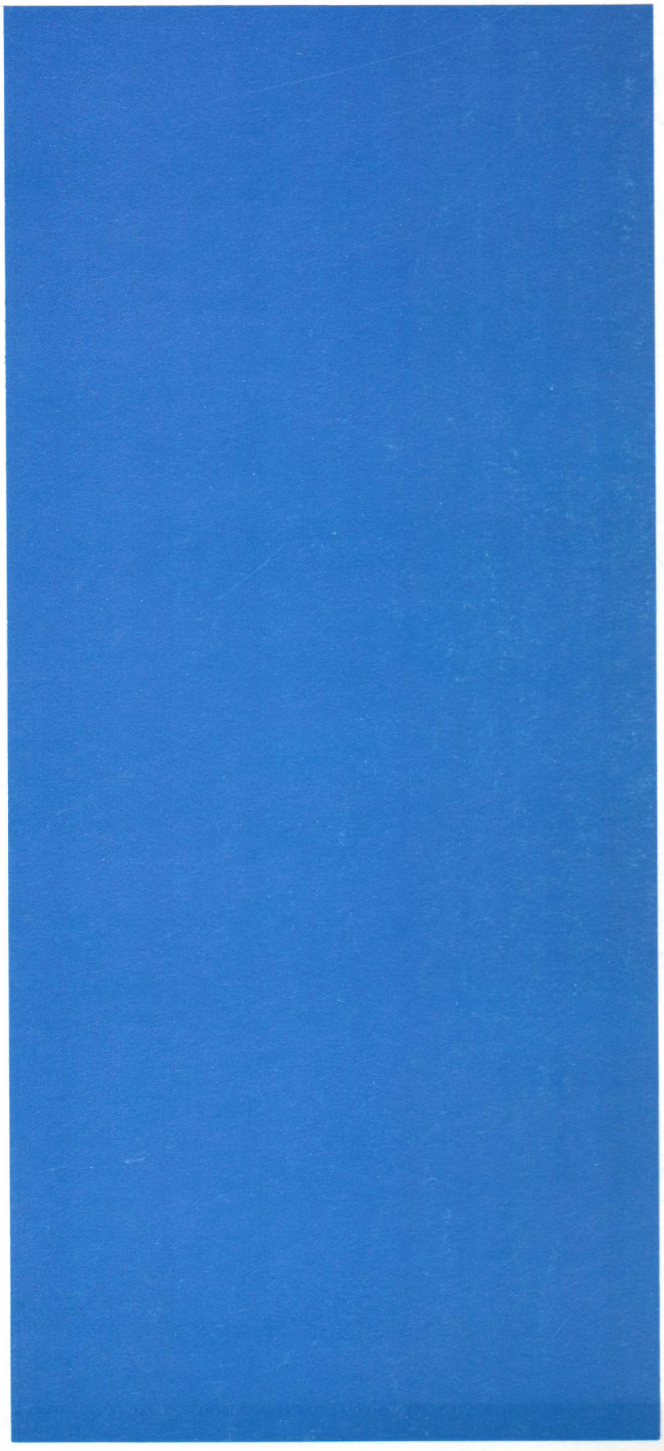
Honeywell

CPZ100, CPZ200, CPZ201, CRZ150, CRZ200, CRZ201 PUNCHED CARD SUBSYSTEMS

SERIES 400/600/6000

HARDWARE



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SERIES 400/600/6000

SUBJECT:

Information, Functional Characteristics, Operating Instructions, and Characteristics of Series 400/600/6000 Punched Card Subsystems.

SPECIAL INSTRUCTIONS:

This manual is an update of CPB-1288A, dated October 1966 and revised December 1967. The new order number is consistent with the HIS publications numbering system. Changes and additions are indicated by bars; deletions are indicated by asterisks.

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PREFACE

This manual furnishes general information and specific reference material for customer executives, system analysts, operators, programmers, and others interested in punched card subsystems available with the Series 400/600/6000 Information Processing Systems and the DATANET communications systems. The first section will satisfy the needs of those who want only a highlight of what the subsystems do. Section II describes in detail the functional capabilities of the subsystems. This chapter will be of prime interest to system operators and furnishes background information for programmers. Detailed descriptions of operating controls are found in Section III. The individual subsystems and the unique features of each are described in Appendix A.

When the subsystems are being used with a Series 400 system, the term "processing system" refers to the central processor; for the Series 600/6000, the term refers to the Input/Output Controller.

File No.: 1503, 1603, 1703

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1. GENERAL INFORMATION

The Honeywell Series 400/600/6000 Information Processing Systems are designed to give the user versatility of operation in card subsystem equipment.

Card reading equipment reads information punched into tabulating cards in alphanumeric or binary modes and feeds it into the core store of the central processor for processing or storage. The user has a choice of reading speeds from 900 to 1200 cards per minute to meet his requirements.

Card readers are designed to:

- Handle either round- or square-cornered cards, intermixed.
- Read cards punched in alphanumeric (binary-coded decimal, or Hollerith) and 12-row binary formats.
- Operate simultaneously with central processor computation and other input/output operations.
- Read at variable speeds (asynchronous).
- Read cards serially, column by column, by means of photocells which provide reliable and accurate reading of data in either continuous or demand-type operations.
- Check card timing and synchronization, proper card feeding and reading, empty hopper, and full stacker.
- Check for the presence of invalid characters.

Card punching equipment permits information from the central processor to be recorded directly on cards under control of a stored program. Punching speeds from 100 to 300 cards per minute are available.

Card punches are designed to:

- Punch cards in alphanumeric or 12-row binary formats.
- Operate simultaneously with central processor computation and other peripheral subsystems.
- Punch cards row by row, 80 columns at a time.
- Check card feeding
- Check punching accuracy by a read-after-punch hole count.

PHYSICAL CHARACTERISTICS

The punched card subsystems, packaged as single, freestanding units, are on-line devices, each consisting of a card handling mechanism, control electronics, and a power supply. Operator's control panels display a full array of controls and indicators for observing and controlling the operation of the subsystems.

The power supply is adequately fused against overloads and provides and regulates the necessary a.c. and d.c. voltages for the card handling mechanism and the control electronics.

The control electronics interpret and transmit to and from the processing system the data read from or punched into cards and generate and transmit timing signals and information on the operating condition of the subsystem.

USE WITH THE SERIES 600/6000

Whenever the subsystem operates within a multiprogramming environment, its operation must be coordinated to mesh efficiently and simultaneously with that of other peripheral equipment in the system. The General Input/Output Supervisor (GIOS) program, available with the Series 600/6000 systems, does this for the programmer. It handles the details that arise from supervising the activities and status of many peripherals and makes the most efficient use of them in conjunction with the valuable time of the processing unit.

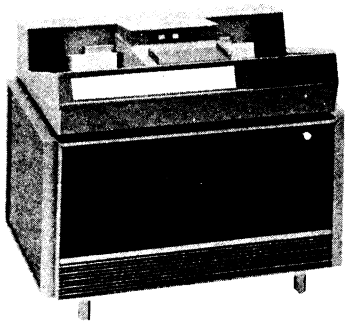
Whenever use of the subsystem is required, GIOS communicates with the Input/Output Controller (IOC) by means of a connect instruction. If the subsystem is busy when the output request is made, GEIOS queues the request until the subsystem becomes ready. When the subsystem has accepted the instruction and received all the information necessary to initiate data acceptance and punching or reading, the connect sequence ends and the IOC data service sequence begins. This sequence controls the transfer of information to the subsystem.

When operation stops, either because of a normal termination or because an alert condition occurred, the IOC places the status and substatus of the subsystem in the proper queue and sends a program interrupt signal to the store controller. GIOS, in turn, checks each queue entry to be sure that the peripheral operation was completed free of errors. If it was not, the proper recovery routines are called in. GIOS also returns status and substatus information to the program whenever it requests it.

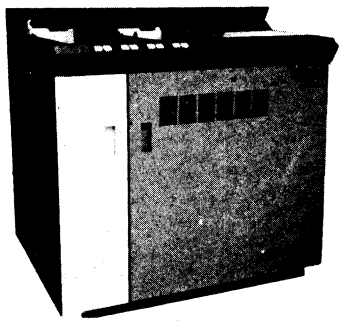
With GIOS efficiently assuming the burden of responsibility for directing peripheral operations, the programmer is relieved of much detailed programming. Programming information on the use of the subsystem with the Series 600/6000 is contained in Series 6000/600 General File and Record Control System, BN85, and Series 6000/600 GMAP Macro Assembly Program, BN86.

USE WITH THE SERIES 400

All peripheral operations are identified by the instruction code field of the general instruction that initiates the operation. For detailed information on programming subsystem operations, refer to Series 400 Programmer's Reference Manual, BM54, and Series 400 Macro Assembly Program, BM69.



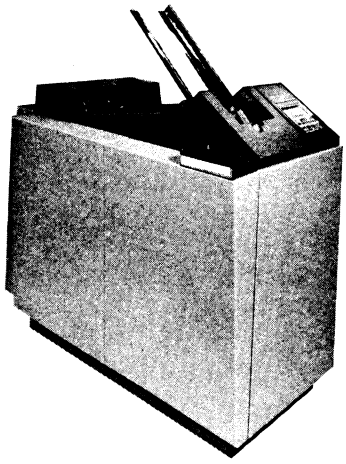
CRZ200



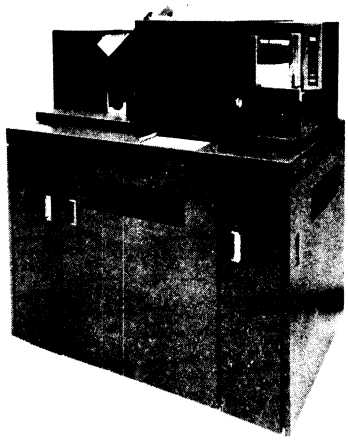
CRZ201

READERS

PUNCHES



CPZ200



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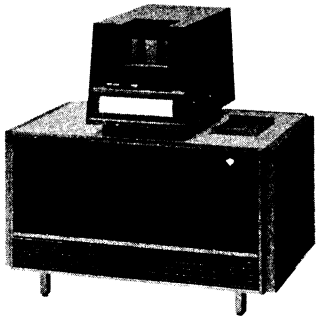


CPZ100

2. FUNCTIONAL CHARACTERISTICS

READERS

Honeywell card readers are on-line devices consisting of a card reading mechanism and the control logic that links it to the central processor. The card reading mechanism consists of the card input hopper, a card feed mechanism, a reading stations, and a card output stacker. The reading station is composed of a lamp and 12 light-sensitive photocells.

The reading of each card is initiated by a specific sequence of instruction signals received by the card reader. If no Attention conditions exist, the card reader goes into a busy state, decodes the instruction, checks its validity, and initiates the proper control functions.

The first card is released from the input hopper. The card track moves the card to the reading station. There, the photocells read the card, one column at a time. The photocells detect light from the light source passing through the punched holes in the columns and send an electronic signal to the control electronics. In each card cycle, the operation of the photocells in the read station is checked to determine that there is no malfunction and that the card has not been unstable in its passage through the read area.

The transfer of data continues until the entire card is read, an alert condition is detected, or the card reader receives a signal telling it to transfer no more data. When reading of the card is completed, a check is made to determine whether the correct number of columns were read. If not, an error is indicated. The card reader then makes available information on its status and generates a signal indicating termination of operation.

PUNCHES

Honeywell card punches are on-line devices consisting of a card punching mechanism and the control logic that links it to the central processor. The card punching mechanism consists of the card input hopper, the card feed mechanism, a punching station, a reading station, and a card output stacker.

Before punching can begin, the card punch must be properly loaded and free of any Attention conditions. The subsystem becomes busy and card punching begins when a punch instruction is received and accepted.

When the instruction is given to begin card punching, the bottom card of the stack is pushed from the hopper into the punching station. As soon as the punch goes into the busy state, it requests data for the card. Data is transmitted, character by character, from

the processing system to the buffer of the punch's controller. The parity of each character is checked as it is received. If the instruction requests the data to be punched in the Hollerith code, the code is converted by the controller before the data enters the buffer. The 80 punching dies punch the card, a row at a time. The card then moves into the reading station, where 80 wire brushes read it by sensing the presence or absence of holes. From the reading station, the card is moved to the output stacker.

DATA MEDIA

The subsystems accept and punch or read data into or from punched cards in a variety of intermixed card stocks. The mechanism of the subsystem handles cards so as to produce the least possible wear both to the cards and to the subsystem itself. Cards should meet the basic requirements specified for their use with most electronic and tabulating equipment in order to provide the greatest possible amount of service.

The subsystems also handle cards exposed to a wide range of temperature and humidity conditions, provided the cards are first given a reconditioning period.

MODES OF OPERATION

Readers

ALPHANUMERIC MODE. The contents of each card column punched in the Hollerith format are converted to the equivalent 6-bit character and transmitted with an odd parity bit. In addition, a check is made to see that the punches in each column represent a valid character of the character set. (See the Appendix B of this manual for the character set and the corresponding punches in the Hollerith format.)

BINARY MODE. Data punched into the top half of each column (row 12-row 3) is transmitted as the first character, supplemented by an odd parity bit. Data read from the lower half of the column (row 4-row 9) is transmitted as the second character.

MIXED MODE. When the card reader is operating in the mixed mode, it is reading a deck composed of both alphanumeric and binary cards. As each card enters the reader, column 1 is examined to determine which type the card is and thus, how the data is to be handled. If the "7" and "9" of column 1 are punched, regardless of what other punches occur in the column, the card is read in the binary mode. If either or both of these two punches are missing, the card is read in the alphanumeric mode. In either case, the full 80 columns of card information are transmitted, including column 1. Since there are no alphanumeric characters represented by both the 7 and 9 punches, either with or without other punches, the card reader cannot accidentally misinterpret a standard Hollerith punch configuration in column 1 for the special identifying 7 and 9 punches of a binary card.

Punches

BINARY MODE. Two 6-bit binary characters are punched into each card column. The first character goes into card rows 12-3 (row 12 contains the most-significant bit). The

second character is punched into card rows 4-9 (row 4 is the most-significant bit). The third and fourth characters are punched in column 2, etc.

ALPHANUMERIC MODE. Each 6-bit data character received is converted into Hollerith code and punched into a single card column. The character set and the corresponding punches in the alphanumeric format are given in Appendix B of this manual.

EDITED ALPHANUMERIC MODE. This mode of operation is identical to the alphanumeric mode, but with the additional feature of allowing the punch to delete any Ignore characters (octal 17) which it may receive. Whenever an Ignore character is deleted, the next valid character received is punched with no blank column intervening.

INPUT/OUTPUT SIGNALS

Instructions transmitted to the subsystem and data transmitted to or received from the subsystem are accompanied by signals that help time operations, trigger operations, and identify information. Some signals function automatically, while others can be accessed or caused by programmers or operators. Those signals of direct concern to users are:

End Data Transfer

Terminate

Special Interrupt

End Data Transfer Signal

The processing system transmits the End Data Transfer signal to the subsystem to indicate that no more data is to be transferred. A list pointer word overflow causes this signal in a Series 400 system.

When the subsystem receives the signal, or an error condition is detected, data transfer is terminated for the remainder of the card operation time. The two error conditions that cause this are the Attention, Read Alert, and the Data Alert, Transfer Timing Alert, conditions. Both are defined under "Status," below. Note that the subsystem remains in the Channel Busy state for the entire operation time.

Terminate Signal

The subsystem transmits the Terminate signal to the processing system to indicate that the Channel Busy condition was terminated for one of the following reasons:

1. Processing of a card is complete.
2. A card jam was detected.
3. A data alert is detected.

The status information transmitted with the Terminate signal identifies the specific type of termination.

Special Interrupt Signal

The subsystem transmits the Special Interrupt signal to the processing system to call attention to a change in the operating state of the subsystem. The signal means that the subsystem was manually cleared from the Attention status.

STATUS INFORMATION

The punched card subsystem transmits status information about its operating condition to the processing system. The status tells the processing system when the subsystem is ready to accept an instruction or is busy, whether an instruction was successfully executed, when error conditions have occurred, etc.

Status information can be placed in core store and interrogated by the program. When used in this way by the program or operating system, the status permits detecting and attempting to recover from certain error conditions under program control. For conditions that require operator intervention, status enables the program or operating system to give specific instructions to the operator for correcting inoperable conditions.

There are two types of status information--the major status and the substatus. Major status indicates the general category of the condition. For some major statuses, there are substatuses that indicate more specific reasons for the existence of the major status.

In the following discussions of major status and substatus, codes are interpreted as follows:

Bit positions →	2^3	2^2	2^1	2^0
Major Status Code →	0	0	0	0

Bit positions →	2^5	2^4	2^3	2^2	2^1	2^0
Substatus Code →	0	0	x	x	1	x

A bit shown as "0" must always be zero. A bit shown as "x" can be either one or zero. A 1-bit identifies the existing condition. The pattern of x's, 1's, and 0's indicates which substatuses can occur together.

The major statuses that may be encountered by a punched card subsystem are described on the following pages. The list below shows the 4-bit configuration for each major status possible. The exact statuses returned by a particular subsystem are given in the subsystem descriptions in Appendix A.

Readers and Punches

Channel Ready	0000
Attention	0010
Data Alert	0011
Instruction Rejected	0101
Channel Busy	1000
Channel Absent*	1001

Readers Only

Device Busy	0001
Load Operation Complete	0111
Channel Alert*	1010

CPZ100 Punch Only

Intermediate	0110

*NOTE: Channel Absent and Channel Alert are generated by the I/O channel of the G-400 Series.

Major status always exists on certain electrical lines in the subsystem. This status changes only on initiation or termination of an instruction. Substatus exists in the subsystem only during initiation and after termination of an instruction.

Priority of Status

When two or more major statuses exist simultaneously, the subsystem sends the higher priority status. For these subsystems, major statuses rank as follows (highest priority listed first):

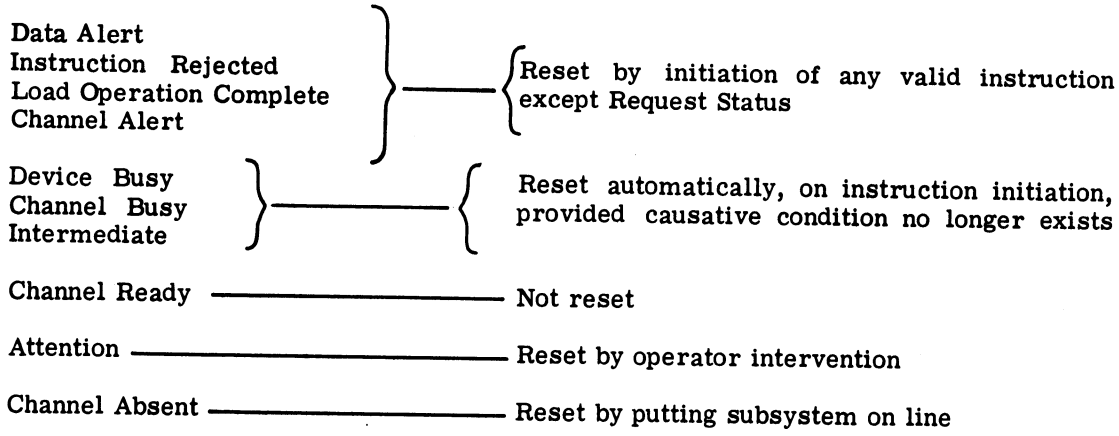
Channel Absent
Channel Alert
Attention* (Card Jam Only)
Instruction Rejected
Data Alert
Intermediate
Attention* (Other than Card Jam)
Load Operation Complete*
Device Busy*
Channel Busy
Channel Ready

Instruction Rejected is never stored in the subsystem. This is a transient condition that is reflected to the processing system only in response to the instruction being rejected. Reflection of the Instruction Rejected major status never affects the status currently stored.

*Attention inhibits existence of Load Operation Complete and Device Busy.

Resetting Status

Receipt of any valid instruction by the subsystem (except Request Status) resets all existing program-resettable statuses within the subsystem except certain conditions that still exist. Channel Ready is not reset, but exists as an all-zero condition when all other major statuses are reset to zero. Methods of resetting status are indicated below:



Only one program-resettable major status is stored at any one time. If a program-resettable condition exists with a lower priority nonresettable status, the program resets the higher priority status. The code of the lower priority status is then available to the processing system.

STATUS AND SUBSTATUS DESCRIPTIONS

In the detailed descriptions which follow, the symbol (R) indicates a condition which occurs only on the readers. (P) indicates a condition which occurs only on the punches. Note that the substatus configuration for those major statuses without substatuses is always 000000.

Channel Ready

The Channel Ready major status indicates that execution of the preceding instruction, if there was one, was error-free and the subsystem is ready and available to accept a new instruction. NOTE: A punch subsystem may be not-busy and still not be in the ready state.

Device Busy (R)

The Device Busy status is transmitted in response to a Request Status or Reset Status instruction to indicate that a card is in transit to the read station. The status is sent when two Feed instructions or two Stack instructions are given in succession.

Attention

The subsystem sends the Attention major status to indicate that an inoperable condition exists that requires operator correction. The subsystem rejects subsequent instructions, with one exception, with this return until the condition is corrected and the logic is manually reset. However, if the Attention status transmitted at terminate time was caused by a Hopper/Stacker Alert, a Manual Halt, the Last-Batch condition, or a Read Alert (all described below), the reader can accept a Stack instruction and stack the card for which the respective Terminate signal was given.

One or more substatuses always occur with the Attention major status. Unless otherwise noted in the descriptions below, when an Attention condition is detected during the Channel Busy condition, the busy state is not terminated until normal termination time. This allows cards in transit to be processed before feeding halts.

The substatuses that can occur with the Attention major status are described below. The binary code for each substatus is shown in parentheses.

HOPPER/STACKER ALERT (xxxxx1)--Occurs when the input hopper is empty or the output stacker is full. (See Appendix A for additional conditions which may cause this condition on the CRZ201 Reader.)

MANUAL HALT (xxxx1x)--Occurs when:

1. The MANUAL HALT pushbutton on the operator's control panel is actuated.
2. Power is turned on by the POWER ON pushbutton.
3. The field engineer goes from the off-line test mode to the on-line mode.
4. (P) Blank cards have not been loaded into the prepunch stations.

LAST BATCH (R) (xxx1x1)--Occurs when the input hopper goes empty while the LAST BATCH control is in the on state.

FEED ALERT (0x1xxx)--Occurs when a card fails to feed from the hopper into the card track in response to a Feed or Punch instruction.

CARD JAM (x1xxxx)--Occurs when the progress of a card on the card track becomes impeded to the point that card feeding cannot be successfully completed. If the subsystem is in the Channel Busy state at this time, the subsystem interrupts the current operation and terminates the instruction being executed. If the subsystem was not in the Channel Busy state at time of detecting the card jam, the subsystem reverts to the Attention condition and rejects further instructions with this status. On detection of a card jam, the electrical power starts cycling down. Note that Card Jam overrides any other existing status in the subsystem.

If the processing system recognized the last data character sent from a reader, the subsystem sends a Terminate signal. If the card reader has sent a character that was not recognized, no Terminate signal is sent.

READ ALERT (R) (1x0xxx)--Occurs upon failure of any card check (light check, dark check, column strobe count check, or internal parity check) made at the read station during card reading time.

SNEAK FEED (R) (1x1xxx)--Occurs when a card is fed without the reader having received an instruction to feed. No data is transmitted from the card. No Terminate signal is sent.

CHAD BOX FULL (P) (0xx1xx)--Occurs when too much chad has accumulated and chad box must be emptied before punching can continue, or the chad box is not present.

Data Alert

The subsystem returns the Data Alert major status to the processing system to indicate that some type of error or alert condition was detected during the processing of a card. One or more of the substatuses always occur with Data Alert. Occurrence of a Data Alert condition does not cause termination of the Channel Busy condition. The operation in progress is allowed to come to its normal termination. The substatuses that can occur with Data Alert are described below:

TRANSFER TIMING ALERT (R) (000001)--Occurs when the card reader data buffers become filled, because the processing system has failed to recognize a transmitted character, or it can mean that the processing system has not accepted all characters read from a card by the time the card clears the read station. Transfer of data to the processing system is immediately stopped, but the Channel Busy state is not terminated until card reading is completed and all checks are made.

TRANSFER TIMING ALERT (P) (000xx1)--Occurs whenever the time arrives for the punch dies to be actuated but the punch has not yet received all of the required data. The operation terminates.

VALIDITY ALERT (R) (000x10)--Occurs when the subsystem detects an invalid character while reading an alphanumeric card. The subsystem sends an Ignore character (octal 17) in place of the invalid configuration from the card column. Reading continues until normal termination time; then the subsystem sends the substatus and the Terminate signal.

TRANSMISSION PARITY ALERT (P) (000x1x)--Occurs whenever a parity error is detected on the data characters received for punching. Operation terminates.

DUAL READ ALERT (R) (0001x0)--Occurs when the two outputs of the dual read head do not meet the compare test for a card column. In the binary mode of operation, the subsystem transmits two Ignore characters in place of the two characters in the card column. In the alphanumeric mode, the subsystem transmits one Ignore character in place of the Hollerith character in the card column. The subsystem continues reading the card and sends the Data Alert at normal termination time.

PUNCH ALERT (P) (0001xx)--Occurs whenever the row parity accumulated from the read station does not agree with that previously established when the data entered the card image buffer in the controller. After the Punch Alert substatus and Data Alert status information has been transmitted, the punch sends a Terminate signal.

Since the punch check is made by the read head while the following card is being punched, a punch alert, if there is one, concerns not the card just punched, but the card just read and entering the stacker.

The last card to be punched at any time, regardless of whether it is the last data card or a blank card following the data deck, is automatically transported through the read station and punch-checked. The only indication of a punch alert on this card is the illumination of the PUNCH ALERT indicator on the operator's control panel. When a blank card is provided by the program, a punch alert on the last data card is indicated by programmed typeout; but a punch alert on the blank card is indicated only by the PUNCH ALERT indicator.

NO READ INSTRUCTION (R) (001000)--Occurs when a card is fed as the result of a Feed instruction and enters the read station before a Read instruction is received by the subsystem. No data is transmitted from the card.

Instruction Rejected

The subsystem transmits the Instruction Rejected major status to indicate that the received instruction is being rejected. One of the following substatuses occur on the reader to show why the instruction is rejected. Note that only one substatus can occur at any time.

No substatus occurs on the punch subsystems.

INVALID OPERATION CODE (R) (000001)--Occurs when the operation code is not recognizable for any reason, including a parity error.

NO CARD COMMITTED (R) (000010)--Occurs when a Stack instruction is received when no card is in transit to the stacker. The substatus is reflected only to Stack instructions.

LATE READ INSTRUCTION (R) (000100)--Occurs when a Read instruction is received after the card has entered the read station. This substatus is reflected only to Read instructions.

Load Operation Complete (R)

The reader returns the Load Operation Complete major status to indicate the termination of a successful program load operation.

Intermediate (P) (CPZ100 only)

The Intermediate major status indicates that the punch, although not currently engaged in data transfer or in actual punching, is not at the end of the card. It has finished punching a row (other than the 9-row) without encountering an alert condition and is awaiting the instruction to punch the next row of data. This status is always automatically set between rows.

Channel Busy

The subsystem transmits the Channel Busy major status to indicate that it is processing a card and receiving or transmitting data.

Channel Absent

The I/O channel circuitry of the Series 400 generates the Channel Absent major status to indicate that the processing system cannot communicate with the subsystem. Reasons can be that the subsystem is disconnected, without power, or absent.

Channel Alert (R)

The I/O channel circuitry of the Series 400 generates the Channel Alert major status to indicate that during the card reading operation just ended, the processing system received a character with incorrect parity.

CARD READER INSTRUCTIONS

The General Electric card readers are capable of executing both operational and non-operational instructions. A 6-bit operation code in the instruction informs the reader of the operation to be performed.

Operation Code	Function
000000	Sends the code for the existing status of the subsystem to the processing system.
000001	Reads one card in the binary mode.
000010	Reads one card in the alphanumeric mode.
000011	Reads one card in the mixed mode.

Operation Code	Function
100000	Resets all resettable statuses in the subsystem and sends the remaining status to the central processor.
100100	Feeds one card from the hopper.

Operational Instructions

An on-line instruction is one whose execution requires the card reader to be in the busy state.

These instructions are:

Read Card Binary

Read Card Alphanumeric

Read Card Mixed.

INSTRUCTION INITIATION. When the card reader receives any one of these three instructions, the resettable status conditions are reset. Major status then either indicates the card reader has become busy as a result of accepting the instruction or the instruction has been rejected. If the instruction is rejected, the following major status conditions are reflected:

Attention

Instruction Rejected.

INSTRUCTION EXECUTION. The card reader completes the instruction sequence and then begins execution of the instruction by feeding the card from the hopper onto the card track. The reader goes into the mode of operation indicated by the instruction.

- If the instruction is to read a binary card, the card reader goes into the binary mode of operation and handles each column as containing two binary characters of data.
- If the instruction is to read a card punched in the Hollerith format, the card reader goes into the alphanumeric mode of operation and handles each column as containing only one character of data.
- If the instruction is to read a card in the mixed mode of operation, the card reader looks for the identifying 7 and 9 punches in column 1 to indicate that the card is to be read in the binary mode; if there are no 7 and 9 punches, the card is read in the alphanumeric mode.

INSTRUCTION TERMINATION. If the card reader successfully executes the read instruction just received and no errors or inoperable conditions have occurred, when the Terminate signal is transmitted, one of the following major status conditions will also be sent:

Channel Ready

Load Operation Complete.

If an error or inoperable condition did occur after the card reader accepted an instruction and began executing it, status sent at the time of the Terminate signal will be one of the following:

Data Alert

Attention

Appropriate substatus information is also transmitted. Rereading of the card may be attempted.

If the program calls for data from only part of the card, the card reader receives an End Data Transfer signal when all the desired information has been transmitted. The card reader remains busy and continues reading the rest of the card, but none of the remaining data is transferred. When the physical end of the card is reached, the Terminate signal is sent, along with the appropriate status information.

No-op Instructions

Request Status and Reset Status are instructions which do not directly involve media or imply media movement. Thus, these instructions do not require the card reader to go into the busy state.

REQUEST STATUS INSTRUCTION. When the card reader receives a Request Status instruction, it transmits major status signals identifying the following various conditions which may exist:

Channel Ready

Attention

Data Alert

Load Operation Complete.

Although a Request Status instruction may be rejected by the card reader, the status shown as the result of an accepted Request Status instruction will never include the Instruction Rejected condition. The Instruction Rejected major status is returned only in response to the specific instruction which was rejected and does not reflect the existing state of the card reader at that time.

The Request Status instruction does not cause any status conditions to be reset; and status, therefore, remains unchanged by this instruction.

Since there is no execution sequence to perform in response to the Request Status instruction, as soon as the instruction sequence has been completed, the card reader returns to the ready state.

RESET STATUS INSTRUCTION. A Reset Status instruction is one method by which card reader status can be reset (see the explanation on resetting status under "Status Information" in the preceding pages of this chapter). It causes all resettable conditions--the Data Alert substatuses and Load Operation Complete--to be reset. Any existing status conditions not resettable by this instruction are reflected in the major status code configuration.

There is no execution sequence with the Reset Status instruction, consequently, as soon as the instruction sequence is completed, the card reader returns to the ready state.

CARD PUNCH INSTRUCTIONS

The control electronics of the card punches recognize and accept the following instructions. Depending on whether the punch has an 80-character row buffer or a card image buffer, a single punch instruction punches one row or an entire card, one row at a time.

Operation Code	Function
000000	Sends the code for the existing status of the subsystem to the processing system.
001001	Punches one row/card in the binary mode.
001010	Punches one row/card in the alphanumeric mode.
001011	Punches one row/card in the edited alphanumeric mode.
100000	Resets all resettable statuses in the subsystem and sends the remaining status to the central processor.

Operational Instructions

An on-line instruction is one whose execution requires the card punch to be in the busy state. For the card punch, these instructions are:

Punch Card/Row Binary

Punch Card/Row Alphanumeric

Punch Card/Row Edited Alphanumeric.

INSTRUCTION INITIATION. When the card punch receives one of the three instructions, the resettable major status conditions are reset. Major status then indicates that the punch has become busy as a result of accepting the instruction or that the instruction has not been accepted.

If the instruction is not accepted, one of the following major status conditions will be reflected:

Attention
Instruction Rejected

If the instruction is accepted, as soon as the card punch becomes busy, it begins requesting data for punching.

INSTRUCTION EXECUTION. The card punch completes the instruction sequence and then begins execution of the instruction by feeding a card from the hopper into the card track (after all data for a row or card has been received). The card punch goes into the mode of operation indicated by the instruction.

- If the instruction is to punch in the binary mode, 160 characters of data are transmitted to the punch. The punch treats the data as binary characters and punches two 6-bit characters in each card column.
- If the instruction is to punch in the alphanumeric mode, 80 characters of data are transmitted to the punch. The punch first decodes each 6-bit character into its 12-bit Hollerith configuration, and then punches a single character into each card column.
- If the instruction is to punch in the edited alphanumeric mode, the data is handled in the same manner as for a Punch Alphanumeric instruction, except that the punch deletes all Ignore characters before punching the data, one character per column. Card columns from which Ignore characters are edited out do not remain blank, but are punched with the next valid data character.

In each instruction, the data characters are punched a row at a time from the 80-bit row image buffer.

INSTRUCTION TERMINATION. If the card punch successfully executes the punch instruction just received (that is, if no errors or inoperable conditions have occurred), one of the following major status conditions is signaled when the Terminate signal is transmitted:

Channel Ready
Intermediate

If a data error or inoperable condition did occur after the card punch accepted an instruction and began executing it, the status reflected will be one of the following:

Data Alert
Attention

When a data error occurs, the Data Alert major status and the appropriate substatus are sent at the time the Terminate signal is transmitted.

If a card jam occurs while the instruction is being executed, the Terminate signal, the Attention major status, and the Card Jam substatus are signaled immediately.

If any Attention condition other than a card jam occurs during instruction execution, status sent at the time of the row Terminate signal is the Intermediate condition until the Terminate signal for the last row is transmitted. At that time, the Attention status is reflected along with the appropriate substatus information. Generally, the card just punched will not have been affected by the Attention status that just occurred.

No-op Instructions

The Request Status and Reset Status instruction do not directly involve media or imply media movement. Thus, they do not require the card punch to go into the busy state.

REQUEST STATUS INSTRUCTION. When the card punch receives a Request Status instruction, it transmits major status and substatus signals identifying the following various conditions which may exist within it.

Channel Ready

Attention

Data Alert

Intermediate

Although a Request Status instruction may be rejected by the card punch, the status shown as the result of an accepted Request Status instruction will never include the Instruction Rejected major status, since this status is returned only in response to the specific instruction which was rejected and does not reflect the existing state of the card punch at that time.

The Request Status instruction does not cause any status conditions to be reset; and status, therefore, remains unchanged by this instruction.

Since there is no execution sequence to perform in response to the Request Status instruction, as soon as the instruction sequence has been completed, the card punch returns to the ready state (provided it is not in the Attention condition).

RESET STATUS INSTRUCTION. A Reset Status instruction causes all Data Alert conditions to be reset. (See "Resetting Status," page 10.) Any existing major status not resettable by this instruction--Channel Ready, Attention, Intermediate, Channel Busy--continues to be reflected in the major status code configuration.

There is no execution sequence with the Reset Status instruction; consequently, as soon as the instruction sequence is completed, the card punch returns to the ready state, provided no Attention conditions exist.

3. OPERATING INSTRUCTIONS

Operating the punched card subsystems involves setting up the subsystem, loading and unloading cards, and correcting alert conditions. General procedures are described below. Specific procedures for the individual subsystems are given later in this chapter.

CARE OF PUNCH CARDS

Punch cards are precision media. They must be handled and stored with card to protect the punched information, ensure correct processing, and prevent damage to equipment. Environmental limits must be observed. Dampness and dirt can damage both cards and equipment. Unnecessary or careless handling can damage cards.

Recommended operating conditions are:

Temperature--65 to 85 degrees Fahrenheit (18 to 29 degrees Centigrade)

Humidity --40 to 60 percent

Air --free of dust

Handling Cards

Cards should not be bent, folded, or otherwise damaged. All edges of the card, particularly the leading edge, should be smooth and free of burrs and creases. Cards should not be handled roughly or held together by staples, paper clips, or rubber bands. They also should be kept free of dirt and moisture.

Any cards in poor or doubtful condition should be replaced before processing begins.

Storing Cards

A card deck that is to be retained for rerun should be kept under pressure while in storage to prevent curling, buckling, or bending. Cards in trays or open cartons should be pressure-blocked. Compressors are standard on card trays. In open cartons, a piece of metal, wood, or folded cardboard can be used. For very small decks, stiff cardboard cut slightly larger than the cards can be used on each side of the deck and the deck bound with a rubber band. (See Figure 1.) Store cards and card cartons so that cards stand on edge.

Figure 1. Blocking Small Decks

Cards that have been stored where temperature and humidity differ greatly from that of the processing site must be conditioned at the correct temperature and humidity before being used. Conditioning time depends on the temperature and humidity to which the cards were exposed during storage or shipment and on the length of time they were exposed. Cards that have been away from ideal conditions for more than 12 hours normally require 24 hours of conditioning. If exposed less than 12 hours, cards should be conditioned for twice the time of exposure.

These rules also apply to blank cards. If the card supply cannot be stored at the recommended temperature and humidity, at least a week's supply of cards should be kept in the processing area.

Preparing Cards for Loading #3

Before loading cards into the input hopper, it is recommended that the operator go through these procedures:

Figure 2. Riffle Each End of Cards

1. Unblock and remove the cards from their storage tray or holder.
2. Be sure that all cards are positioned with the top edge up and facing the same direction.
3. When reading, check cards for correct sequence, as given in the program run book or other operating procedures for the program.
4. Inspect the cards for nicked, frayed, or split leading and trailing edges and for tears, folds, etc.
5. Replace damaged cards with new cards before attempting to run the deck.
6. Grasp a handful of cards (about 4 or 5 inches thick) at the left side and riffle or fan the right side. (See Figure 2.)
7. Grasp the right side of the deck and riffle the left side. If the card deck is new or freshly punched, fan the cards thoroughly to ensure that they are not stuck together and will feed correctly.

8. Place the cards on the joggling plate on top of the card reader, and with the top edges up and leading edges to the right, gently tap them toward the left rail of the joggling plate, using an in-up motion. Do not joggle the cards more than necessary, as the edges need not be aligned perfectly.

ALERT CONDITIONS AND CORRECTIVE ACTION

When the checking circuitry of the card subsystem detects an alert condition, the operator is normally notified by an alert light on the operator's control panel, a typed message, or both.

CARD JAMS. A card jam occurs when normal card movement is impeded in the card track. When this occurs, the RESET light glows briefly. Power begins to cycle down within about 2 seconds, and feeding halts. This 2-second interval allows the subsystem to indicate the termination of the operation and to transmit its status.

Serious card jams require handling by the service engineer. However, in most cases, the operator is able to clear jams in the input and output areas. If he can see the card causing the jam, the operator should try to remove it. He should be sure that all pieces of torn cards are removed. At no time should sharp implements or tools be used. When the jam is apparently corrected and cards still do not feed through the subsystem, the service engineer must be called.

When the jam is corrected, resume operation by pressing the POWER ON switch, then pressing MANUAL CYCLE to fill any stations left empty as a result of the jam. When the subsystem is correctly loaded, press OPERATE/RESET so that OPERATE glows green.

CHANNEL ABSENT. If the program tries to address the subsystem when it is not connected to its channel, is off line, or is not receiving power, Channel Absent is indicated in the status information generated by the channel logic. A message also may be typed. To correct this condition, turn on subsystem power or call the service engineer to put it on line or connect the subsystem to its channel. Start operation in the normal manner.

OPERATOR MAINTENANCE

Routine maintenance by the operator consists primarily of removing accumulated card dust by vacuuming and blowing out the read or punch station, transport mechanism, input hopper, and output stackers. This operation should be performed every 250,000 cards.

The operator also keeps the cabinet clean by wiping dust from it with a lint-free cloth or paper towel. For badly soiled cabinets, the operator can use a cloth slightly dampened with a mild liquid cleaner and then wipe the cabinet clean with a cloth dampened with clear water. (The service engineer can recommend a suitable cleaner.)

All other maintenance procedures require the special skills of the service engineer.

CRZ201 CARD READER

Operator's Control Panel

The controls for the CRZ201 Reader are located on a panel in front of the input hopper. See Figure 3.

The functions of the controls and indicators are described on the following pages in the order in which they appear on the panel.

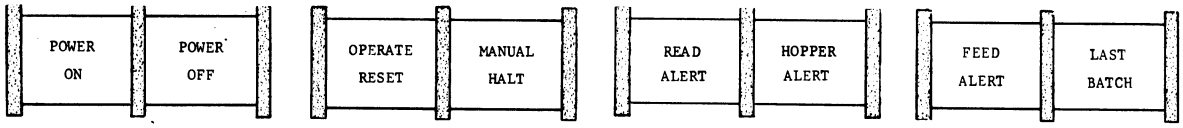


Figure 3. CRZ201 Control Panel

CONTROL/INDICATOR	FUNCTIONS
POWER ON pushbutton and indicator (yellow)	Pressing this control applies electrical power to operate the subsystem and places the subsystem in the Attention, Manual Halt condition. The control is inactive if pressed within 3-4 seconds of the time POWER OFF is pressed.
POWER OFF pushbutton	Pressing this control removes all electrical power from the subsystem and turns off the POWER ON indicator.
OPERATE/RESET pushbutton and indicator (green/blue)	Pressing this control when the RESET indicator is on clears the Attention status, provided the operator has corrected all inoperable conditions. The OPERATE indicator glows green when the card reader is ready to operate. The OPERATE indicator goes off and RESET glows blue to indicate that: 1. Power was turned on for the first time. 2. HALT was actuated. 3. One of the following conditions exists: Hopper Alert Feed Failure Card Jam Last Batch Read Alert Sneak Feed Any time an Attention condition is cleared by actuating the OPERATE/RESET control, the subsystem sends a Special Interrupt signal to the processing system.

CONTROL/INDICATOR	FUNCTIONS
MANUAL HALT pushbutton and indicator (blue)	Pressing this control sets the Attention, Manual Halt status. The indicator glows while the subsystem is in the Manual Halt condition. All cards that have been committed to the transport when the control is actuated will be read, sorted, and stacked before operation halts.
READ ALERT indicator (red)	Indicator glows when the Read Alert or the Sneak Feed (Attention) conditions occur. NOTE: When a Sneak Feed occurs both the FEED ALERT and READ ALERT are on.
HOPPER ALERT indicator (blue)	The indicator comes on to indicate occurrence of one or more of the following: 1. Input hopper empty. 2. Output stacker full. 3. A card was improperly stacked. 4. The correct card-length control rail or a stacker bumper is not in place.
FEED ALERT indicator (red)	Indicator glows when a feed failure or a sneak feed occurs. NOTE: When a sneak feed occurs, READ ALERT also comes on.
LAST BATCH pushbutton and indicator (white)	Pressing this control when the indicator is off turns on the indicator and enables the last-batch circuit. When the hopper goes empty, the last-batch state exists. Pressing the control when the circuit is enabled resets the control to the off state and turns off the indicator.

Card Handling Mechanism

The card handling mechanism includes an input hopper, card feeder, card track, dual-read head, stacker gate, and output stacker. See Figure 4.

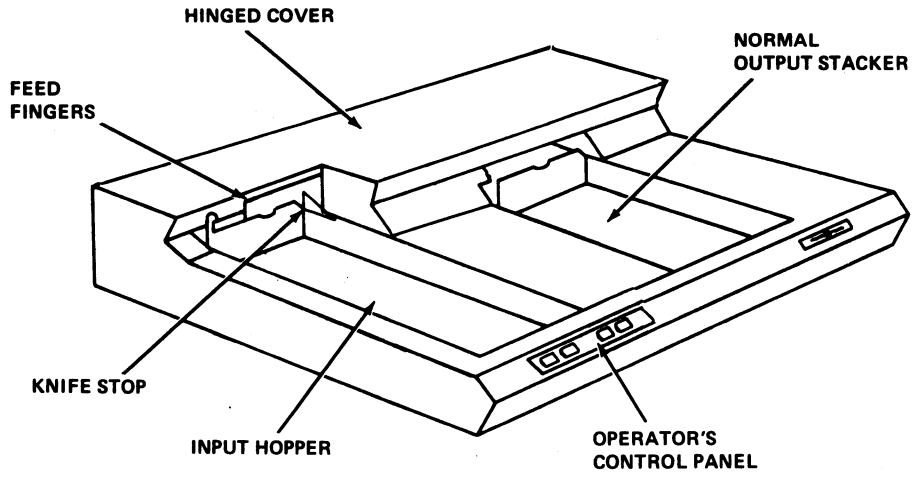


Figure 4. CRZ201 Card Handling Mechanism

The input hopper and output stacker have pusher plates that hold the cards upright. The pusher plates swing up 90 degrees from the card reader deck to aid in adding and removing cards without interrupting operations.

Cards are placed in the input hopper 12-row up, card face toward the feed fingers at the feed station, and column 1 toward the read station. The input hopper holds at least 2000 cards. Cards are picked off from the input card deck by vacuum and the pulsing feed fingers and fed into the card transport through the feed gate.

The read station contains a light source, fiber optics light distribution, and two vertical columns of 12 solar cells each. The cells are spaced one column apart. Each vertical column has one cell for each card row. As the card passes between the light sources provided by the fiber optics and the solar cells, the punched holes are sensed. Output from the cells is fed into the control electronics of the card reader. Each column is read twice. The results of the first reading are compared with results from the second reading in order to protect against misreads.

Cards go through several control stations to ensure that the cards are fed correctly and continue an orderly advance through the card track. When a station is dark too long, this means a card jam; the card reader is immediately powered down.

The card reader has three quick-opening jam release mechanisms that aid the operator in clearing card jams. To clear jams in the card track, the operator merely unscrews a large knurled knob and swings the breakaway track jam release mechanism away from the card path. Jammed cards can then be easily removed with bare fingers. (See Figure 5.)

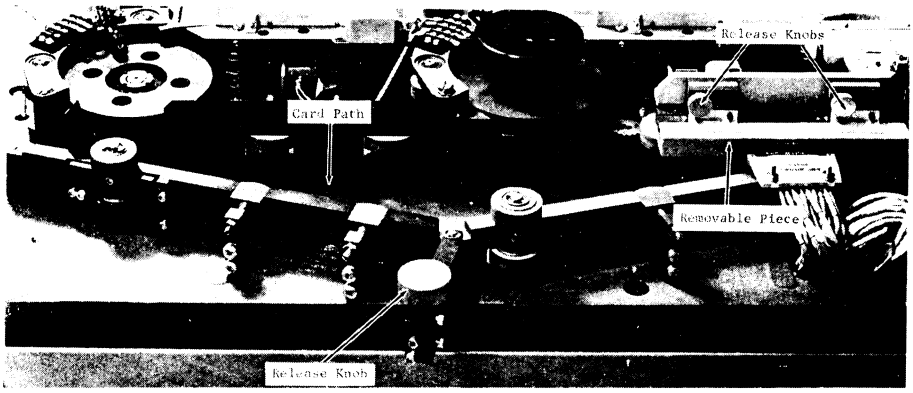


Figure 5. Track Jam Release Mechanism (Opened)

There is also a stacker jam release at each stacker entry point. The stacker jam release is operated to allow the mechanism to swing away from the stacker drum to release jammed cards. (See Figure 6.)

Each jam release is interlocked so that the release must be in place before power can be turned on.

With these new features, there is an excellent chance of recovering jammed cards in a condition that allows reproduction in a keypunch. The devices also save much time in clearing jams.

The normal output stacker holds at least 2000 cards, while the auxiliary output stacker holds at least 1000 cards. In each stacker, the stacker full switch is activated by the pusher plate when the stacker becomes full. The switch stops card feeding and leaves the card reader in an inoperable condition.

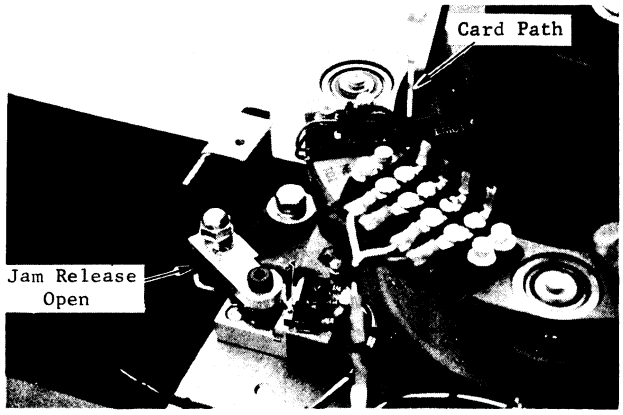


Figure 6. Stacker Jam Release Mechanism

Cards can be added without interrupting card reading, provided the input hopper contains at least a 3-inch stack of cards. Cards can be removed from the output stackers during stacking, provided at least 5 inches of cards are left in the stacker.

A joggling plate is provided on top of the reader cabinet for use in manually aligning card decks.

Setup

Setting up the CRZ201 Card Reader includes preparing and loading cards, turning on power at the operator's control panel, and correcting any Attention conditions that exist in the subsystem.

Loading Cards

The recommended procedures for loading cards in the card reader are described below. The procedures vary, depending on whether the input hopper is empty, nearly empty, or has more than 3 inches of cards.

In an empty hopper:

1. Prepare the cards for loading by inspecting, fanning, and joggling them as described on page 22 .
2. Grasp the handful of joggled cards firmly with the right hand so that they do not slip and become misaligned.
3. Pull the pusher plate in the input hopper far enough to allow the card deck to be placed gently in the hopper between the plate and the feed station.
4. Hold the card deck with the right hand and with the left hand, load the first card of the deck into the feed area so that its leading edge enters the feed throat. The card must lie flat against the feed fingers. This ensures positive feeding of the first card when card reading starts.
5. Slide the pusher plate against the back of the cards.
6. Press the OPERATE/RESET pushbutton so the card reader is ready to feed cards when the program calls for card reading. The OPERATE light will glow green.

Adding cards--less than 3-inch stack in hopper:

1. Inspect, fan, and joggle cards as already described.
2. If the pusher plate in the input hopper is closer than 3 inches to the feed station, stop card feeding by pressing the MANUAL HALT pushbutton.
3. Firmly grasp a handful of joggled cards with the right hand and set them behind the pusher plate with the back of the hand just touching the pusher plate.

4. Use the left hand to swing the pivoted pusher plate up to clear the card deck; slide the added cards against those already in the hopper, making sure the cards in the hopper do not fall over.

5. Slide the pusher plate away from the feed station, lower it, and slide it against the back of the deck. Continue this procedure until the hopper is filled or the entire card deck is loaded.

6. Press the OPERATE/RESET pushbutton so that the card reader is ready to feed cards on program demand. The OPERATE light will glow green.

Adding cards--more than 3 inches in hopper:

1. Prepare cards as previously described.

2. Grasp a handful of cards with the right hand and set them behind the pusher plate with the back of the hand just touching the pusher plate. Note that feeding continues on program demand.

3. Use the left hand to swing the pivoted pusher plate up to clear the card deck. Slide the added cards against those already in the hopper, making sure the cards in the hopper do not fall over. Do not exert pressure against the cards in the hopper as this may cause a misfeed.

4. Slide the pusher plate away from the feed station, lower it, and slide it against the back of the deck. Continue this procedure until the hopper is filled or the entire card deck is loaded.

Converting to Alternate-Size Cards (Optional)

Reading of 80-column cards requires no special attachments in the input hopper and output stackers. However, when converting the card reader from 80-column cards to 51-column cards, the operator makes a few simple changes in the hopper and stackers, using the optional equipment described below.

The operator places in position a 51-column-card rail in the input hopper and each output stacker. This rail is a rectangular-shaped bar that runs the length of the hopper or stacker. The leading edges of the shorter cards ride against the card rail. (See Figure 7.)

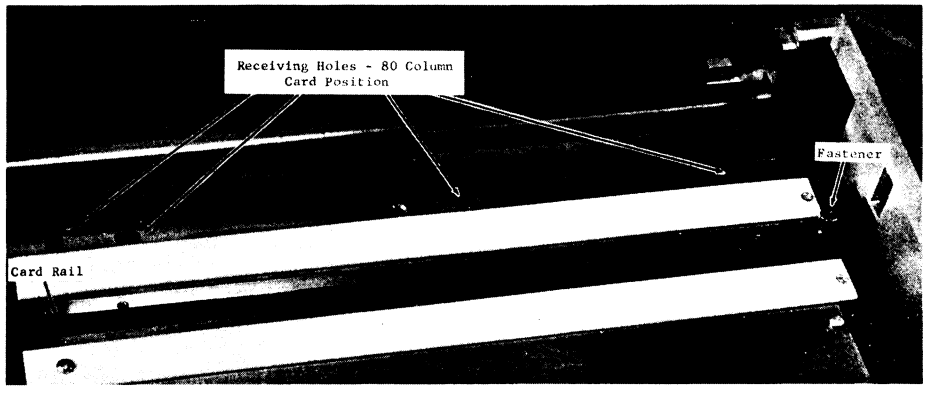
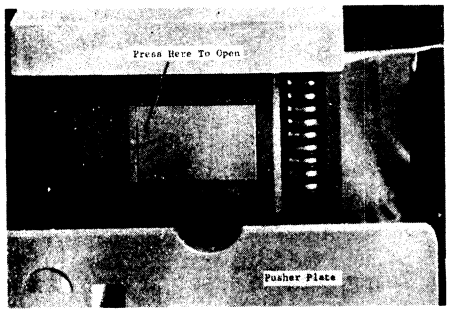
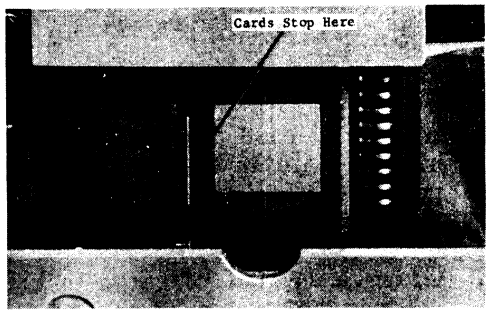


Figure 7. Card Rail in Place for Reading 51-Column Cards

A card bumper for 51-column cards is located at the rear of each output stacker. This bumper must be pivoted into position in order for the card reader to read 51-column cards. The operator presses a finger against the left side of the rectangular plate (see Figure 8) and pushes back. The spring-loader bumper pivots and extends into the stacker. As cards are fed into the stacker, the leading edges bump the rubber pad on the card bumper.



Closed for 80-Column Cards



Opened for 51-Column Cards (OPTIONAL)

Figure 8. Card Bumper

Pushing both card bumpers and all three 51-column-card rails into position automatically sets the card reader electronics for processing 51-column cards. Pushing both bumpers back into their recessed positions and removing all three card rails sets the electronics for 80-column cards.

If both card bumpers and all three card rails are not in position for a particular length of card, the Hopper/Stacker Alert (Attention) condition exists and the HOPPER ALERT light glows blue.

Summary of Setting Up Procedures

The operator follows these steps to set up and put the card reader on line:

1. Be sure mechanism is set up for the type of cards to be read (51 or 80 columns) and convert if necessary.

2. Press POWER ON. The RESET and MANUAL HALT lights also come on.

3. Load cards into the input hopper as described previously.

4. After loading the last card of the file being read, press the LAST BATCH pushbutton, if the programmer so specified. Otherwise, this light should not be on.

5. Press OPERATE/RESET so that the OPERATE glows green.

6. If the OPERATE light does not come on, manually correct any alert conditions.

7. Again press OPERATE/RESET so that the light comes on. This clears the alert circuitry, turns off the RESET light and alert lights, and indicates that the card reader is ready to operate. The following lights should glow:

   POWER ON
   OPERATE
   LAST BATCH (if applicable)

Unloading Cards

When large card decks are being read, it may be necessary to remove cards from the output stackers during the run. Otherwise, the card reader stops feeding cards when the stacker is full enough to activate the stacker full switch (HOPPER ALERT light glows blue). Procedures vary according to whether the reading operation is to continue uninterrupted or the entire deck is to be removed at the end of the program. Procedures for both situations are listed below:

Removing cards above a 5-inch stack:

1. While the card reader continues stacking cards, place the right hand behind the pusher plate in the output stacker being unloaded. Use the left hand to pivot the pusher plate clear of the cards, at the same time slipping the right thumb behind the card deck so cards do not fall over.

2. Grasp a handful of cards in the right hand, being sure to leave at least a 5-inch stack in the stacker.

3. Slide the handful of cards away from the stacker entry area and slip the pusher plate down in place of the removed cards. Do not exert pressure on the cards that remain, to avoid a card jam or card damage.

4. Repeat the operation until cards are down to the desired level in the stacker or stackers.

5. Return the removed cards immediately to their storage tray or holder to prevent them from curling or being damaged.

6. Block the cards as soon as practical to keep them from warping or curling.

Removing all cards from the stackers:

1. Press MANUAL HALT to stop or prevent card feeding.

2. Place the right hand behind the deck as the pusher plate is moved out of the way with the left hand.

3. Remove the cards, a handful at a time, putting the pusher plate behind the remaining cards to prevent them from falling over.

4. If the program is to continue, press OPERATE/RESET.

5. Return the cards immediately to their storage tray or holder.

6. Block the cards as soon as practical to prevent warping or curling.

Normal Operation

During normal on-line operation of the card reader, the operator adds cards to the input hopper, removes cards from the output stackers, monitors the card reader for alert conditions, corrects operator errors, and shuts down the subsystem when operations end.

Shutdown

When card reading is complete and if the card reader will not be used for some time, power can be turned off by pressing POWER OFF. Cards can be removed from the output stacker.

CRZ200/CRD150 CARD READER

Operator's Control Panel

The controls for the two Card Readers are located against the back of the reader's top panel.

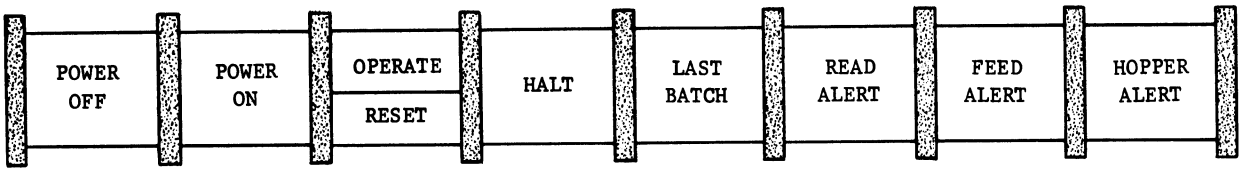


Figure 9. CRD150/CRZ200 Control Panel

CONTROL/INDICATOR	FUNCTIONS
POWER OFF pushbutton	Pressing this control removes power from the reader and turns off the POWER ON indicator. Power may not be turned on again for at least 8 seconds after actuating this control.
POWER ON pushbutton and indicator (amber)	Pressing this control turns on power to the subsystem and the indicator glows amber. This control is inactive if pressed within 8 seconds of the POWER OFF control.
OPERATE/RESET pushbutton and indicator (green/blue)	Pressing this control when the RESET indicator is on clears the Attention status, provided the operator has corrected all inoperable conditions. The OPERATE indicator glows green when the card reader is ready to operate. The OPERATE indicator goes off and RESET glows blue to indicate that: 1. Power was turned on for the first time. 2. HALT was actuated. 3. One of the following conditions exists: Hopper Empty Stacker Full Read Alert Feed Alert Sneak Feed Card Jam Last Batch
HALT pushbutton and indicator (blue)	Pressing this control sets the Attention, Manual Halt status. Both HALT and RESET glow while the subsystem is in this state.

CONTROL/INDICATOR	FUNCTIONS
LAST BATCH pushbutton and indicator (white)	Pressing this control when the indicator is off turns on the indicator and enables the last-batch circuit. When the hopper goes empty, the last-batch state exists. Pressing the control when the circuit is enabled resets the control to the off state and turns off the indicator. RESET and HOPPER ALERT are also turned on when the last card has been read.
READ ALERT indicator (red)	The indicator glows to indicate a malfunctioning photocell, a sneak feed, or card slippage. The RESET indicator is turned on. Card reader halts at the end of the current operation.
FEED ALERT indicator (red)	The indicator glows to indicate a card failed to feed or a sneak feed occurred. The RESET indicator is turned on. Card reader halts at the end of the current operation.
HOPPER ALERT indicator (blue)	The indicator glows to indicate one or more of the following: 1. Hopper Empty 2. Hopper feed plate latched. 3. Stacker Full

Input/Output Area Switches

There are several switches located in the card reader's input and output areas (Figure 10). Although the operator has access to these switches, they are normally actuated by the movement of the cards. The switches are described on the following page.

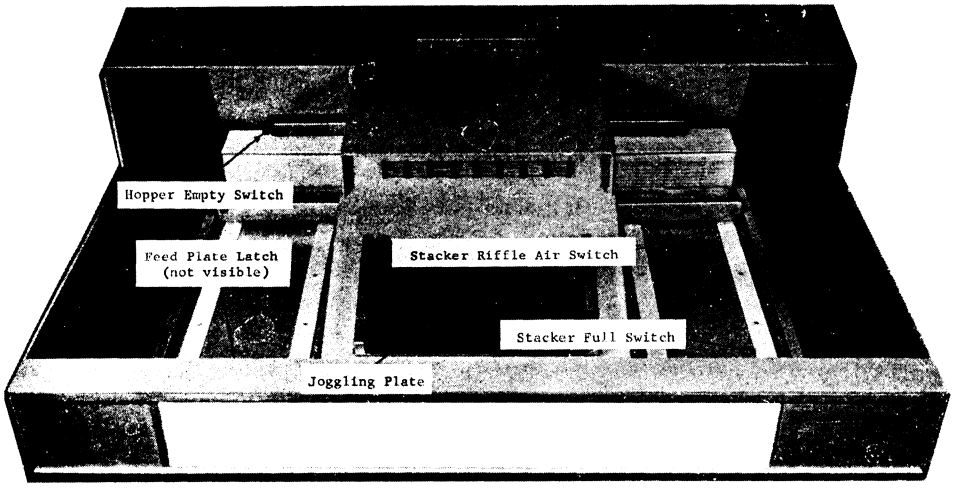


Figure 10. CRD150/CRZ200 Input/Output Area Switches

Identification	Location	Functions
Hopper empty switch	Base of input hopper	Actuated when the absence of cards relieves pressure against it, when the last card moves from the hopper into the feed throat of the reader; causes the HOPPER ALERT and RESET lights to come on. The card reader halts.
Feed plate latch	Top end of input hopper	Enables the operator to stop the feed mechanism to load more cards by manually moving the feed plate in the input hopper to the top of the hopper track to contact the feed plate latch. A catch retains the plate against the top of the track.
Stacker full switch	Top end of output stacker	When the stacker reaches its capacity, the increasing number of cards depresses the switch; turns the HOPPER ALERT and RESET lights on; and the reader halts.
Stacker riffle air switch	Near bottom end of output stacker	Actuated when the cards in the output stacker reach a depth of approximately 3 inches; increases the flow of riffle air to assist movement of cards as they continue to fill the stacker.

Card Handling Mechanism

The card handling mechanism has an input hopper, a card track, a reading station, and an output stacker. The input hopper and output stacker both have a capacity of 2000 cards and are shaped to hold the card stack securely. A plate in the input hopper holds the deck upright and tight against the feed gate. There is a similar pusher plate in the output stacker. Both the input hopper and output stacker can be easily loaded and unloaded during operation.

At the feed alert station, a solar cell checks proper feeding of cards from the input hopper into the transport mechanism. Three synchronization solar cell stations monitor the physical position of the cards as they are moved to the reading station. The reading station is composed of a common light source, fiber optics light distribution, and a vertical row of 12 solar cells, one cell for each card row. As a punched card passes between the light source and the solar cells, the punched holes are sensed. Output from the solar cells is fed to the control electronics of the card reader controller.

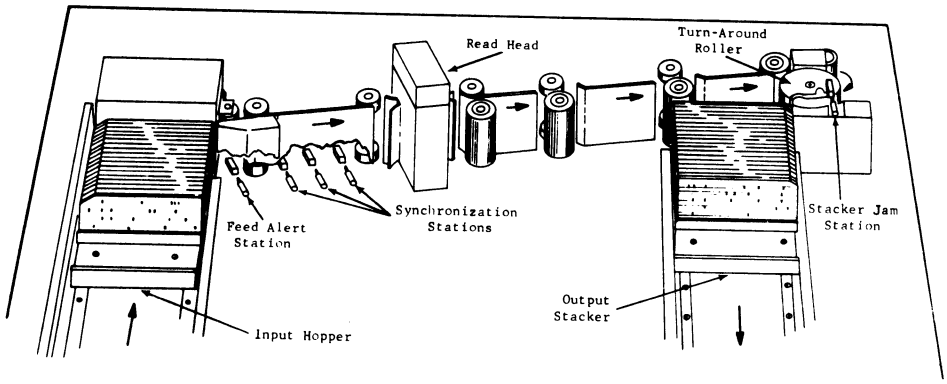


Figure 11. CRD150/CRZ200 Card Reader Mechanism

The contents of each column are read serially into the card reader's two buffers. Each buffer holds one character (6 bits) of information until it is ready for transfer.

The transfer of data continues until the entire card is read, an alert condition is detected, or the card reader receives a signal telling it to transfer no more data. When reading of the card is completed, a check is made to determine whether the correct number of columns were read. If not, an error is indicated. A solar cell at the entrance to the output stacker warns of any card jam as the cards leave the transport mechanism. The card reader then makes available information on its status and generates a signal indicating termination of operation.

A jogger plate, located on the reader's top surface, facilitates manual alignment of cards. An operator's panel contains all the switches and indicators necessary for normal operation. A covered maintenance panel is provided for the use of the service engineer in testing and checking the equipment.

Setup

The operator uses the loading and unloading procedures described below when setting up the subsystem:

1. Press POWER ON. Wait for the light to come on and listen for the blowers to start (about 8 seconds delay) before actuating other controls. The RESET light also comes on.
2. Load cards into the input hopper as described below.
3. Be sure that the pusher plate of the output stacker rests against the output gate at the bottom of the area to ensure correct stacking of cards.
4. After loading the last card of the file to be read, press LAST BATCH if the programmer so specified. Otherwise, this light should not be on.
5. Press OPERATE/RESET so that the OPERATE light glows green.

6. If the OPERATE light does not come on, manually correct any alert conditions.

7. Again press OPERATE/RESET so that the OPERATE light glows green. This clears the alert circuitry, turns off the alert light, and indicates that the card reader is ready to operate. The following lights should glow:

   POWER ON
   OPERATE
   LAST BATCH (if applicable)

Loading Cards

The recommended procedures for loading cards in the CRZ200 card reader are described below. The procedures vary, depending on whether the input hopper is empty, nearly empty, or has more than six inches of cards.

In an empty hopper:

1. Prepare the cards for loading by inspecting, fanning, and joggling them as described previously.

2. If power is on, press HALT to prevent card feeding while loading. The RESET and HALT lights will glow blue.

3. Grasp the deck of joggled cards firmly with the right hand so that they do not slip and become misaligned.

4. Pull the feed plate in the input hopper far enough to allow the card deck to be placed gently in the hopper below the plate (Figure 12).

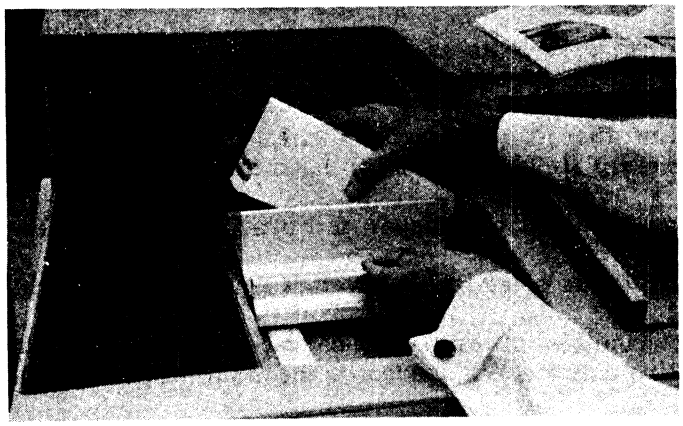


Figure 12. Adding Cards to Empty Hopper

5. Hold the card deck with the right hand; and, with the left hand, load the first card in the deck into the feed area so that its leading edge enters the feed throat (Figure 13). The card must lie flat against the riffle air housing and raise the arm of the hopper empty switch. This procedure ensures positive feeding of the first card and prevents a possible misfeed when card reading starts.

6. Gently slide the pusher plate down against the cards. The riffle air stream will separate the first few cards.

7. Press OPERATE/RESET so that the OPERATE portion glows. The card reader is ready to feed cards when the program calls for card reading.

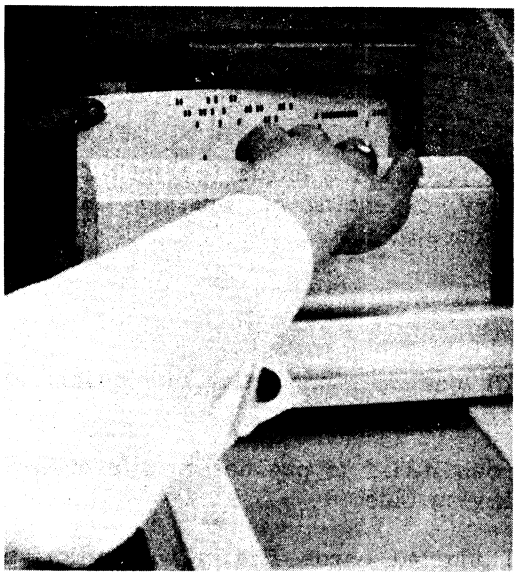


Figure 13. Inserting First Card in Feed Throat

Adding cards--less than 6-inch stack in hopper:

1. Inspect, fan, and joggle cards as already described.

2. If the handle on the feed plate is even with or lower than the operator's control panel, stop card feeding by pressing HALT.

3. Grasp a handful of the joggled cards firmly with the right hand, pick them up, and slide the pusher plate up with the left hand to make room for the added cards.

4. Make sure that no cards in the hopper fall over when the pusher plate is moved.

5. Place the handful of cards being added into this space with the right hand.

6. Continue loading handfuls of prepared cards, sliding the pusher plate up each time, until the entire card deck is loaded or the input hopper is full.

7. Slide the pusher plate gently down against the card deck.

8. Press OPERATE/RESET so that the OPERATE portion again glows. This allows card feeding to begin when the program calls for card reading.

Adding cards--more than 6-inch stack in hopper:

1. Prepare cards as previously described.

2. Grasp a handful of the cards with the right hand. Pick them up and slide the pusher plate up with the left hand just enough to make room for the added cards. Note that feeding continues.

3. Place the added cards into this space with the right hand. Do not exert pressure against the cards already in the input hopper, as this may cause a misfeed. (See Figure 14.)

4. Continue loading cards in this manner, keeping the pusher plate against the cards in the input hopper except when cards are actually being added, until the entire card deck is loaded or the input hopper is full.

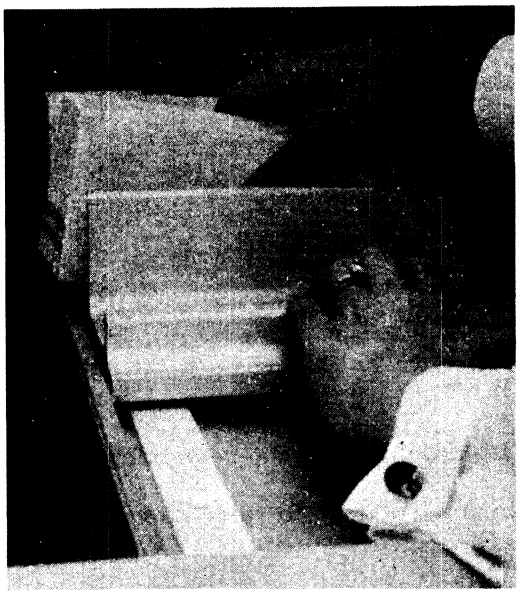


Figure 14. Adding Cards During Feed Operations

Unloading Cards

When the card deck for a program contains more than 2000 cards, it is necessary to remove cards during the run. Otherwise, the card reader stops feeding cards when the stacker completely fills and activates the stacker full switch. However, cards can be removed at any time without stopping operations; but at least a 6-inch stack must remain in the stacker. This quantity remains when the handle on the pusher plate is even with the control panel. Card removal procedures are listed on the following page.

Removing cards above a 6-inch stack:

1. While the card reader continues feeding cards, slide the pusher plate up slightly with the left hand to release pressure on the cards (but not far enough to activate the stacker full switch).

2. With the right hand, gently tilt up the right side of the cards only enough to grasp firmly the cards being removed with the left hand.

3. Lift the cards out of the stacker, being careful not to press against the cards remaining in the stacker. Pressure may cause the cards entering the stacker to tear webs out of the card that has just entered the stacker. (See Figure 15.)

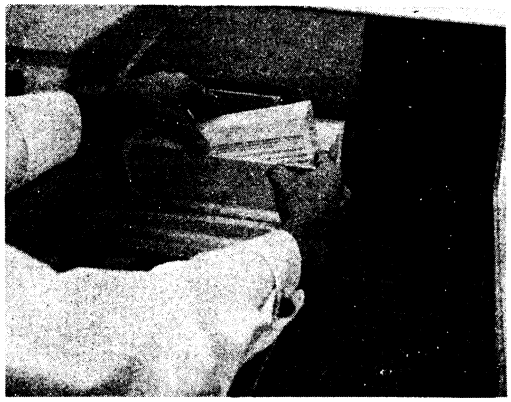


Figure 15. Removing Cards During Feed Operations

4. Gently slide the pusher plate down against the remaining cards.

5. Return the removed cards immediately to their storage tray or holder to prevent them from curling or being damaged.

6. Block the cards as soon as practical, to keep them from warping or curling. (See Figure 16.)

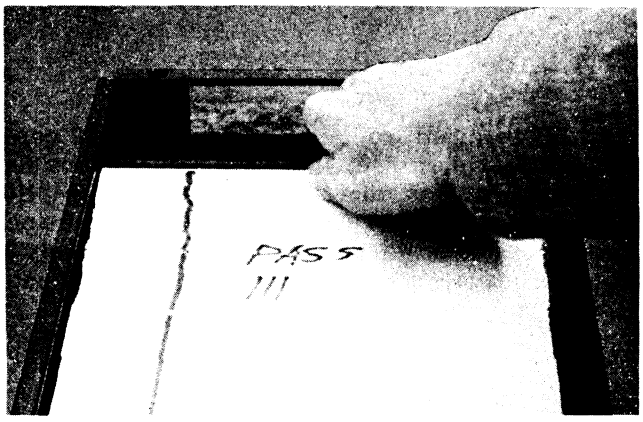


Figure 16. Blocking Cards in Storage Tray

Removing all cards from the stacker:

1. Stop card feeding by pressing HALT.
2. Slide the pusher plate up with the left hand.
3. Firmly grasp the cards to be removed with the right hand and lift them out of the stacker. Remove all cards or leave a small stack, as desired. (See Figure 17.)

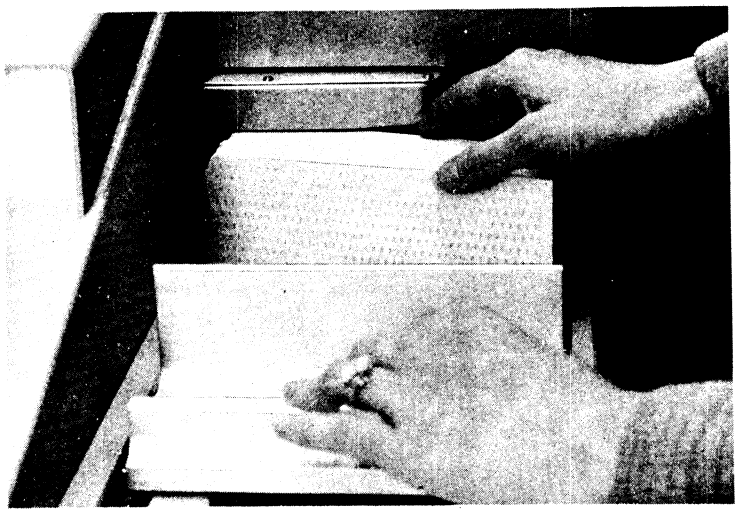


Figure 17. Removing All Cards from Stacker

Shutdown

When reading is complete and if the card reader will not be used again for some time; power can be turned off by pressing POWER OFF. Cards can be removed from the output stacker.

CPZ100 CARD PUNCH

Operator's Control Panel

Operator's Control Panel is located on the front panel of the punch unit.

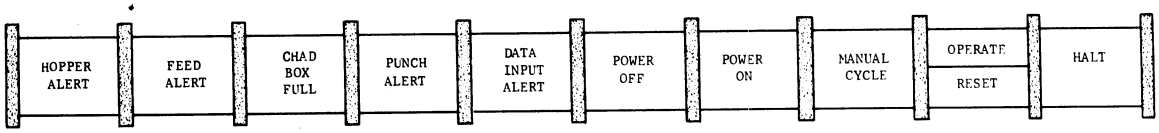


Figure 18. CPZ100 Control Panel

CONTROL/INDICATOR	FUNCTIONS
HOPPER ALERT indicator (blue)	The indicator glows when the hopper is empty or the stacker is full. The card punch halts. The RESET indicator comes on.
FEED ALERT indicator (red)	The indicator glows to indicate a card has failed to feed properly. The card punch halts. The RESET indicator comes on.
CHAD BOX FULL indicator (blue)	The indicator glows when the chad box is full or not properly positioned. RESET comes on.
PUNCH ALERT indicator (red)	The indicator glows to indicate a punch error detected by the read brushes. DATA INPUT ALERT indicator also comes on. The punch may or may not halt, depending on the requirements of the program.
DATA INPUT ALERT indicator (red)	The indicator glows when a transfer timing or transmission parity alert occurs. It also comes on when a punch error is detected. Punching of data stops, but the punch continues to operate until the end of the card passes the punch dies.
POWER OFF pushbutton	Pressing the POWER OFF control removes power from the punch and turns off the POWER ON light.
POWER ON pushbutton and indicator (amber)	Pressing the POWER ON control turns on power to the punch. The indicator comes on only after power is fully applied (approximately 8 seconds).
MANUAL CYCLE pushbutton and indicator (white)	The indicator glows whenever the prepunch or the postpunch areas do not contain cards. Pressing this control feeds a single card from the hopper to the mechanism and all cards already in the mechanism advance to the next station. The indicator goes off when all stations are properly loaded. This control is used

CONTROL/INDICATOR	FUNCTIONS
	to position cards before the punching operation and to clear cards from the equipment after punching stops.
OPERATE/RESET pushbutton and indicator (green/blue)	The OPERATE indicator glows when the punch is ready to operate. RESET glows when power is first turned on. OPERATE goes off and RESET comes on when one of the following occurs: 1. Hopper Empty 2. Stacker Full 3. Manual Halt 4. Chad Box Full 5. Feed Alert 6. Card Jam After the condition is corrected, pressing the control causes RESET to go off and OPERATE to come on. A special interrupt signal is transmitted.
HALT pushbutton and indicator (blue)	Pressing the control causes operation to stop when the current card is completely punched. RESET comes on as well as HALT. Pressing OPERATE/RESET turns off the HALT indicator and punching begins, if MANUAL CYCLE is not on.

Card Handling Mechanism

The card handling mechanism consists of an input hopper and an output stacker, each with a capacity of 800 cards, and a card track for moving the cards. A set of 80 punch dies, regulated by the control electronics, punches cards one row at a time. The postpunch read station of 80 wire brushes double-checks the accuracy of the punching. Warning switches in the mechanism halt the punch whenever an improper condition exists.

A weight in the input hopper holds cards so that the bottom card rests firmly against the feed plate. A convenient place for manually aligning card edges is provided by a jogger plate located near the loading and unloading areas of the punch. Card chips created by the punching operation are accumulated in a removable chad box.

Card punching begins upon receipt of a punch instruction. When the instruction is received and accepted, if no Attention conditions exist, the punch becomes busy and a pair of feed knives push the bottom card of the stack out of the input hopper, face down and 12-row first. The card moves to station 1 (the prepunch station). (See Figure 19.)

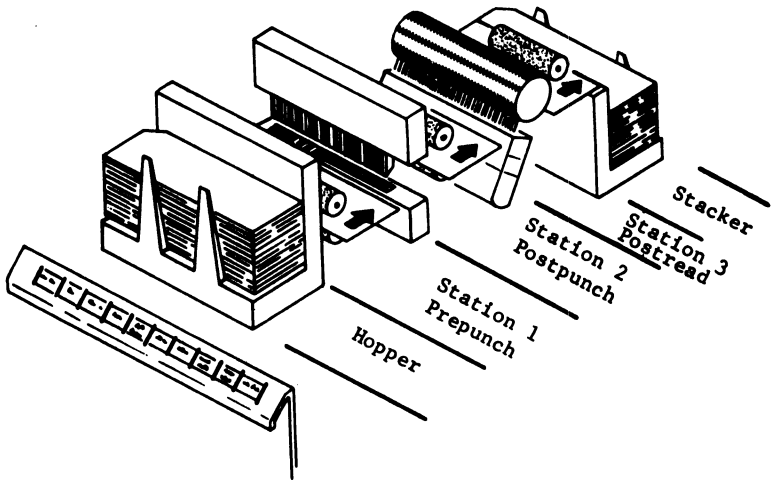


Figure 19. CPZ100 Card Punch Mechanism

As soon as the punch becomes busy, it requests data for the first row (row 12) of the card in station 1 before moving it under the punching mechanism. Once the punch accepts the punch instruction for row 12, it is committed to the handling of the entire card. The card will be advanced, row by row, into the postpunch station whether or not further punch row instructions arrive.

Data is transmitted to the punch controller character by character. The parity of each character is checked and the bits necessary to punch row 12 are automatically extracted and transferred into the punch controller's 80-bit buffer in positions corresponding to the columns in which they are to be punched. The buffer establishes an odd parity count of 1-bits for each row of the incoming data. At the appropriate time all punch dies are activated at once to transfer this information from the buffer to the card row.

When row 12 is completely punched, the punch signals termination of the operation and goes into an intermediate state waiting for an instruction to punch the next row (row 11). When it receives the next punch instruction, it again becomes busy, requests data, and starts punching. This sequence continues until the last row of the card is punched. If the input hopper becomes empty, the output stacker or chad box becomes full, or a feed alert occurs, punching of the card continues to the end (row 9). If a card jam occurs, the punch sequence terminates immediately.

After being punched, the card enters station 2 (the postpunch station). From station 2, the card moves past the punch check area. There, 80 wire read brushes examine the punches a row at a time, accumulate each row's parity, and compare that parity against the parity established when the data was first received by the punch's buffer. If the two parity checks do not agree, a punch alert signals the discrepancy.

The punch check for each card takes place while the next card is being punched. Each row except row 9 is checked for punch accuracy during the intermediate state following punching of the corresponding row on the following card. Instead of going into the intermediate waiting state after punching row 9, the punch remains busy until row 9 of the preceding card is read. When it has been read, the punch signals termination of the operation and then becomes ready for the next instruction.

When the last row has been read and checked, the card enters station 3 (the postread station) and then moves into the output stacker. As the first card drops into the stacker, the second card enters station 3, the third card moves under the punching mechanism and into station 2, and a new card leaves the input hopper to go into station 1.

Setup

To set up the card punch and start operations, follow the sequence below:

1. See that the chad box is correctly in place.

2. Press POWER ON. In 8 seconds, POWER ON glows amber and RESET glows blue. If there are no cards in the punch transport, the MANUAL CYCLE light also glows.

3. Lift the card weight, load the aligned cards into the input hopper, face down, with the top edge facing toward the punch. Place the card weight on top of the loaded cards.

4. Press MANUAL CYCLE twice. This causes the first card to move past the punch dies into station 2. The second card stops in station 1 immediately preceding the punch dies. Thus, the first card will always be blank. This is necessary because the read station must be occupied while punching takes place. When the punch is correctly loaded the MANUAL CYCLE light goes off.

5. Press OPERATE/RESET so that OPERATE glows green. If OPERATE does not come on and RESET remains on, a condition exists that must be manually corrected by the operator. The corresponding alert light on the operator's control panel also glows.

6. Manually correct any Attention conditions.

7. Again press OPERATE/RESET so that OPERATE glows green. This clears the alert circuitry, turns off the alert light, and indicates that the punch is ready to operate. Normally, only the POWER ON and OPERATE lights will be on. If the DATA ALERT is on from a previous operation, either alone or with the PUNCH ALERT light, these lights are turned off by the next punch instruction received.

After punching starts, the operator remains alert for the need to add blank cards, remove punched cards, or empty the chad box.

Adding Cards

Cards can be punched continuously if the input hopper is not allowed to become empty. Cards can be added while punching continues, provided a 1-inch stack of cards remains in the hopper. To add cards, lift the card weight from the hopper, place additional cards on top of those remaining in the hopper, and replace the card weight.

If cards are not added when necessary, the hopper empty switch turns on the HOPPER ALERT light.

Removing Cards

The operator removes punched cards from the output stacker at the end of a program run to prevent mixing the cards with the output of the next run. After the last card has been punched, it is in station 2 (postpunch), and the card punched before that is in station 3 (postread). These must be cleared from the punch.

Press MANUAL CYCLE twice to move the last two punched cards into the output stacker. It is good practice to press the control an extra time and get a blank card on the back of the deck.

When a program punches more than a hopperful (800 cards), the operator either removes cards when the full output stacker causes an alert and stops the punch or removes cards before the stacker is full.

Normally the operator merely presses HALT, removes all cards, presses OPERATE/ RESET to continue punching, then stacks the punched cards on the joggling plate. Cards come into the stacker face down, with the first punched card on the bottom of the stack. Cards must be kept in sequence when removed in this manner.

Experienced operators sometimes remove cards without interrupting punching. This procedure requires special care to prevent jamming of cards as they come into the stacker. A handful of cards must be grabbed at just the right time, when a card is not moving into the output stacker and while the stacker plate is in the up cycle of its oscillating up-and-down movement. The cards must then be pulled out very quickly. Normally, it is easier to halt the punch for the few seconds it requires to remove the cards.

Emptying the Chad Box

The chad box of the CPZ100 card punch is next to the output stacker. If the card punch is operating continuously, the operator should empty the chad box frequently enough to prevent the punch from halting because of a Chad Box Full alert. To do this, he presses HALT to stop card movement, removes and empties the chad box, and then returns it to its original position and presses OPERATE/RESET. If the chad box is not replaced correctly, the punch will not operate.

The CHAD BOX FULL light remains on while the box is not in place.

Shutdown

To end operations follow the sequence below:

1. Remove any blank cards in the input hopper.

2. Press MANUAL CYCLE three times to remove cards remaining in stations 1, 2, and 3. The last card that was punched is checked as it moves past the read brushes. If it contains a punch error, the PUNCH ALERT light glows red.

3. Remove the punched cards from the output stacker and label them for storage.

4. Press POWER OFF if the punch will not be used again for some time.

CPZ200 CARD PUNCH

Operator's Control Panel

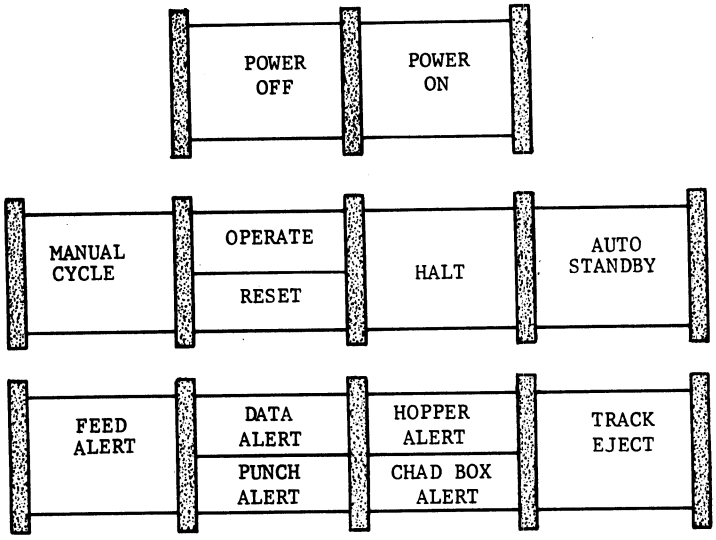


Figure 20. CPZ200 Control Panel

CONTROL/INDICATOR	FUNCTIONS
POWER OFF pushbutton	Turns off all electrical power to the subsystem.
POWER ON pushbutton and indicator (amber)	Turns on power to card punch; light comes on.
MANUAL CYCLE pushbutton and indicator (blue)	If the light is not on, briefly pressing the control once causes cards to move from the input hopper into the prepunch stations. If the control is held down when the light is not glowing, cards move continuously through the punch into the output stacker. The MANUAL CYCLE light glows blue to indicate that not all of the four prepunch stations are loaded with cards. Pressing the control once causes cards to feed from the input hopper into the four prepunch stations and ejects any cards in the postpunch stations. The light goes off when the stations are loaded. Pressing MANUAL CYCLE when the AUTO STANDBY light is on returns the punch to the operate state within 10 seconds. Pressing MANUAL CYCLE again causes cards to be loaded. MANUAL CYCLE has effect in advancing cards only when RESET is on.

CONTROL/INDICATOR	FUNCTIONS
	When the FEED ALERT light glows, MANUAL CYCLE is inoperable until the misfeed condition is corrected.
OPERATE/RESET pushbutton and indicator (green/blue)	Pressing the control when RESET glows blue resets the logic to the ready condition, causes the RESET light to go off and the OPERATE light to come on, providing no inoperable conditions exist. OPERATE portion glows green to indicate that the punch is ready to operate. The blue RESET light comes on when power is first turned on or when the punch enters Attention status. During punching, OPERATE goes off and RESET glows when operation halts for one of the following reasons: 1. Empty input hopper 2. Full output stacker 3. Manual halt initiated by the operator 4. Chad box too full or incorrectly positioned 5. Feed alert 6. Card jam 7. Empty prepunch station
HALT pushbutton and indicator (blue)	Pressing the control during operation stops punching and feeding when the current card is completely punched. This also makes the MANUAL CYCLE and TRACK EJECT controls operable. The HALT and RESET lights come on when: 1. POWER ON is pressed (after an 8-second delay). 2. There is an empty prepunch station. (The MANUAL CYCLE light also glows.) 3. The read brushes were not properly locked into place after a card jam was cleared from the punch block. 4. HALT is pressed during operations.

CONTROL/INDICATOR	FUNCTIONS
	When the cause of the halt is corrected and OPERATE/RESET is pressed, the HALT light goes off.
AUTO STANDBY indicator (amber)	Light on means the punch has gone into the standby state. The light goes off when a punch instruction is received or MANUAL CYCLE is used to return the punch to the operate state.
FEED ALERT pushbutton and indicator (red)	Pressing the control which is operable only when the light is on, feeds one card from the input hopper into station 1. No other cards are moved. If the card feeds, the light goes off. The light comes on any time a card fails to feed correctly from the input hopper, whether in response to a punch instruction or to actuation of MANUAL CYCLE. The punch stops, and the RESET light comes on.
DATA ALERT/PUNCH ALERT indicator (red/red)	When the DATA ALERT light comes on alone, this means the logic detected a Transfer Timing Alert or a Transmission Parity Alert. When the PUNCH ALERT light comes on alone, this means a Punch Alert occurred on the last card of the program but that the alert status has not yet been transmitted. Both portions on means that if a Punch Alert only has occurred the alert status has been transmitted. Whether these alerts halt punching depends on the program.
HOPPER ALERT/CHAD BOX ALERT indicator (blue/blue)	HOPPER ALERT portion on means the input hopper is empty or the output stacker is too full. CHAD BOX ALERT portion on means the chad box is too full or the box is not in its correct position. When either light glows, the RESET light also glows blue and the card punch halts. When the alert condition is corrected and OPERATE/RESET is actuated, these lights go off.
TRACK EJECT pushbutton	Pressing this control in the Halt mode causes all cards in the six stations of the card track to be ejected to the output stacker. No cards are fed in from the hopper. Before this control is operable, RESET must be on.

Card Handling Mechanism

The card handling mechanism consists of an input hopper capable of holding 3500 cards, an output stacker with a capacity of 3000 cards, and a card track for moving the cards. The card track moves cards forward, row by row, in response to feed signals issued by the punch controller. A set of 80 punch dies, regulated by the control electronics, punches cards a row at a time. The postpunch read station of 80 wire brushes checks the accuracy of the punching. Controls in the mechanism halt the punch whenever an improper condition exists.

A weight in the input hopper holds cards so that the bottom card rests firmly against the feed plate. A convenient place for manually aligning card edges is provided by a jogger plate located near the loading and unloading areas of the punch. Card chips created by the punching operation are accumulated in a large removable chad box.

Before punching can begin, the card punch must be properly loaded and free of any Attention conditions. The subsystem becomes busy and card punching begins when a punch instruction is received and accepted.

As soon as the punch becomes busy, it requests data for the card. Data is transmitted, character by character, from the processing system to the card image buffer of the punch's controller. The parity of each character is checked as it is received. If the instruction requests the data to be punched in the Hollerith code, the code is converted by the controller before the data enters the buffer.

If all the data for the punching of a single card (160 binary characters or 80 alphanumeric characters) is received by the first or second feed time following initiation of the punch instruction, the first card moves from station 4 into the punching area, face down and row 12 first. All cards in the track begin moving forward to the next station. (See Figure 21.)

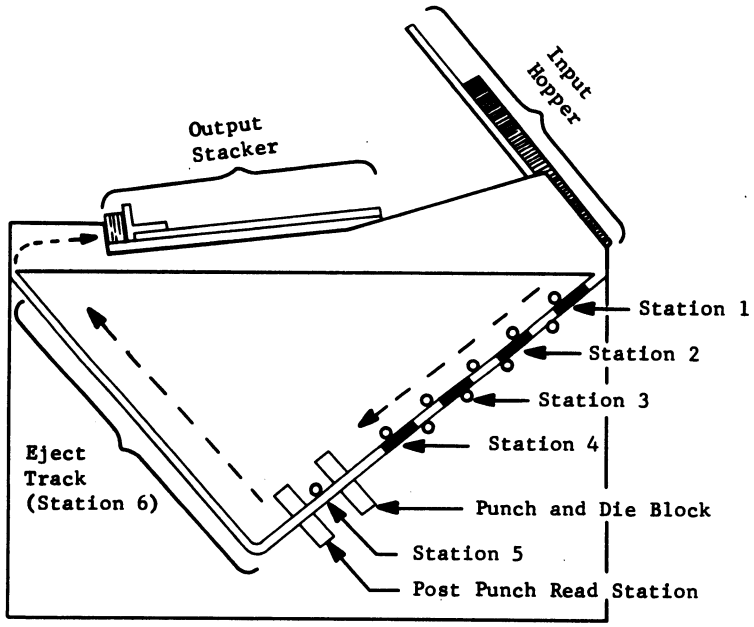


Figure 21. CPZ200 Card Punch Feed Mechanism (Left-Side View)

As row 12 of the first card passes over the punch dies, the control electronics extracts the row-12 information from the card image buffer and activates the punching mechanism. The punch remains in the busy state, punching data row by row until the last row of the card (row 9) is completed. It then transmits a Terminate signal indicating to the processing system that the punch has completed the operation.

The first card is checked while the second card is being punched. As row 12 of the second card enters the punch area, row 12 of the first card starts through the read head. There, 80 read brushes examine the punched holes a row at a time, accumulate each row's parity, and compare that parity against the parity established for the row when the data was first received by the punch's card image buffer. If the two parity checks do not agree, a punch alert signals the discrepancy. After the second card is punched, the results of the read check of the first card are transmitted to the processing system.

When the last row is read and checked, the card moves into station 6 and automatically continues on its way to the output stacker.

Setup

To set up the card punch and start operations, follow the sequence below:

1. Press POWER ON. In about 2 seconds, POWER ON glows amber and the HALT and RESET lights glow blue. If RESET does not light within the normal time, check to see whether the punch is connected to its power supply or a card jam exists in the transport as the result of a previous operation.

   After power is on, it takes approximately 10 seconds for the transport motor to synchronize with the motor for the punching mechanism. If the two motors do not synchronize within 10 seconds, power to the punch is automatically turned off and POWER ON must be pressed again to restart. If the motors fail to synchronize after several attempts, the service engineer must be called.

   When the two motors have synchronized, the punch is ready for operations. If there are no cards in the punch transport, the MANUAL CYCLE light comes on. If there are no cards in the input hopper, the HOPPER ALERT light glows blue.

2. Open the swing-out doors at the left front of the punch cabinet, empty the chad box, and replace the box in the correct position.

3. Lift the card weight and load the aligned cards into the input hopper and the auxiliary hopper, face down, with the top edge (row 12) facing the punch. Replace the card weight. Even though the punch is correctly loaded, the HOPPER ALERT light remains on.

4. Press the lighted MANUAL CYCLE control once. This feeds the first four cards into the punch and removes any cards still remaining in the postpunch stations. When the prepunch stations are loaded, the MANUAL CYCLE light goes off. If cards do not feed and the light remains on, check to see if a Feed Alert has occurred. If so, correct this condition before continuing. If cards still do not feed, the brushes of the read head may not be locked in place. This condition must be corrected by the service engineer.

5. Press OPERATE/RESET so that OPERATE glows green. The HALT light and any other alert lights go off, providing no Attention conditions exist.

If OPERATE does not come on and RESET remains on, a condition exists that must be manually corrected by the operator. The corresponding alert light on the operator's control panel also glows.

6. Manually correct any Attention conditions.

7. Again press OPERATE/RESET so that OPERATE glows green. This clears the alert circuitry, turns off alert lights, and indicates that the punch is ready to operate. Normally, only the POWER ON and OPERATE lights will be on. If either of the DATA ALERT/PUNCH ALERT lights is on from a previous operation, it will be turned off by the next punch instruction received.

After punching starts, the operator remains alert for the need to add blank cards, remove punched cards, or empty the chad box.

Adding Cards

Cards can be punched continuously if the input hopper is not allowed to become empty. Cards can be added while punching continues, provided a 3-inch stack of cards remains in the hopper. To add cards, lift the card weight from the hopper, place additional cards on top of those remaining in the hopper, and replace the card weight.

If cards are not added when necessary, the HOPPER ALERT light comes on as soon as the last card leaves the hopper. The card punch halts.

It is good practice to keep the auxiliary hopper at least partially full.

Removing Cards

The operator removes punched cards from the output stacker at the end of a program run, to prevent mixing the cards with the output of the next run. After the last card has been punched, press the unlighted MANUAL CYCLE control, holding it down until the punched cards are cleared and stacked.

If the program provides for a blank card at the end of the deck, the last card containing punched data is checked by the read area and continues on to the stacker. If the program does not provide for a blank card and Punch Alert exists on the last card, a glowing PUNCH ALERT light is its only indication. The card causing the Punch Alert is the last card in the stacker.

When a program punches more than 3000 cards, the operator either removes cards when the full output stacker causes the HOPPER ALERT light to come on and stops the punch, or he removes cards before the stacker is full. Cards can be removed while punching continues.

Emptying the Chad Box

The chad box on the CPZ200 card punch is large enough to meet the requirements of any normal run. However, unusually high punching activity may require that the box be emptied more frequently to avoid an alert halt. A worst-case situation, such as punching 30,000 cards at 50 percent density, would require emptying the chad box every 1-1/2 hours. The level of chad can be observed without interrupting operations by opening the front door below the input hopper.

To empty the chad box, first press HALT to stop the punch. After emptying the box, replace it in the correct position and resume operation in the normal manner, using the startup procedure.

Manually Returning to Operate State

If the punch is in the standby state, the reception of any instruction causes it to enter the operate state. However, the operator can manually place the punch in the operate state if there are no existing Attention or Data Alert conditions. Press the following controls, in sequence:

1. HALT
2. MANUAL CYCLE
3. OPERATE/RESET

Shutdown

To end card punching operations, follow the sequence below:

1. If it is desired to remove the four blank cards in the prepunch stations, press TRACK EJECT.

2. Remove the punched cards from the output stacker and remove any unnecessary blank cards from the end of the deck. Label the deck for storage.

3. Remove any blank cards in the input hopper.

4. Press POWER OFF if the punch will not be used again for some time. When POWER OFF is pressed, the punch motors stop and all lights on the operator's control panel go off.

CPZ201 CARD PUNCH

Operator's Control Panel

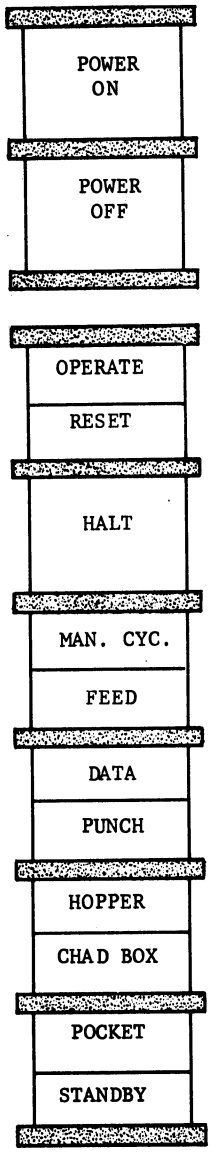


Figure 22. CPZ201 Control Panel

CONTROL/INDICATOR	FUNCTIONS
POWER ON pushbutton and indicator (yellow)	Pressing the control turns on power to the subsystem. The indicator glows. NOTE: If the Punch Block is not locked, power will not come on.

CONTROL/INDICATOR	FUNCTIONS
POWER OFF pushbutton	Pressing the control turns off all a.c. and d.c. power to the subsystem.
OPERATE/RESET pushbutton and indicators (green/blue)	Pressing the control when RESET glows blue resets the logic to the ready condition, causes the RESET light to go off and the OPERATE light to come on, providing no inoperable conditions exist. OPERATE portion glows green to indicate that the punch is ready to operate. The blue RESET light comes on when power is first turned on or when the punch enters Attention status. During punching, OPERATE goes off and RESET glows when operation halts for one of the following reasons: 1. Empty input hopper 2. Full output stacker 3. Manual halt initiated by the operator 4. Chad box too full or incorrectly positioned 5. Feed alert 6. Card jam 7. Empty prepunch station 8. Reject pocket full 9. Cards fed to wrong stacker NOTE: When control is actuated, and subsystem reverts to the operate condition, a Special Interrupt signal is sent to the processing system.
HALT pushbutton and indicator (blue)	Pressing the control during operation stops punching and feeding when the current card is completely punched. When the cause of the halt is corrected and OPERATE/RESET is pressed, the HALT light goes off.
MANUAL CYCLE/FEED pushbutton and indicator (blue/red)	If the light is not on, briefly pressing the switch once causes a card to move from the input hopper into station 1; all cards in the track advance to the next station. If the switch is held down when the light is not

CONTROL/INDICATOR	FUNCTIONS
	on, cards move continuously through the punch into the reject pocket. The MANUAL CYCLE light glows blue to indicate that both of the prepunch stations are not loaded with cards. Pressing the lighted switch once causes cards to feed from the input hopper into the prepunch stations and ejects any cards in the postpunch stations. The light goes off when the stations are loaded. Pressing MANUAL CYCLE when the STANDBY light is on returns the punch to the operate state within 10 seconds. Pressing MANUAL CYCLE again causes cards to be loaded. Switch has effect in advancing cards only when RESET is on. The FEED light comes on any time a card fails to feed correctly from the input hopper, whether in response to a punch instruction or to actuation of MANUAL CYCLE. The punch stops, and the RESET light comes on.
DATA/PUNCH indicator (red/red)	When the DATA light comes on alone, this means the logic detected a Transfer Timing Alert, or a Transmission Parity Alert. When the PUNCH light comes on alone, this means a Punch Alert occurred on the last card of the program but that the alert status has not yet been transmitted. Both portions on means that if a Punch Alert only has occurred, the alert status has been transmitted. Whether these alerts halt punching depends on the program.
HOPPER CHAD BOX lights (blue/blue)	HOPPER portion on means either the input hopper is empty or the output stacker is too full. CHAD BOX portion on means the chad box is too full or the box is not in its correct position. When either light glows, the RESET light also glows blue and the card punch halts. When the alert condition is corrected and OPERATE/RESET is actuated, these lights go off.

CONTROL/INDICATOR	FUNCTIONS
POCKET/STANDBY indicator (red/yellow)	The POCKET indicator glows red when a rejected card is put in the normal stacker or when a valid card is fed to the reject pocket. The indicator is turned off by pressing OPERATE/RESET. STANDBY glows yellow when the subsystem is in the standby mode. The indicator goes off when the subsystem returns to the normal mode of operation.

Card Handling Mechanism

The card handling mechanism consists of an input hopper capable of holding 1200 cards, an output stacker with a capacity of 1200 cards, a reject pocket with a capacity of at least 100 cards, and a card track for moving the cards. The card track moves cards forward, row by row, in response to feed signals issued by the punch controller. A set of 80 punch dies, regulated by the control electronics, punches cards a row at a time. The postpunch read station of 80 wire brushes checks the accuracy of the punching. Warning switches in the mechanism halt the punch whenever an improper condition exists.

A weight in the input hopper holds cards so that the bottom card rests firmly against the feed plate. A convenient place for manually aligning card edges is provided by a jogger plate located near the loading and unloading areas of the punch. Card chips created by the punching operation are accumulated in a large removable chad box.

Before punching begins, the card punch must be properly loaded and free of any Attention conditions. The subsystem becomes busy and card punching begins when a punch instruction is received and accepted.

As soon as the punch becomes busy, it requests data for the card. Data is transmitted, character by character, from the processing system to the card image buffer of the punch's controller. The parity of each character is checked as it is received. If the instruction requests the data to be punched in the Hollerith code, the code is converted by the controller before the data enters the buffer.

If all the data for the punching of a single card (160 binary characters or 80 alphanumeric characters) is received by the feed time following initiation of the punch instruction, the first card moves from station 3 into the punching area, face down and row 9 first. All cards in the track begin moving forward to the next station. (See Figure 23.)

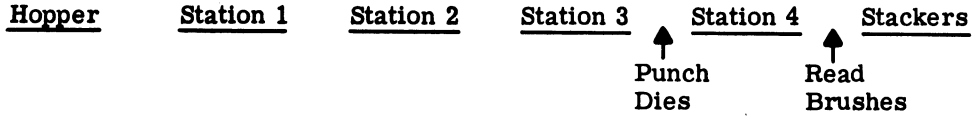


Figure 23. CPZ201 Card Feed Mechanism

As row 9 of the first card passes over the punch dies, the control electronics extract the row-9 information from the card image buffer and activate the punching mechanism. The punch remains in the busy state, punching data row by row until the last row of the card (row 12) is completed. It then transmits a Terminate signal indicating to the processing system that the punch has completed the operation.

The first card is checked while the second card is being punched. As row 9 of the second card enters the punch area, row 9 of the first card starts through the read head. There, 80 read brushes examine the punched holes a row at a time, accumulate each row's parity, and compare that parity against the parity established for the row when the data was first received by the punch's card image buffer. If the two parity checks do not agree, a punch alert signals the discrepancy. After the second card is punched, the results of the read check of the first card are transmitted to the processing system.

When the last row is read and checked, the card moves into station 4 and automatically continues on its way to the output stacker.

Setup

To set up the card punch and start operations, follow the sequence below:

1. Press POWER ON. In about 2 seconds, POWER ON glows amber and the HALT and RESET lights glow blue. If RESET does not light within the normal time, check to see whether the punch is connected to its power supply or a card jam exists in the transport as the result of a previous operation.

   After power is on, it takes approximately 10 seconds for the transport motor to synchronize with the motor for the punching mechanism. If the two motors do not synchronize within 10 seconds, power to the punch is automatically turned off and POWER ON must be pressed again to restart. If the motors fail to synchronize after several attempts, the service engineer must be called.

   When the two motors have synchronized, the punch is ready for operations. If there are no cards in the punch transport, the MANUAL CYCLE light comes on. If there are no cards in the input hopper, the HOPPER ALERT light glows blue.

2. Empty the chad box, and replace the box in the correct position.

3. Lift the card weight and load the aligned cards into the input hopper and the auxiliary hopper, face down, with the bottom edge (row 9) facing the punch. Replace the card weight. Even though the punch is correctly loaded, the HOPPER ALERT light remains on.

4. Press the lighted MANUAL CYCLE control once. This feeds the first four cards into the punch and removes any cards still remaining in the postpunch stations. When the prepunch stations are loaded, the MANUAL CYCLE light goes off. If cards do not feed and the light remains on, check to see if a feed alert has occurred. If so, correct this condition before continuing. If cards still do not feed, the brushes of the read head may not be locked in place. This condition must be corrected by the service engineer.

5. Press OPERATE/RESET so that OPERATE glows green. The HALT light and any other alert lights go off, providing no Attention conditions exist.

If OPERATE does not come on and RESET remains on, a condition exists that must be manually corrected by the operator. The corresponding alert light on the operator's control panel also glows.

6. Manually correct any Attention conditions.

7. Again press OPERATE/RESET so that OPERATE glows green. This clears the alert circuitry, turns off alert lights, and indicates that the punch is ready to operate. Normally, only the POWER ON and OPERATE lights will be on. If either of the DATA ALERT/PUNCH ALERT lights is on from a previous operation, it will be turned off by the next punch instruction received.

After punching starts, the operator remains alert for the need to add blank cards, remove punched cards, or empty the chad box.

Adding Cards

Cards can be punched continuously if the input hopper is not allowed to become empty. Cards can be added while punching continues, provided a 3-inch stack of cards remains in the hopper. To add cards, lift the card weight from the hopper, place additional cards on top of those remaining in the hopper, and replace the card weight.

If cards are not added when necessary, the HOPPER ALERT light comes on as soon as the last card leaves the hopper. The card punch halts.

Removing Cards

The operator removes punched cards from the output stacker at the end of a program run, to prevent mixing the cards with the output of the next run. After the last card has been punched, press the unlighted MANUAL CYCLE, holding it down until the punched cards are cleared and stacked.

If the program provides for a blank card at the end of the deck, the last card containing punched data is checked by the read area and continues on to the stacker. If the program does not provide for a blank card and punch alert exists on the last card, a glowing PUNCH ALERT light is its only indication. The card causing the punch alert is the last card in the stacker.

When a program punches more than 1200 cards, the operator either removes cards when the full output stacker causes the HOPPER ALERT light to come on and stops the punch, or he removes cards before the stacker is full. Cards can be removed while punching continues.

Emptying the Chad Box

The chad box on the CPZ201 card punch is large enough to meet the requirements of any normal run. However, unusually high punching activity may require that the box be emptied

more frequently to avoid an alert halt. A worst-case situation, such as punching 30,000 cards at 50 percent density, would require emptying the chad box every 1-1/2 hours. The level of chad can be observed without interrupting operations by opening the front door below the input hopper.

To empty the chad box, first press HALT to stop the punch. After emptying the box, replace it in the correct position and resume operation in the normal manner, using the startup procedure.

Manually Returning to Operate State

If the punch is in the standby state, the reception of any instruction causes it to enter the operate state. However, the operator can manually place the punch in the operate state if there are no existing Attention or Data Alert conditions. Press the following controls, in sequence:

1. HALT
2. MANUAL CYCLE
3. OPERATE/RESET

Shutdown

To end card punching operations, follow the sequence below:

1. If it is desired to remove the three blank cards in the prepunch stations, remove the cards from the hopper and depress the MANUAL CYCLE control.

2. Remove the punched cards from the output stacker and remove any unnecessary blank cards from the end of the deck. Label the deck for storage.

3. Press the POWER OFF control if the punch will not be used again for some time. When POWER OFF is pressed, the punch motors stop and all lights on the operator's control panel go off.

APPENDIX A
SUBSYSTEM CHARACTERISTICS

This appendix contains a description of the features and operating characteristics of the individual subsystems available.

CRZ201 CARD READER

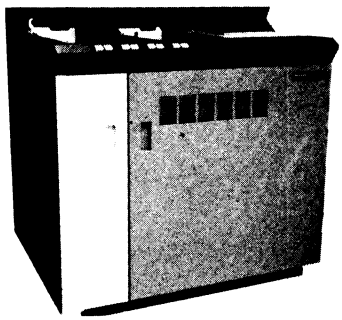


Figure 24. CRZ201 Card Reader Subsystem

Data Medium

80-column cards

51-column cards

Speeds and Capacity

900 cards per minute (80-column)

1200 cards per minute (51-column) (Optional)

Buffer capacity--one card column of data

Hopper capacity--2000 cards

Stacker capacity--2000 (normal)
1000 (auxiliary)

Data Formats

The CRZ201 subsystem can read data punched in either Hollerith or binary formats, or the two punch modes can be intermixed in a card deck. Cards can be stacked in either of two output stackers under program control.

The subsystem reads, sorts, and stacks decks of 12-row punched cards of either 80-column or optional 51-column cards. These two types of cards cannot be intermixed. The reader is easily converted from one type of reading to the other by the operator.

All cards must have a true leading edge between rows 0 and 1. Scored or perforated cards require that special attention be paid to this point.

Checking

The subsystem makes five types of checks during the card read time:

Light check--Ensures that when a card is not present, the read station transducer register indicates a light condition.

Dark check--Ensures that the transducer register indicates a dark condition when a card is in the read station.

Column strobe count check--Ensures that the correct number of column strobes were generated for a card.

Dual read check--Ensures that data read from each column at both read stations agrees.

Internal parity check--Ensures that correct parity is maintained through the card reader subsystem and is transmitted.

Operating Speeds

When the card reader is operating under correctly timed, continuous feeding conditions, it is capable of reading cards at approximately 1200 cards per minute for 51-column cards and 900 cards per minute for 80-column cards.

When the program calls for demand feeding, speeds vary according to the timing of the instructions.

Timing Considerations

The program must issue a Read instruction for each card read. In order to maintain the maximum possible feed/read rates, the processing system must issue a new Feed or Read instruction within 1 millisecond after receiving the preceding Terminate signal. When instructions are delayed, the reading rate drops proportionately.

To stack a card in the auxiliary output stacker, the subsystem must receive the Stack instruction for the card within 6 milliseconds of the respective Terminate signal. If the Stack instruction is delayed, the card goes to the normal output stacker and the late Stack instruction is rejected with the Instruction Rejected, No Card Committed, status.

Card feeding can be initiated by either a Feed instruction or a Read instruction. The card enters the read station approximately 9 milliseconds after feeding is initiated. When a card is fed in response to a Feed instruction, the card reader must receive a Read instruction within 9 milliseconds of the preceding Feed instruction. When the lead edge of the card enters the read station, reading and transfer of data commence.

Status Returns

			Status at Initiation			Status at Termination	
	Status	Substatus*	Read/Feed Instructions	Request Status	Reset Status	Read/Feed Instructions	Status Instructions
CHANNEL READY	0000	000000	*	*	*		
DEVICE BUSY	0001	000000	*	*	*		
ATTENTION	0010						
Hopper/Stacker Alert		xxxxx1	*	*	*	*	
Manual Halt		xxxx1x	*	*	*	*	
Last Batch		xxx1x1	*	*	*	*	
Feed Alert		0x1xxx	*	*	*	*	
Card Jam		x1xxxx	*	*	*	*	
Read Alert		1x0xxx		*	*	*	
Sneak Feed		1x1xxx	*	*	*	*	
DATA ALERT	0011						
Transfer Timing Alert		000001		*	*	*	
Validity Alert		000x10		*	*	*	
Dual Read Alert		0001x0		*	*	*	
No Read Command		001000		*	*	*	
INSTRUCTION REJECTED	0101						
Invalid Operation Code		000001	*				
No Card Committed		000010	*				
Late Read Command		000100	*				
LOAD OPERATION COMPLETE	0111	000000		*	*	*	
CHANNEL BUSY	1000	000000	*	*	*		
CHANNEL ABSENT #	1001	000000	*	*	*		
CHANNEL ALERT #	1010	000000		*	*	*	

* Symbol x = 0 or 1

Generated by I/O Channel of G-400 Series

Instructions

Operation Code (octal)	Instruction
00	Request Status
01	Read Card Binary
02	Read Card Alphanumeric
03	Read Card Mixed
40	Reset Status
44	Feed Card
45	Stack Card

When the Stack instruction is not given, cards are automatically stacked in the normal output stacker. When a Read instruction is not preceded by a Feed instruction, the Read instruction initiates card feeding. Thus, cards can be fed, read, and stacked in the normal output stacker using the applicable Read instruction as the only operational instruction.

NOTE: Programs written for the CRZ200 card reader can be executed with the CRZ201 card reader. However, all cards will be stacked in the normal stacker.

CRZ200 CARD READER

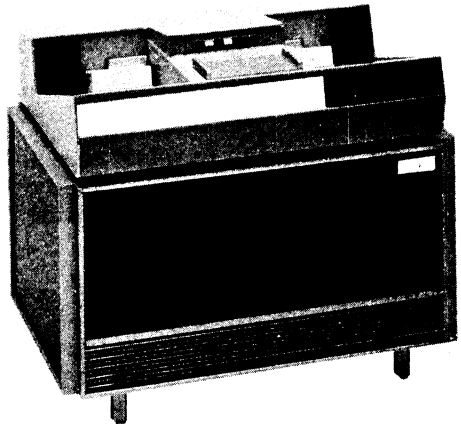


Figure 25. CRZ200 Card Reader Subsystem

Data Medium

Standard 80-column cards

Speeds and Capacities

900 cards per minute

Buffer capacity --one card column of data (6 bits in each of two buffers)

Hopper capacity --2000 cards

Stacker capacity --2000 cards

Data Formats

The CRZ200 subsystem can read data punched in either alphanumeric or binary formats, or the two punch modes can be intermixed in a card deck.

Checking

The following card reader conditions are checked:

Reader ready or busy.

Attention --hopper empty, stacker full, feed or read alert, jam, halt, or last batch.

Data Alert--full buffer, invalid punch configuration.

Instruction Rejected.

Reader absent or off line.

Operating Speeds

When the card reader is operating under correctly timed, continuous feeding conditions, it is capable of reading 80-column cards at approximately 900 cards per minute. When the program calls for demand feeding, speeds vary according to the timing of the instructions.

Timing Considerations

Since reading is done on a single-card-per-instruction basis, a new instruction must be given for each card. To achieve and maintain reading at the rate of 900 cards per minute (15 cards per second), a new read instruction must be given within one millisecond after the card reader generates a terminate signal for the previous card. If the card reader does not receive a new read instruction within this time, speed drops in proportion to the delay.

Although the average amount of time required to move a card from the input hopper through the read station is 67 milliseconds, this time may vary between 61 and 84 milliseconds without causing a feed alert.

Status Returns

			Status at Initiation			Status at Termination	
	Status	Substatus*	Read/Feed Instructions	Request Status	Reset Status	Read/Feed Instructions	Status Instructions
CHANNEL READY	0000	000000	*	*	*		
DEVICE BUSY	0001	000000	*	*	*		
ATTENTION	0010						
Hopper/Stacker Alert		xxxxx1	*	*	*	*	
Manual Halt		xxxx1x	*	*	*	*	
Last Batch		xxx1x1	*	*	*	*	
Feed Alert		0x1xxx	*	*	*	*	
Card Jam		x1xxxx	*	*	*	*	
Read Alert		1x0xxx		*	*	*	
Sneak Feed		1x1xxx	*	*	*	*	
DATA ALERT	0011						
Transfer Timing Alert		000001		*	*	*	
Validity Alert		000x10		*	*	*	
INSTRUCTION REJECTED	0101	000000					
LOAD OPERATION COMPLETE	0111	000000		*	*	*	
CHANNEL BUSY	1000	000000	*	*	*		
CHANNEL ABSENT #	1001	000000	*	*	*		
CHANNEL ALERT #	1010	000000		*	*	*	

* Symbol x = 0 or 1

Generated by I/O Channel of GE-400 Series

Instructions

Operation Code Octal	Instruction
00	Request Status
01	Read Card Binary
02	Read Card Alphanumeric
03	Read Card Mixed
40	Reset Status

CPZ100 CARD PUNCH

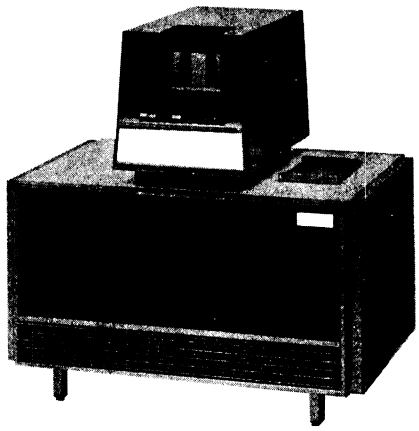


Figure 26. CPZ100 Card Punch Subsystem

Data Medium

Standard 80-column cards

Speeds and Capacities

100 cards per minute

Buffer capacity --80 bits (one row)

Hopper capacity --800 cards

Stacker capacity --800 cards

Data Formats

The CPZ100 card punch accepts and punches data into 80-column, 12-row cards in a variety of intermixed card stocks. Data is transmitted to it serially, character by character, and can be punched in alphanumeric, edited alphanumeric, or binary modes.

Subsystem States

A feature of this punch is its standby capability, designed for maximum operating efficiency. The punch goes from an operate, or normal, state to a standby state (motors off but power on) if not called upon to punch cards within 16 seconds. The punch returns automatically to the operate state as soon as another punch instruction is received.

The operate state exists whenever the subsystem is engaged in punching cards or when it is actively waiting for an instruction. In this state the punch can handle data in three different modes--binary, alphanumeric, or edited alphanumeric. The current mode is determined by the instruction received.

The punch reverts to the standby state whenever it does not receive a punch instruction within 16 seconds and there are no existing Attention conditions or Data Alerts. Whenever the specified amount of time has gone by without the punch receiving a punch instruction, the operating mechanism and the motors automatically halt; however, power does not go down. Lights on the operator's control panel indicate the change in the subsystem's state. While it is in the standby state, the punch reflects to the processing system its current status.

Whenever it receives an instruction, within 2 seconds the punch automatically leaves the standby state and goes into the operate state and the proper punching mode. Also, the operator can manually return the punch to the operate state by pressing switches on the subsystem's control panel.

Checking

Complete reliability of the punch is guaranteed by a read-after-punch feature. This reading station examines the parity of each punched row to determine if the correct number of holes has actually been punched.

The following punch conditions are also checked:

Punch ready or busy.

Attention--hopper empty, stacker full, feed alert, chad box missing or full, card jam, manual halt.

Data Alert--punch instruction or data not received in time, parity error, punch error.

Instruction rejected.

Punch absent or off line.

Timing Considerations

Approximately 600 milliseconds are required for the punching of each card except the first. On each card there is a data transfer time of 24.0 milliseconds for each row except the 12-row. Each row has a punching time of 14.4 milliseconds. Following this, there are 4.4 milliseconds available for brush reading the corresponding row of the preceding card. For each row except the 9-row, data transfer for the next row may begin during the 4.4 millisecond reading time; however, of the resulting total of 28.4 milliseconds, only the row punch instruction and the first data character may be received during the 4.4-millisecond reading time.

After the last row of the card (row 9) is punched and row 9 of the preceding card is read, there are 43 milliseconds in which a punch instruction may be received for row 12 of the next card if punching is to be maintained at the rate of 100 cards per minute. If the new instruction is received during this 43-millisecond interval, there are approximately 66 additional milliseconds available (instead of 24.4 ms) for the transfer of punch data for the first row. If a row punch instruction is not received during this period, there is a 7-card-per-minute reduction in the overall card punching rate. There will be an additional 7-card-per-minute reduction in speed for every additional 43 milliseconds of delay in receiving this first instruction.

Since the 43-millisecond interval can occur only between cards, this time factor does not apply to the first card.

Status Returns

	Status	Substatus	Status at Initiation			Status at Termination	
			Punch Instructions	Request Status	Reset Status	Punch Instructions	Status Instructions
CHANNEL READY	0000		*	*	*	*	
ATTENTION	0010						
Hopper/Stacker Alert		0xxxx1	*	*	*	*	
Manual Halt		0xxx1x	*	*	*	*	
Chad Box Full		0xx1xx	*	*	*	*	
Feed Failure		0x1xxx	*	*	*	*	
Card Jam		01xxxx	*	*	*	*	
DATA ALERT	0011						
Transfer Timing Alert		000xx1		*		*	
Transmission Parity Alert		000x1x		*		*	
Punch Alert		0001xx		*		*	
INSTRUCTION REJECTED	0101		*				
INTERMEDIATE	0110			*	*	*	
CHANNEL BUSY	1000		*	*	*		
CHANNEL ABSENT #	1001		*	*	*		

* = Possibility of Occurrence

x = 1 or 0

= GE-400 Series Only

Instructions

Operation Code Octal	Instruction
00	Request Status
11	Punch Card Row Binary
12	Punch Card Row Alphanumeric
13	Punch Card Row Edited Alphanumeric
40	Reset Status

CPZ200 CARD PUNCH

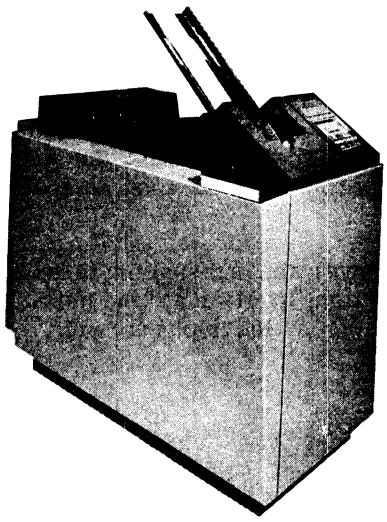


Figure 27. CPZ200 Card Punch Subsystem

Data Medium

Standard 80-column cards
(Prepunched or perforated cards are not acceptable)

Speeds and Capacities

300 cards per minute

Buffer capacity --entire card

Hopper capacity --3500 cards

Stacker capacity --3000 cards

Data Formats

Data is transmitted to the CPZ200 punch serially, character by character in three different card formats: binary, alphanumeric, or edited alphanumeric.

Subsystem States

A feature of this punch is its standby capability, designed for maximum operating efficiency. The punch goes from an operate, or normal, state to a standby state (motors off but power on) if not called upon to punch cards within a specified period of time. The time may lie within a range of 1/2-5 minutes as determined by the special needs of the user. The punch returns automatically to the operate state as soon as another punch instruction is received.

The operate state exists whenever the subsystem is engaged in punching cards or when it is actively waiting for an instruction. In this state the punch can handle data in three different modes--binary, alphanumeric, or edited alphanumeric. The current mode is determined by the instruction received.

The punch reverts to the standby state whenever it does not receive a punch instruction within a certain specified period of time and there are no existing Attention conditions or Data Alerts. This time interval may be set anywhere between 0 and 5 minutes, depending upon the needs of the user. Whenever the specified amount of time has gone by without the punch receiving a punch instruction, the operating mechanism and the motors automatically halt; however, power does not go down. Lights on the operator's control panel indicate the change in the subsystem's state. While it is in the standby state, the punch reflects to the processing system its current status.

Whenever it receives an instruction, within 10 seconds the punch automatically leaves the standby state and goes into the operate state and the proper punching mode. Also, the operator can manually return the punch to the operate state by pressing switches on the subsystem's control panel.

Checking

Reliability of the punch is guaranteed by a read-after-punch feature. This reading station examines the parity of each punched row to determine if the correct number of holes has actually been punched.

The following punch conditions are also checked:

Punch ready or busy.

Attention--hopper empty, stacker full, feed alert, card jam, manual halt, chad box missing or full, or empty prepunch station.

Data Alert--punch instruction or data not received in time, parity error, punch error.

Instruction rejected.

The processing system determines whether or not the punch is properly connected to it.

Timing Considerations

The CPZ200 punch may operate asynchronously or in synchronization with the processing system. When operating in synchronization, the subsystem receives a punch instruction and the associated data in time to punch a card during each feed cycle.

Each feed cycle is initiated by a feed signal from the controller and lasts for 200 milliseconds. During the first 170.4 milliseconds, a card is punched with data received during a previous feed cycle. When the card is punched, the Terminate signal indicates the end of the operation to the processing system. There remains an interval of 29.6 milliseconds between the Terminate signal and the next feed signal. To achieve and maintain the 300 cpm speed of which this punch is capable, the next punch instruction must be received during the first 9 milliseconds of this interval. All data associated with the next instruction must be received before the end of the 29-millisecond interval.

Synchronization with the processing system is established through the Terminate signal. Thus, a synchronized operation cannot start until after the first card is punched.

The punch operates asynchronously not only during punching of the first card, but whenever it is not punching cards at its maximum rate of 300 cards per minute. This occurs under the following conditions:

1. When both the punch instruction and the data are received during the first feed cycle, but not in time to allow card movement and punching to occur in response to the next feed signal

2. When the punch instruction is received during the first feed cycle, but all data is not received until the second feed cycle, and cards are not moved until the third feed cycle

3. When the punch instruction is received during the first feed cycle, but all the data is not received during the second feed cycle, nor during the third

The first two conditions are acceptable to the punch and it punches the data. However, the third condition is not acceptable and, when it occurs, operation terminates and the punch indicates to the processing system that a Data Alert (Transfer Timing Alert) has occurred.

Status Returns

	Status	Substatus	Status at Initiation			Status at Termination	
			Punch Instructions	Request Status	Reset Status	Punch Instructions	Status Instructions
CHANNEL READY	0000		*	*	*	*	
ATTENTION	0010						
Hopper/Stacker Alert		0xxxx1	*	*	*	*	
Manual Halt		0xxx1x	*	*	*	*	
Chad Box Full		0xx1xx	*	*	*	*	
Feed Failure		0x1xxx	*	*	*	*	
Card Jam		01xxxx	*	*	*	*	
DATA ALERT	0011						
Transfer Timing Alert		000xx1		*		*	
Transmission Parity Alert		000x1x		*		*	
Punch Alert		0001xx		*		*	
INSTRUCTION REJECTED	0101		*				
CHANNEL BUSY	1000		*	*	*		
CHANNEL ABSENT	1001		*	*	*		

* = Possibility of Occurrence

x = 1 or 0

= GE-400 Series Only

Instructions

Operation Code Octal	Instruction
00	Request Status
11	Punch Card Binary
12	Punch Card Alphanumeric
13	Punch Card Edited Alphanumeric
40	Reset Status

CPZ201 CARD PUNCH

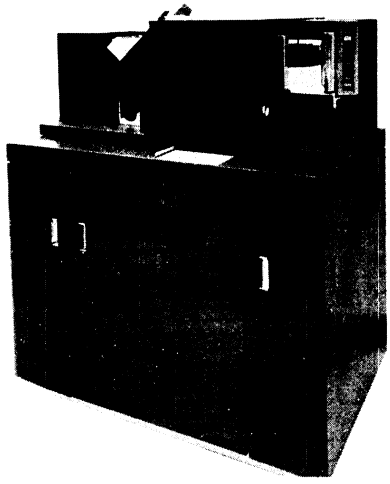


Figure 28. CPZ201 Card Punch Subsystem

Data Medium

Standard 80-column cards
(prepunched or perforated cards are not acceptable)

Speeds and Capacities

300 cards per minute

Buffer capacity --entire card

Hopper capacity --1200 cards

Stacker capacity --1200 cards

Reject pocket capacity--100 cards minimum

Data Formats

Data is transmitted to the CPZ201 punch serially, character by character, in three different card formats: binary, alphanumeric, or edited alphanumeric.

Subsystem States

Insofar as the operator is concerned, the CPZ201 subsystem operates on line with the computer. The punch is operated off line only by the service engineer for testing and maintenance. During on-line operations, the punch can be in either the operate state or the standby state.

In the operate, or normal, state the subsystem is engaged in punching cards or is actively waiting for a command. In this state the punch can handle data in any of the three punching modes described above. The current mode is determined by the instruction received.

The punch enters the standby state when it does not receive a punch instruction within a certain time and there are no existing Attention or Data Alert conditions. This interval may be set for anywhere between 12 seconds to 3 minutes and 42 seconds, depending on the user's needs. When the specified period expires, the motors halt; however, power is not cycled down. Lights on the operator's control panel indicate the change in the subsystem's state. The operator can manually return the punch to the operate state by pressing controls on the subsystem operator's control panel. The subsystem automatically reverts from standby to the operate state by receiving a punch instruction.

Checking

Reliability of the punch is guaranteed by a read-after-punch feature. This reading station examines the parity of each punched row to determine if the correct number of holes has actually been punched.

The following punch conditions are also checked:

Punch read or busy.

Attention --hopper empty, stacker full, feed alert, card jam, manual halt, chad box missing or full, or empty prepunch station.

Data Alert--punch instruction or data not received in time, parity error, punch error.

Instruction rejected.

The processing system determines whether or not the punch is properly connected to it.

Timing Considerations

The CPZ201 punch may operate asynchronously or in synchronization with the processing system. When operating in synchronization, the subsystem receives a punch instruction and the associated data in time to punch a card during each feed cycle.

Each feed cycle is initiated by a feed signal from the controller and lasts for 200 milliseconds. During the first 174 milliseconds, a card is punched with data received during a previous feed cycle. When the card is punched, the Terminate signal indicates the end of the operation to the processing system. There remains an interval of 26 milliseconds between the Terminate signal and the next feed signal. To achieve and maintain the 300 cpm speed of which this punch is capable, the next punch instruction must be received during the first 6 milliseconds of this interval. All data associated with the next instruction must be received before the end of the 26-millisecond interval.

Synchronization with the processing system is established through the Terminate signal. Thus, a synchronized operation cannot start until after the first card is punched.

The punch operates asynchronously not only during punching of the first card, but whenever it is not punching cards at its maximum rate of 300 cards per minute. This occurs under the following conditions:

1. When both the punch instruction and the data are received during the first feed cycle, but not in time to allow card movement and punching to occur in response to the next feed signal

2. When the punch instruction is received during the first feed cycle and all the data is received before the seventh feed signal, cards are moved on the next feed signal.

3. When the punch instruction is received during the first feed cycle, but all the data is not received before the seventh feed signal.

The first two conditions are acceptable to the punch and it punches the data. However, the third condition is not acceptable and, when it occurs, operation terminates and the punch indicates to the processing system that a Data Alert, Transfer Timing Alert, has occurred.

Status Returns

			Status at Initiation			Status at Termination	
	Status	Substatus	Punch Instructions	Request Status	Reset Status	Punch Instructions	Status Instructions
CHANNEL READY	0000		*	*	*	*	
ATTENTION	0010						
Hopper/Stacker Alert		0xxxx1	*	*	*	*	
Manual Halt		0xxx1x	*	*	*	*	
Chad Box Full		0xx1xx	*	*	*	*	
Feed Failure		0x1xxx	*	*	*	*	
Card Jam		01xxxx	*	*	*	*	
DATA ALERT	0011						
Transfer Timing Alert		000xx1		*		*	
Transmission Parity Alert		000x1x		*		*	
Punch Alert		0001xx		*		*	
INSTRUCTION REJECTED	0101		*				
CHANNEL BUSY	1000		*	*	*		
CHANNEL ABSENT	1001		*	*	*		

* = Possibility of Occurrence

x = 1 or 0

= GE-400 Series Only

Instructions

Operation Code Octal	Instruction
00	Request Status
11	Punch Card Binary
12	Punch Card Alphanumeric
13	Punch Card Edited Alphanumeric
40	Reset Status

APPENDIX B
CHARACTER SET

Character Set	Internal Machine Code	Octal Code	Hollerith Card Code	Character Set	Internal Machine Code	Octal Code	Hollerith Card Code
0	00 0000	00	0	↑	10 0000	40	11-0
1	00 0001	01	1	J	10 0001	41	11-1
2	00 0010	02	2	K	10 0010	42	11-2
3	00 0011	03	3	L	10 0011	43	11-3
4	00 0100	04	4	M	10 0100	44	11-4
5	00 0101	05	5	N	10 0101	45	11-5
6	00 0110	06	6	O	10 0110	46	11-6
7	00 0111	07	7	P	10 0111	47	11-7
8	00 1000	10	8	Q	10 1000	50	11-8
9	00 1001	11	9	R	10 1001	51	11-9
[	00 1010	12	2-8	-	10 1010	52	11
#	00 1011	13	3-8	$	10 1011	53	11-3-8
@	00 1100	14	4-8	*	10 1100	54	11-4-8
:	00 1101	15	5-8	)	10 1101	55	11-5-8
>	00 1110	16	6-8	;	10 1110	56	11-6-8
?	00 1111	17	7-8	'	10 1111	57	11-7-8
ß	01 0000	20	(blank)	+	11 0000	60	12-0
A	01 0001	21	12-1	/	11 0001	61	0-1
B	01 0010	22	12-2	S	11 0010	62	0-2
C	01 0011	23	12-3	T	11 0011	63	0-3
D	01 0100	24	12-4	U	11 0100	64	0-4
E	01 0101	25	12-5	V	11 0101	65	0-5
F	01 0110	26	12-6	W	11 0110	66	0-6
G	01 0111	27	12-7	X	11 0111	67	0-7
H	01 1000	30	12-8	Y	11 1000	70	0-8
I	01 1001	31	12-9	Z	11 1001	71	0-9
&	01 1010	32	12	←	11 1010	72	0-2-8
.	01 1011	33	12-3-8	,	11 1011	73	0-3-8
]	01 1100	34	12-4-8	%	11 1100	74	0-4-8
(	01 1101	35	12-5-8	=	11 1101	75	0-5-8
<	01 1110	36	12-6-8	"	11 1110	76	0-6-8
\	01 1111	37	12-7-8	!	11 1111	77	0-7-8

GLOSSARY

ALPHABETIC CODE	A code the character set of which contains letters only.
ALPHANUMERIC CODE	A code the character set of which contains both letters and digits.
ASYNCHRONOUS WORKING	The performance of a sequence of operations such that each operation starts its successor as soon as practicable.
BUFFER	A set of locations used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transmitting data from one device to another, and possibly also to retain temporarily a copy of the data as a safeguard against faults.
CARD FEED	The mechanism which causes punched cards to be transferred from the hopper to the card track.
CARD PUNCH	A machine which punches holes in a punched card.
CARD READER	A machine which reads the holes in a punched card.
CARD TRACK	That part of a machine which moves and guides the punched card during its passage through the machine.
CHANNEL	A path or aggregate of related paths for carrying signals between a source and a destination.
CONTROL CHARACTER	A character that, in a particular context, may be interspersed with characters representing data in order to cause an operation controlling the recording, processing or interpretation of the data. For example, a carriage return character on a paper tape controlling a teleprinter, an ignore character, a transmission control character.
CONTROL RELATIONSHIP	A relationship between any two units of equipment which indicates the nature of the control of either unit by the other. If one unit can be controlled by the other without human intervention, the first unit is said to be ON-LINE to the second, and is under the DIRECT CONTROL of the second while such control is being exercised. If human intervention is necessary, the first unit is said to be OFF-LINE

	to the second and is under the INDIRECT CONTROL of the second while an operator is acting as a link in the control chain.
CORE STORE	A store using an array of storage cores as magnetic cells.
DEMAND PROCESSING	The processing of data substantially as soon as it becomes available, thus avoiding the need for storage of any appreciable quantity of unprocessed data.
ERROR	The quantitative discrepancy by which a calculated or measured result differs from the correct value, or a variable which takes the values of such discrepancies.
HOPPER	That part of a machine where the punched cards are placed immediately prior to being fed into the machine.
IGNORE CHARACTER	A control character used to indicate that errors in data preparation or transmission have been detected, and a certain predetermined amount of the most recently occurring data should be ignored.
INTERRUPT	A signal, condition or device that causes an interruption.
INTERRUPTION	A suspension of the operation of a sequence of instructions followed by starting another sequence or reverting to the one suspended, as for example in priority processing.
JOGGLE (TO)	To agitate a deck of punched cards by hand to bring them into alignment before placing in the hopper.
MEDIUM	The material in (or on) which a specific physical variable may represent data, also the physical quantity which may be varied. Any agency or means for representing data.
MISFEED	The failure of a punched card to pass through a machine in the manner specified. This may result in holes being incorrectly sensed or punched or in damage to cards.
NUMERIC CODE	A code the character set of which contains digits only.
OPERATION CODE	A code used to represent the elementary operations of a computer.
OVERFLOW	In an arithmetical operation, the generation of a result which is too large for the range of number representation.

PROGRAM	In automatic data processing, a general term for a specification of a process to be performed on data, e.g. an ordered collection of instructions and other data associated with the instructions.
PUNCHING STATION	That part of a card track where a punched card is punched.
READING STATION	That part of a card track where the data on a punched card is read.
SIGNAL	The useful part of what is transmitted from a source to destinations in order to convey data. It can be initiated and controlled at the source and recognized at a destination.
STACKER	A part of a machine where punched cards are deposited after passing through the machine.
STORAGE	The retention of data for subsequent reference.
STORE	A device intended for storage. The properties of a store depend upon the purposes for which it is intended; thus a store forming part of an automatic data processing equipment (an INHERENT STORE, computer store or automatic store) may be controlled automatically, i.e. without human intervention. If the storage medium is a data carrier (as in a DATA CARRIER STORE), some action by an operator is needed (e.g. selection and loading) before automatic control becomes possible.
SYNCHRONOUS WORKING	The performance of a sequence of operations controlled by regularly spaced clock signals. Note: A sequence of operations controlled synchronously may form one of a sequence of larger operations working asynchronously.

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