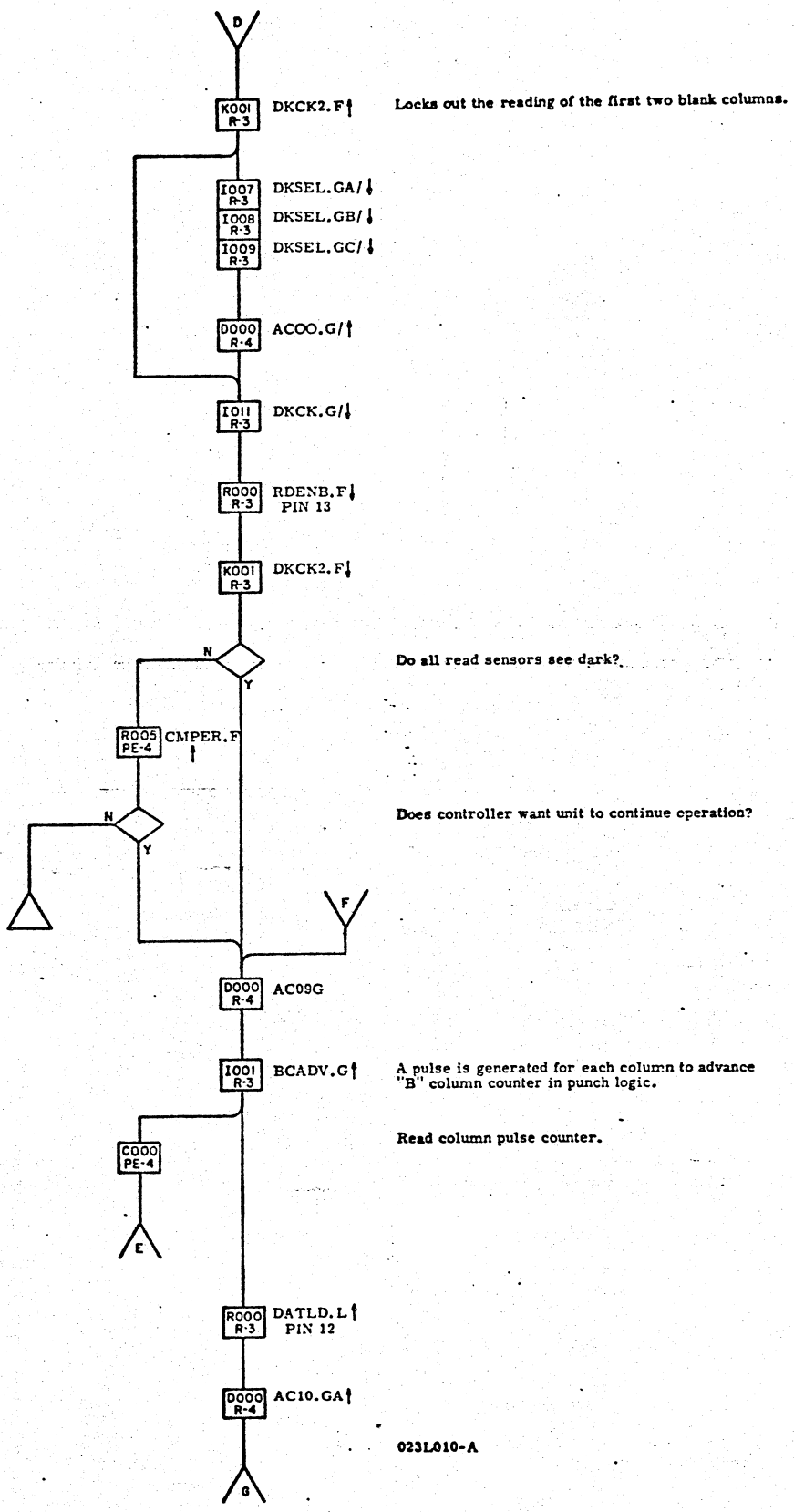


Figure 3-25. Read Lead Edge and Data Sensing

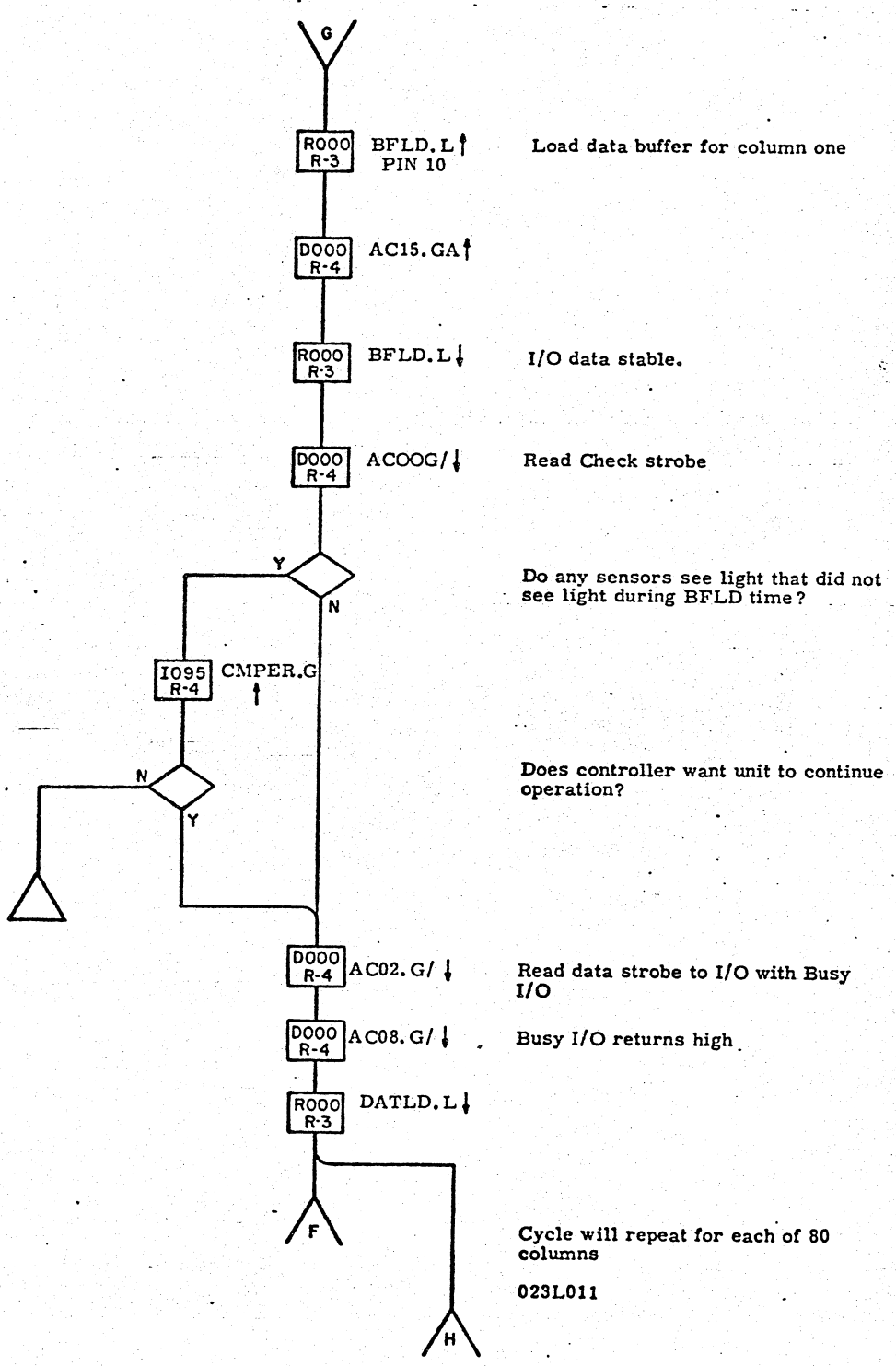


Figure 3-25. Read Lead Edge and Data Sensing (Sheet 3)

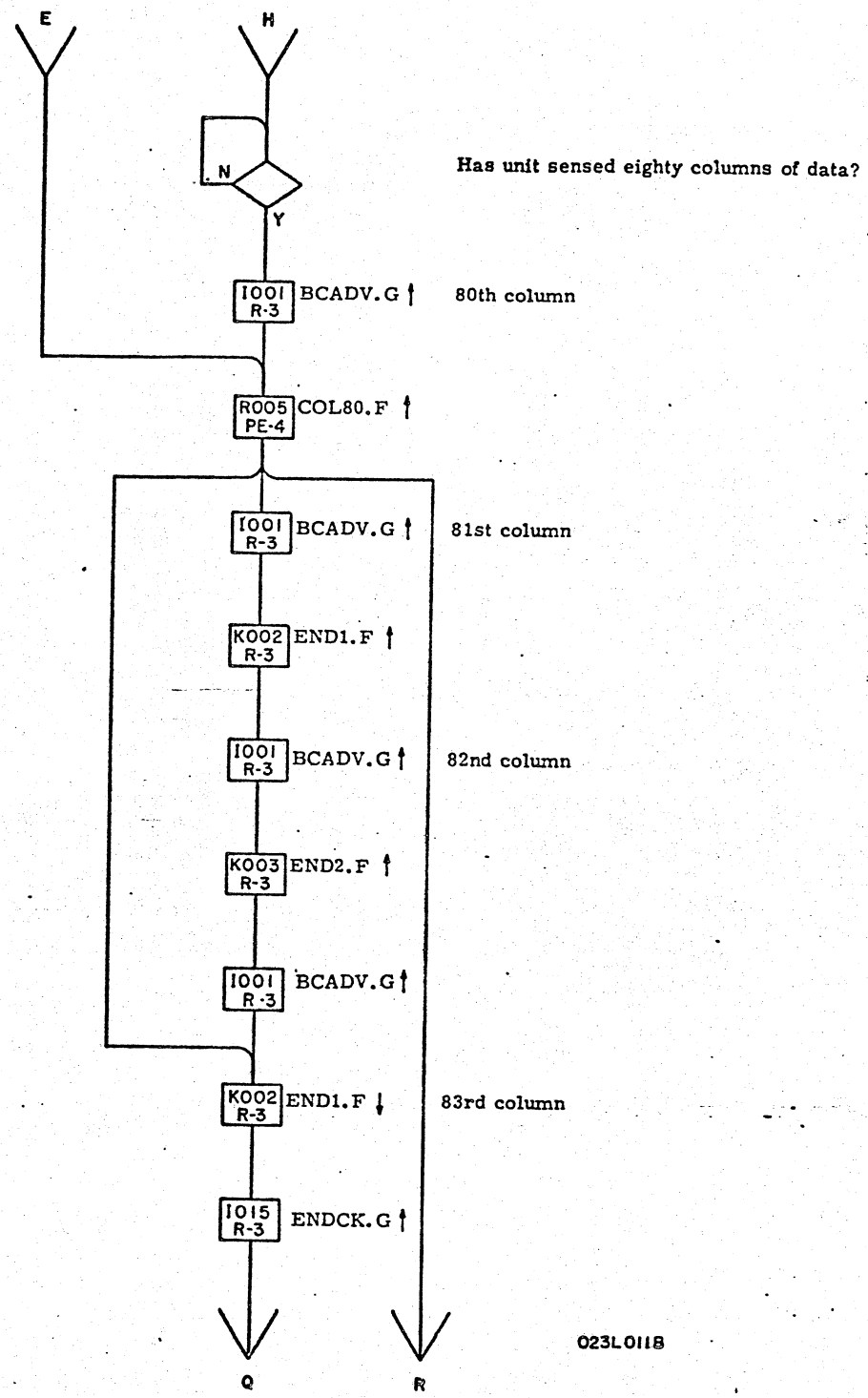


Figure 3-26. Read-Tail Edge Flowchart (Part I)

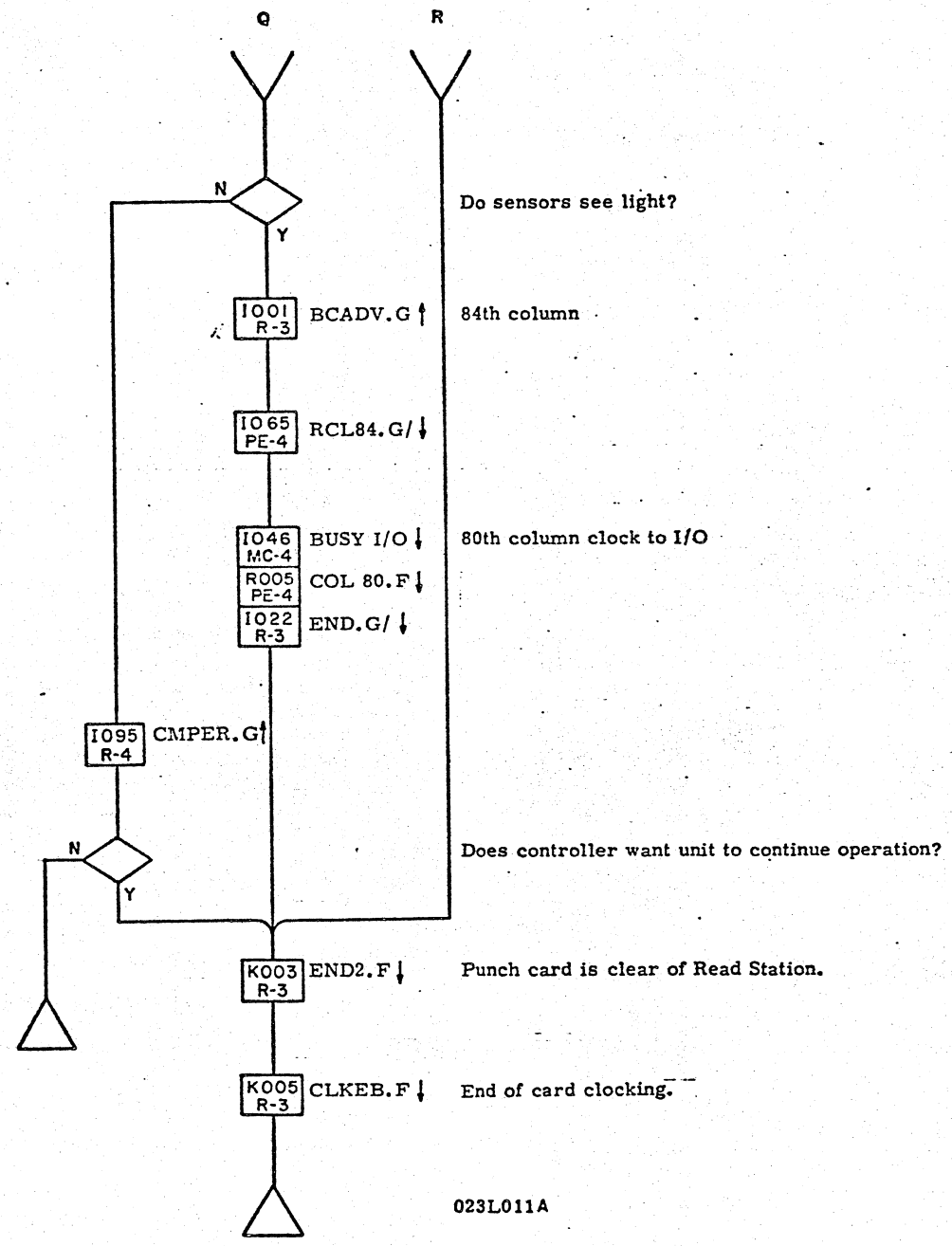
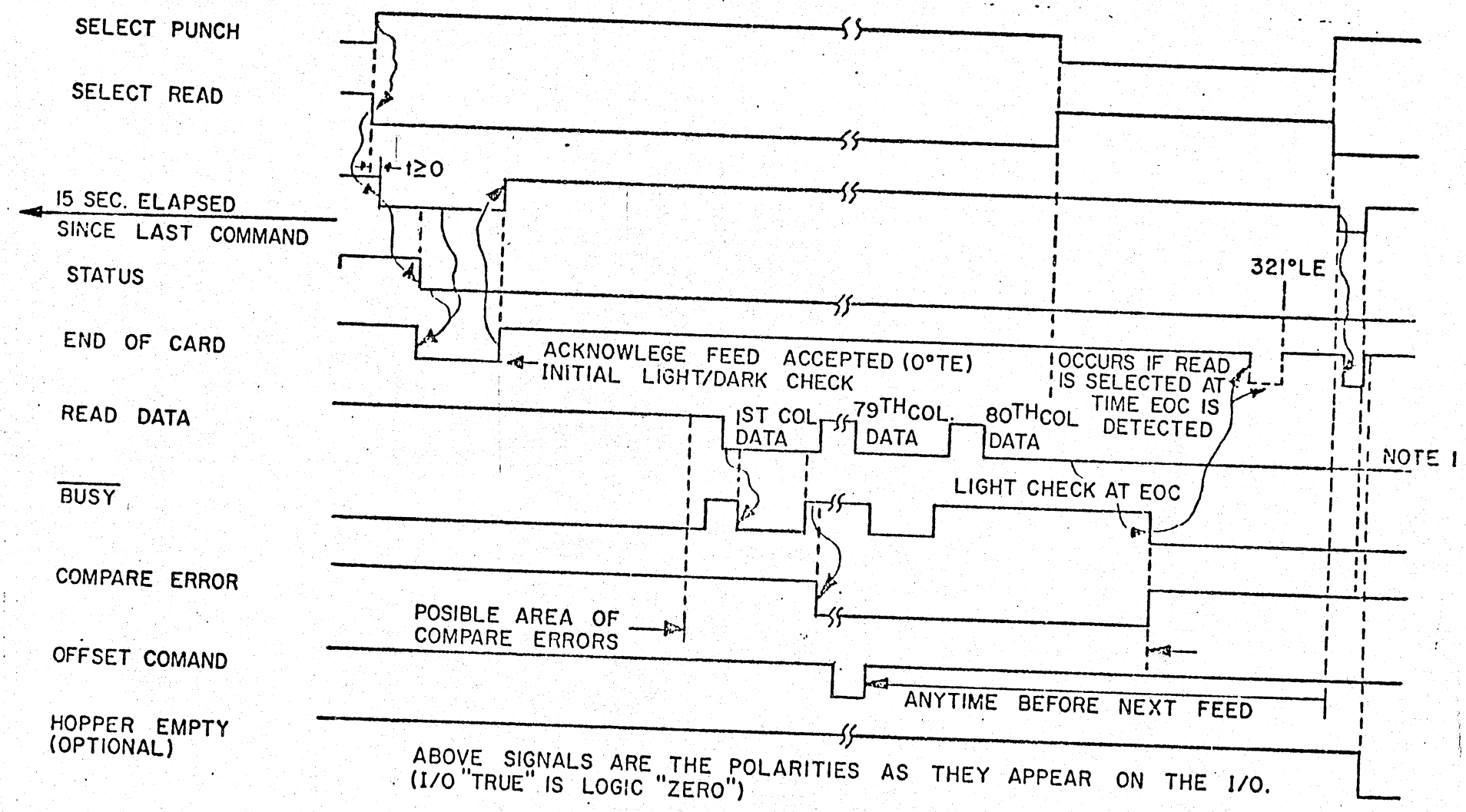


Figure 3-26. Read-Tail Edge Flowchart (Part II)



NOTE: 1. COL. 80 DATA IS RETAINED UNTIL JUST PRIOR TO NEXT CARD COL. 1 DATA BECOMES AVAILABLE.

Figure 3-27. Read Timing

023-L007

3-5.4 PUNCH

With a punch card properly positioned at Punch Ready Station, the following is a logic description of a punch operation. The PUNCH INHIBIT F/F is reset by depressing the PUNCH INHIB switch on the Operators Control Panel (Switch indicator is not illuminated). At this time the FEED F/F and PUNCH LOCKOUT F/F must be reset and READY F/F set before the PUNCH SEL F/F can be set. When INFO READY (I026) goes high indicating data is on line for column one, it enters a count of one into the Column Counter (C000).

INFO READY and Echo/Punch Strobe will set the BUSY F (R004). Echo/Punch Strobe will trigger Echo Check single shot (M000), that will in turn trigger Punch Data Clear single shot (M001), that in turn triggers Punch Load single shot (M002). Punch Data Clear will reset all twelve PUNCH DATA F/F and BUSY F/F. A data load pulse strobes the Data I/O gates. If a hole is to be punched in a row, then the corresponding gate is enabled, that in turn sets the PUNCH DATA F/F for that row.

The PUNCH DATA F/F, is set, will prime one input to the Punch Solenoid gate. When the SOLEN.F (R000) is set, it will prime the other input of each Punch Solenoid gate. If the corresponding PUNCH DATA F/F (PDAT00. F thru PDAT12. F) is set, then the gate is enabled and the punch coil is energized.

The reluctance pickups (2), monitoring the mechanical position of the stepper mechanism, are timed to the Punch Head so the Echo/Punch strobe occurs prior to the stepper strobe. There are two stepper reluctance pickups controlling each stepper latch. The latch to be energized first is determined by the reluctance pickup that senses the cutout in the stepper wheel first after SOLEN.F (R000) is set.

At the end of a punch operation, the Echo Check Operation (optional feature) is performed. After a hole is punched, the interposer is returned to the latched position. As the interposer approaches its solenoid coil, a magnetic flux is induced in the coil. The Echo Check circuit on the Power Driver Board will shape the magnetic flux signal, and then store it in the Echo Latch circuit. An "O" output of the Echo Latch circuit indicates a hole has been punched.

Each of the twelve Echo Latch outputs corresponds to an input of an "EXCLUSIVE OR" circuit. The other input is from a corresponding Punch Data F/F. As long as the twelve "EXCLUSIVE OR" circuits output a "1" the compare F/F will not set. If any of the "EXCLUSIVE OR" a circuits outputs a "0" the compare F/F will set and send a compare error to I/O and illuminate indicator.

A second INFO READY signal from the I/O will start a punch logic sequence for column two. This will continue until the counter (C001) reaches a count of 79 INFO pulses. At this time the EOC F/F will set. At the 80th INFO pulse (C001) COL 80F/F is set and Busy F/F is held reset. The EOC F/F indicates to the I/O that column 80 data is being requested, and the controller should terminate the punch mode and request a feed cycle after transmitting the column 80 data. No interlocking exists in the punch control logic to prevent further punching after column 80.

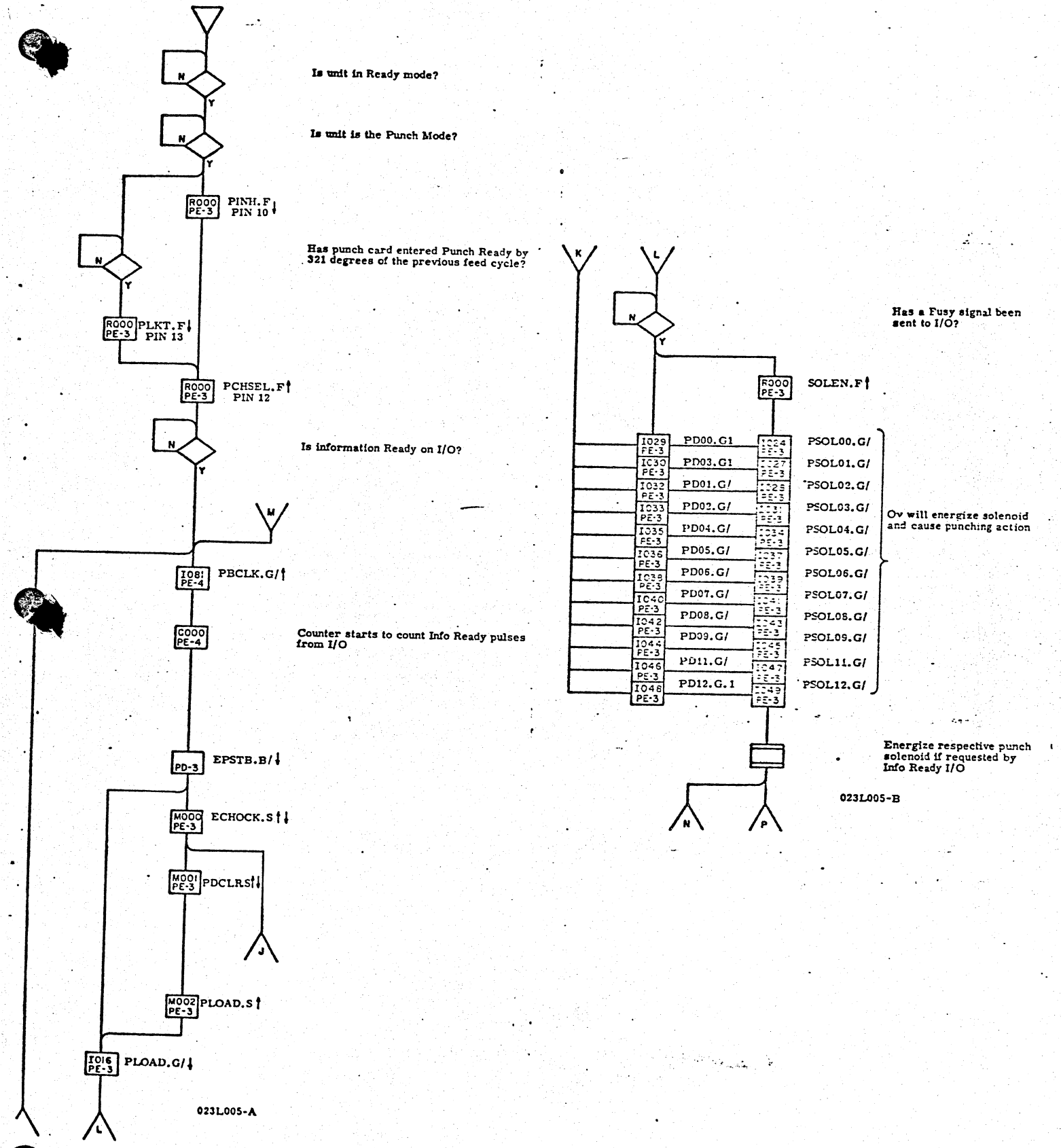
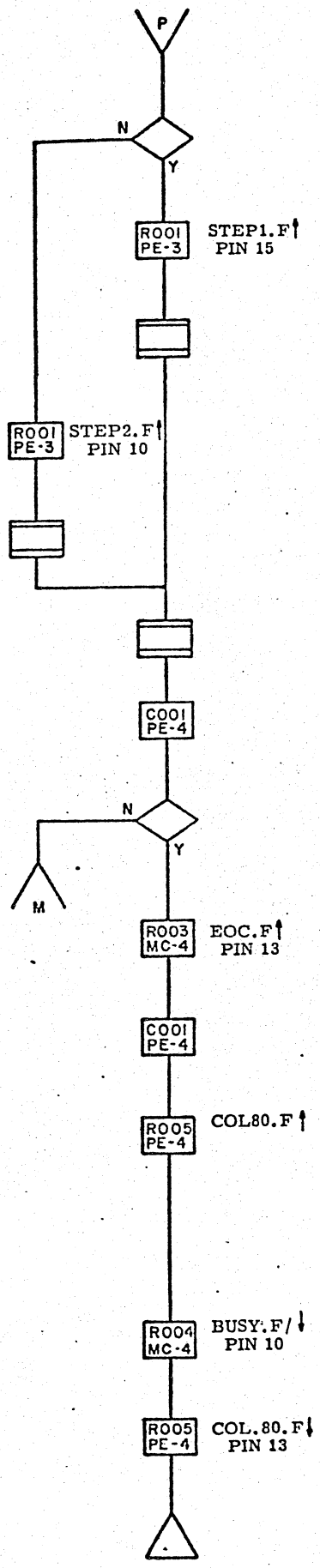


Figure 3-28. Punch Flowchart (Sheet 1)



Is stepper strobe one next to be energized?

Energize stepper one solenoid and move punch card one column

Energize stepper two solenoid and move punch card one column

Counts Info Ready pulses

Has counter (C000) counted 79 Info Ready pulses

Counts 80 Info Ready pulses

023L005-C

Figure 3-28. Punch Flowchart (Sheet 2)

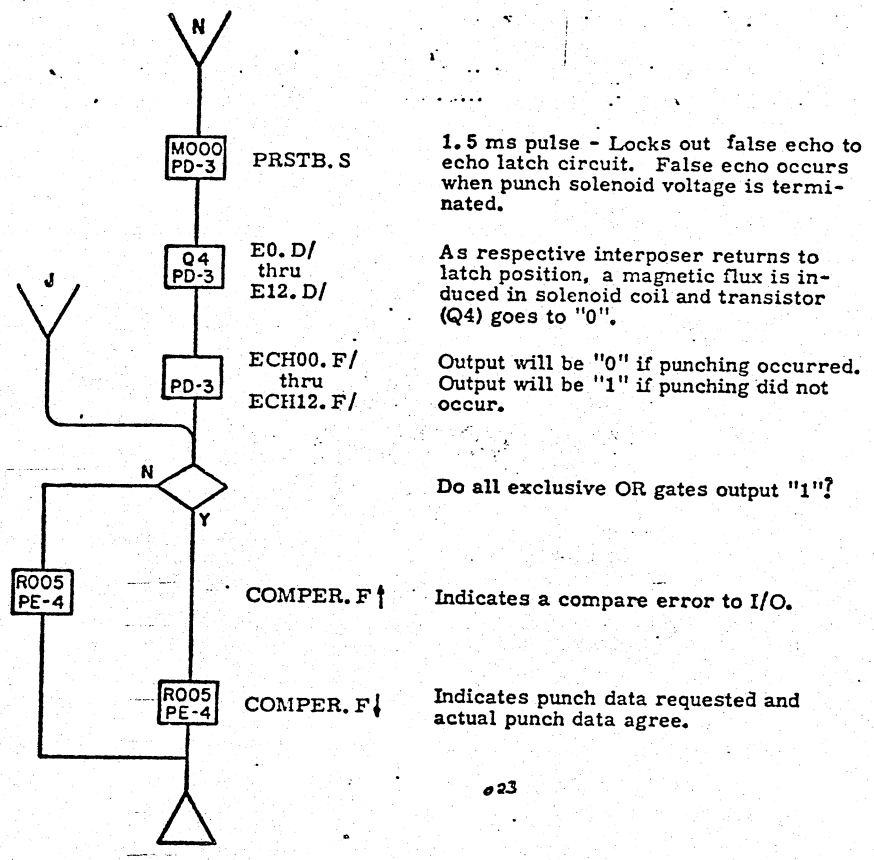
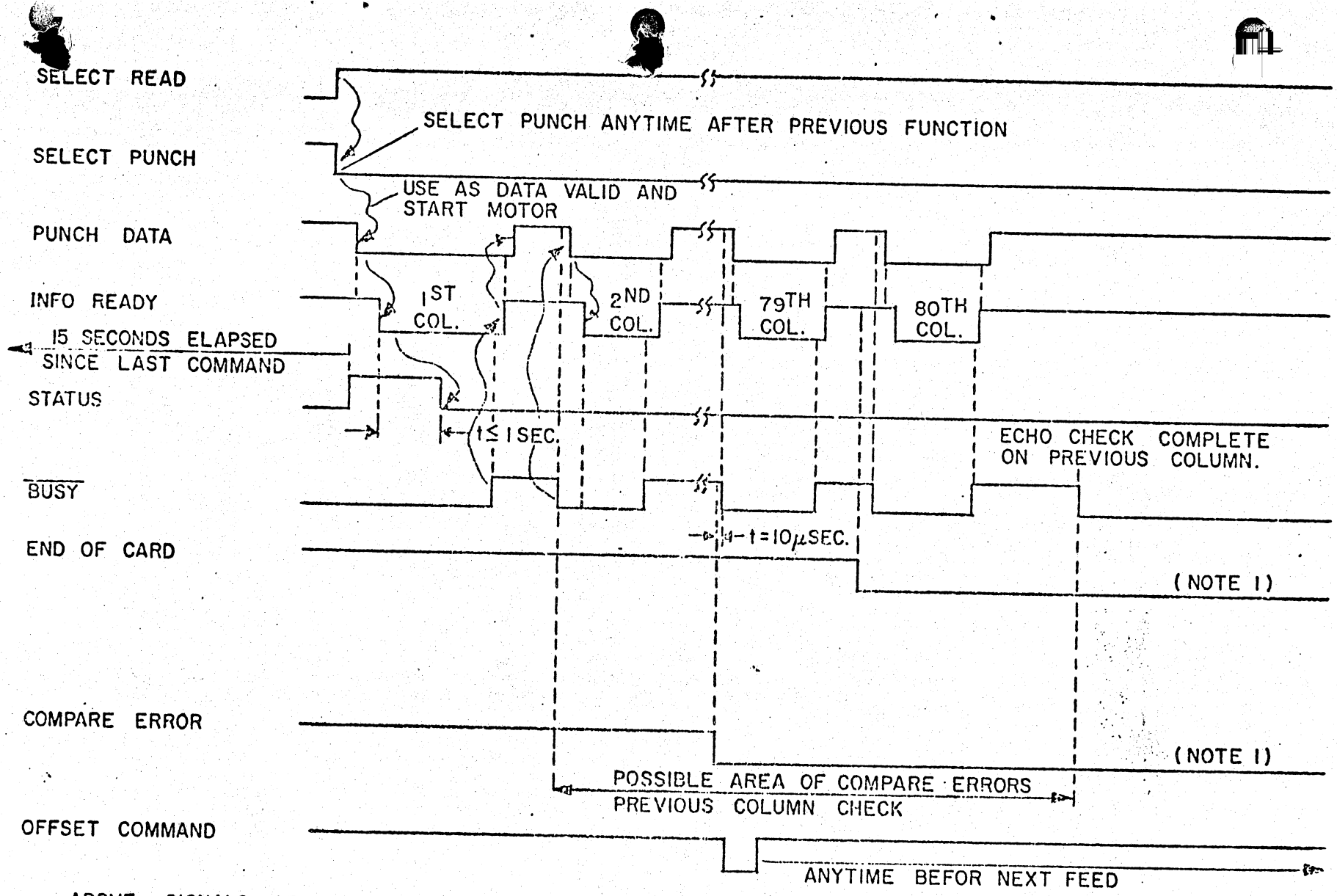


Figure 3-29. Echo Check Flowchart



ABOVE SIGNALS ARE THE POLARITIES AS THEY APPEAR ON THE I/O. (I/O "TRUE" IS LOGIC "ZERO")

NOTE: 1. END OF CARD AND COMPARE ERROR (IF TRUE) RETURN TO LOGIC "ONE" AFTER NEXT FEED CYCLE HAS BEEN INITIATED.

Figure 3-30. Punch Timing

023-L008

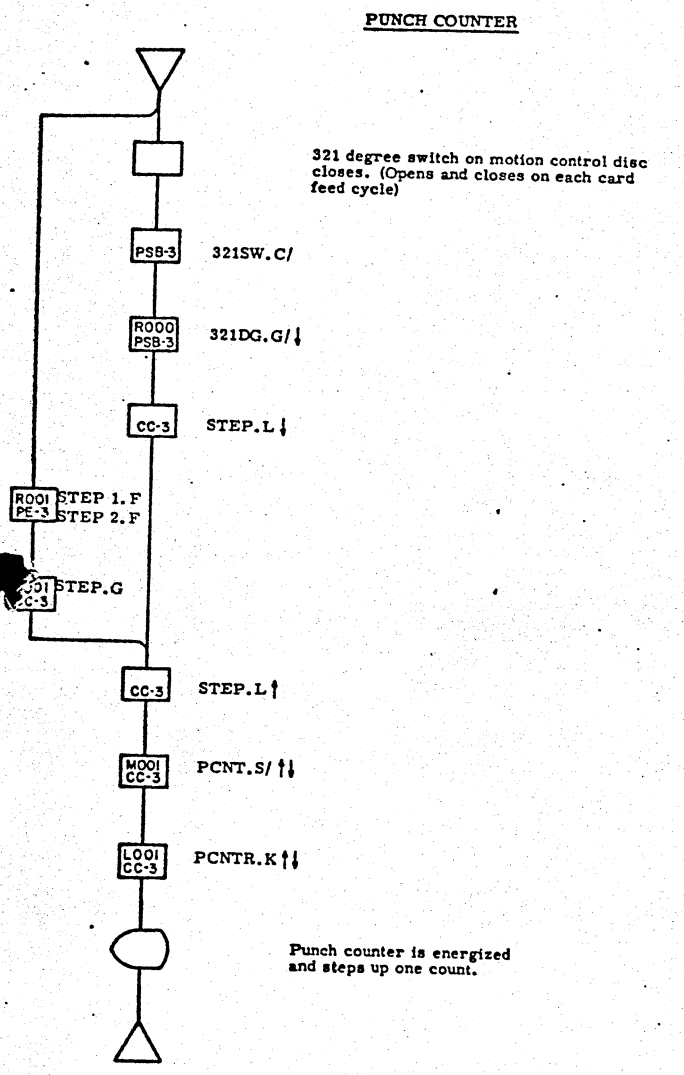


Figure 3-31. Punch Counter Flowchart

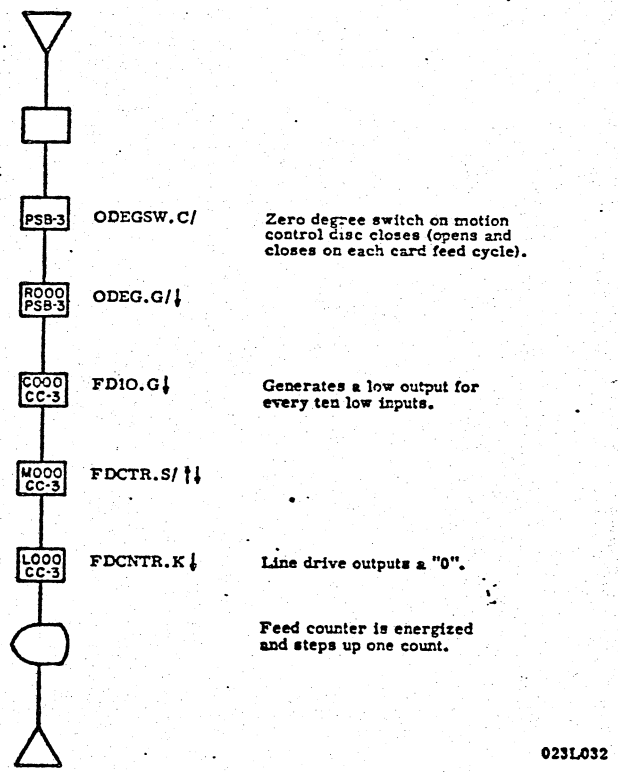


Figure 3-32. Feed Counter Flowchart

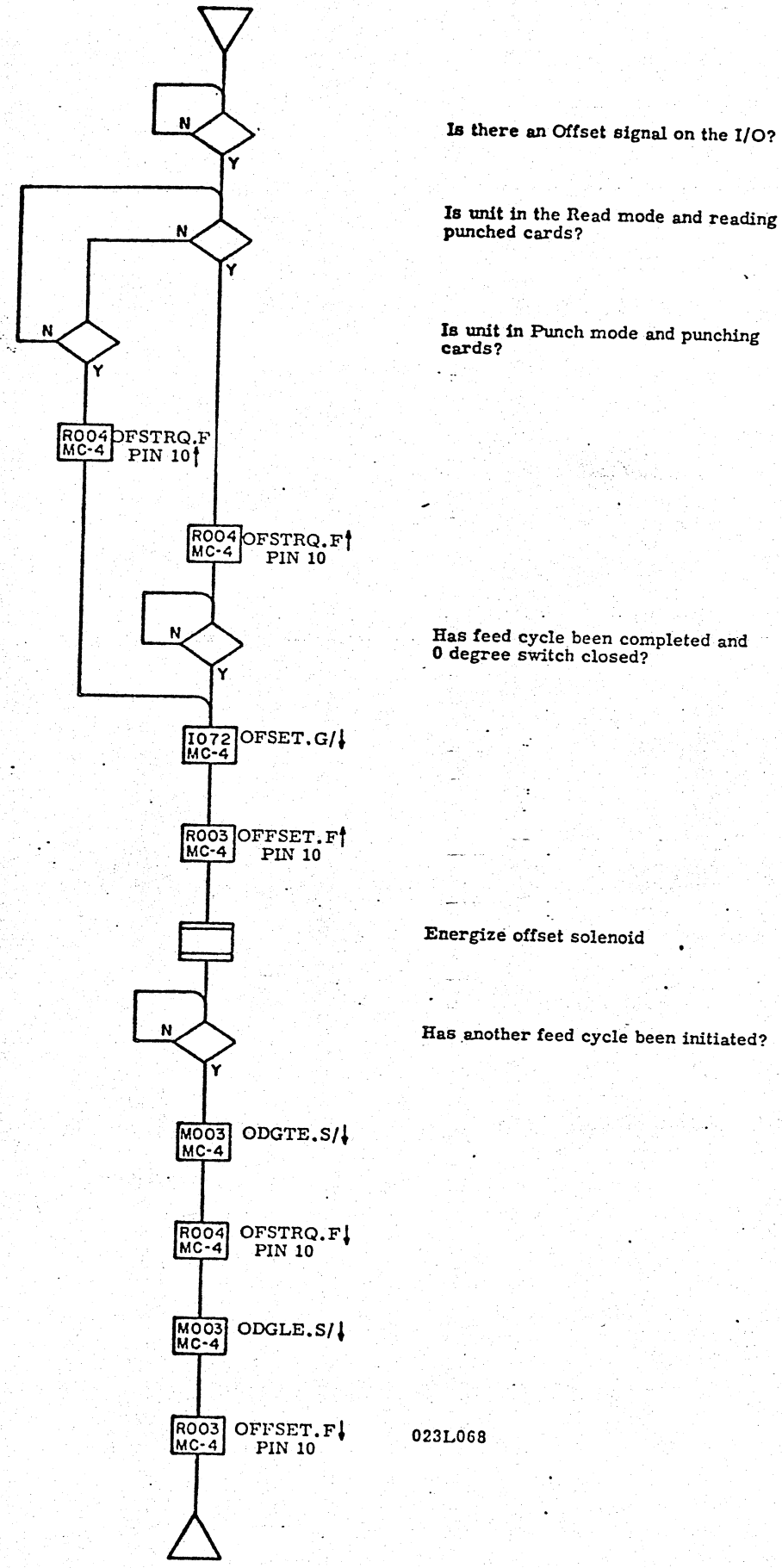


Figure 3-33. Offset Flowchart

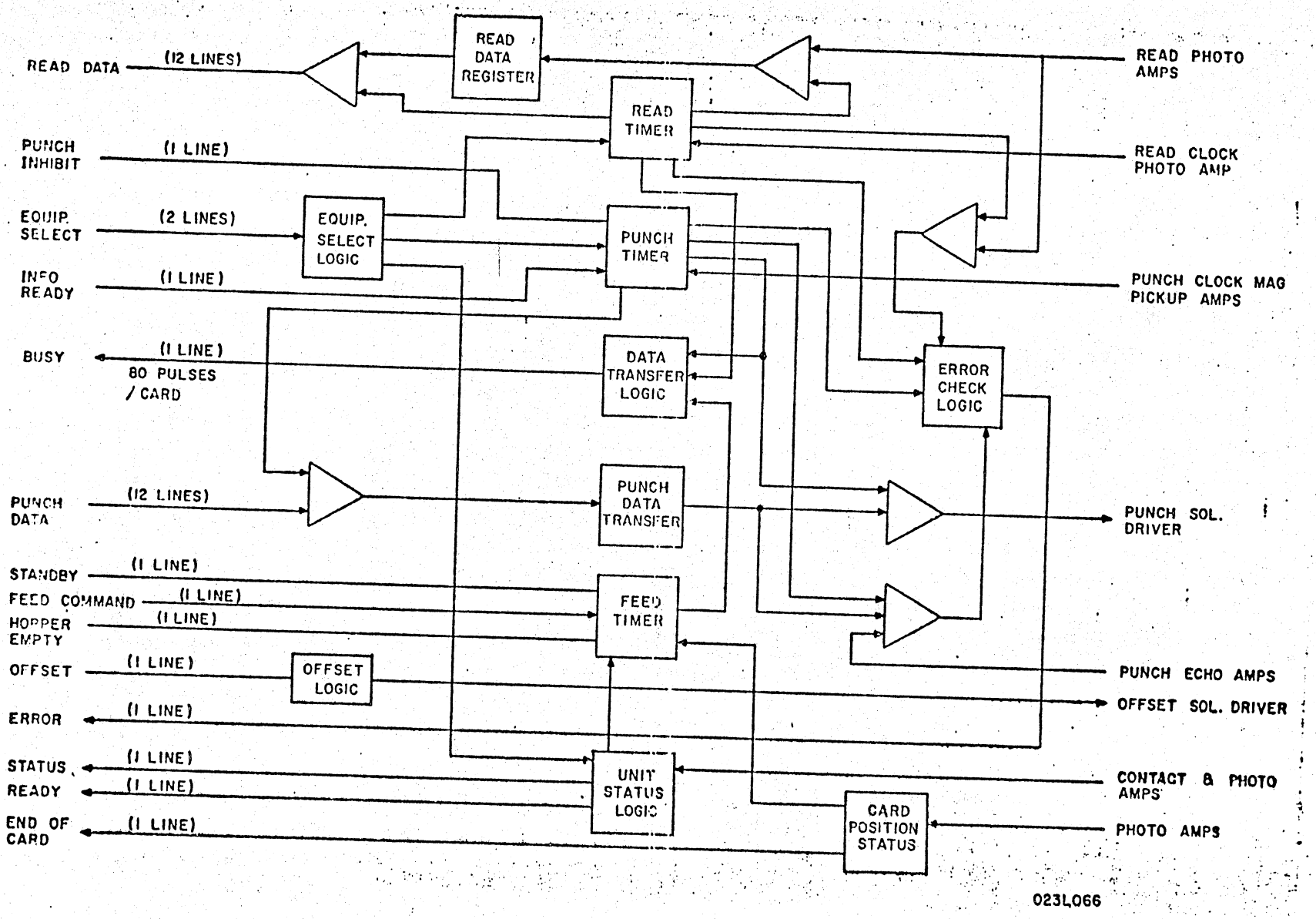


Figure 3-34. Logic Control Block Diagram

COMMENT SHEET

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