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## **Systems Reference Library**

### **IBM 1402 Card Read-Punch**

This publication covers the IBM 1402 Models 1, 2, 3, 4, 5, and 6. Included are descriptions of major mechanical units, their functions and operating controls, and special features that can be installed to expand the capabilities of the basic machine.

Additional publications concerning 1402 operation with various IBM data processing systems are listed in the SRL bibliography for the specific system. The bibliography lists all technical reference literature and related materials necessary for planning, programming, installing, and operating the data processing system in any configuration.

### Third Edition

This is a major revision of, and obsoletes, A24-3072-1. Changes have been made throughout to delete references to Model N1 and to include information about Model 6.

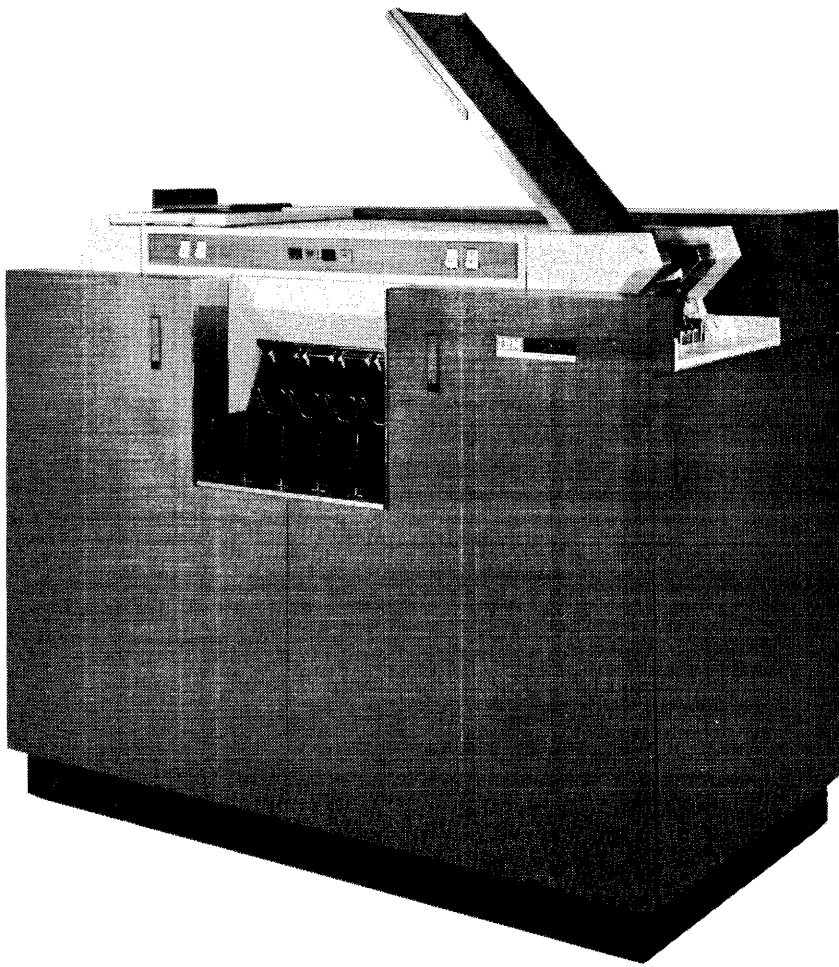
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IBM 1402 Card Read-Punch

## INTRODUCTION

The IBM 1402 Card Read-Punch provides punched-card input and output for several of the IBM data processing systems. It is available in six models. Model 1 is used with Models A, B, C, E, and F of an IBM 1401 Data Processing System; Model 2 is used with the IBM 1410, 7010, 7040, and 7044 Data Processing Systems; Model 3 is used with the IBM 1460 Data Processing System; Models 4 and 5 are used with the IBM 1401 Model G Data Processing System; and Model 6 is used with the IBM 1401 Model H Data Processing System.

Each model of the 1402 has a read feed, a punch feed, and five card stackers. The stackers are so controlled that three stackers can serve each feed.

## MAJOR UNITS OF THE 1402

### Read Feed

The read feed on Models 1, 2, and 3 can read 800 cards a minute; the read feed on Models 4, 5, and 6 can read 450 cards a minute. The actual reading speed during an application depends upon the processing time required for each card.

The read feed is at the right end of the 1402 (Figure 1). On Models 1, 2, 3, 4, and 6, a file feed tray permits the loading of approximately 3,000 cards at one time. Small groups of cards (200 or fewer) can be placed directly into the read hopper by lowering the joggler gate, carefully aligning the cards and card weight in feeding position, then raising the joggler gate to allow card feeding or runout. Model 5, which does not have the file feed tray and joggler gate, has a read hopper capacity of approximately 1,200 cards. In all other respects, Model 5 is identical to Model 4.

A card is read in three machine cycles. On the first cycle, the card moves from the read hopper to the read check station. During the second cycle, the card passes through the read check station, where a hole count is established, and stops at the read station. On the third cycle, the card moves through the read station, the hole count is proved, and data read from the card enters the processing unit's core storage or, in Model 2, the read buffer. In all models except 2, the card continues past the read station to the normal read (NR) stacker unless program-directed to stacker 1 or stacker 2 within 10 milliseconds after the read command. Model 2 has a separate prestacker station where the card just read can await stacker selection without a time limit (Figure 2).

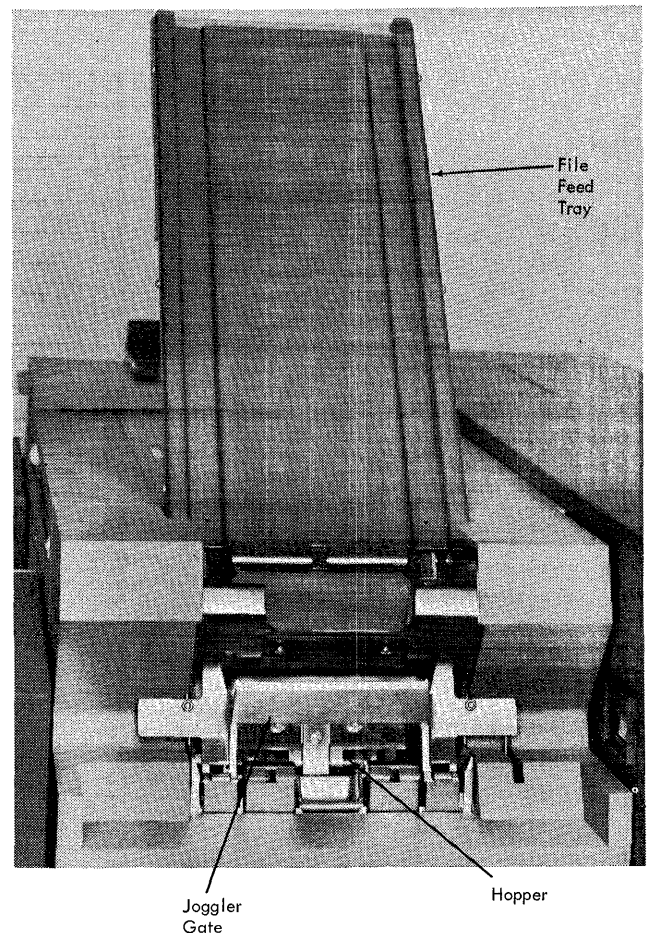


Figure 1. Read Hopper, Models 1, 2, 3, 4, and 6

The read feed on Model 3 is equipped with an idle control timer that turns off the read feed drive motor whenever 30 seconds elapse without a read command. The motor restarts automatically when the next read instruction is issued.

### Punch Feed

All models of the 1402 have a maximum punching speed of 250 cards a minute. The actual number of card processed depends on the processing time required between punch commands. The punch hopper, at the left end of the 1402, has a capacity of approximately 1,200 cards.

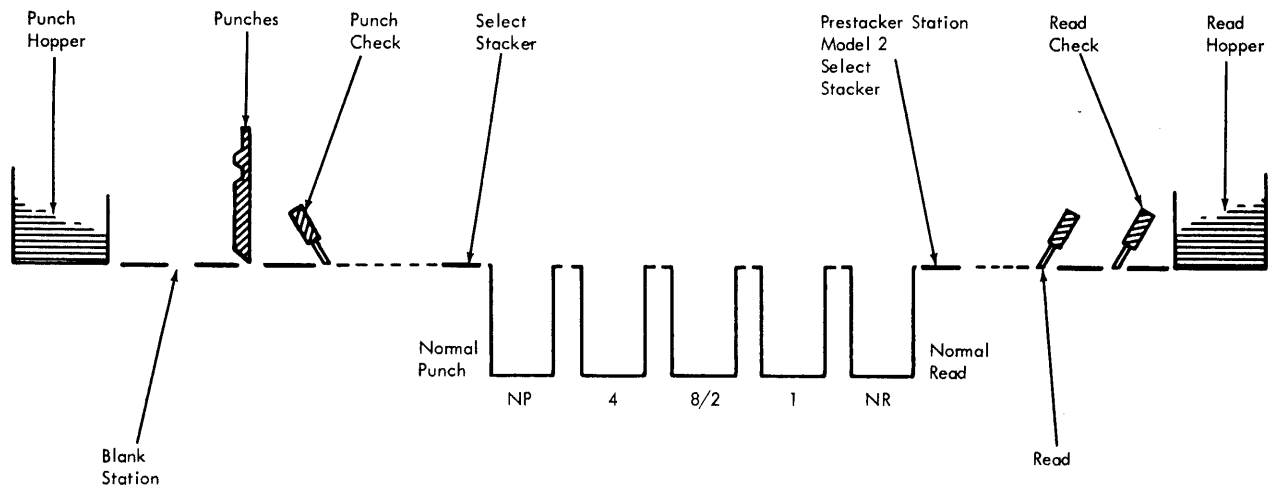


Figure 2. Card Feed Schematic

A punch operation requires four machine cycles. The card moves from the punch hopper to a blank station on the first cycle. This blank station is reserved for the reading brushes associated with the Punch Feed Read special feature when that feature is installed on the 1402. During the second punch cycle, the card passes through the blank station and stops at the punching station. The card is punched during the third cycle; a hole count is established, and the card stops at the punch check station. On the fourth punch cycle, the card moves through the punch check station, where the hole count is proved, then passes into the normal punch (NP) stacker, unless program directed into another stacker (see Figure 2).

Models 3, 4, 5, and 6 are equipped with a punch idle control timer that turns off the punch motor whenever 30 seconds elapse without a punch command. The punch motor restarts automatically when the next punch instruction is issued.

### Stackers

The IBM 1402 has five radial stackers (Figure 3), each with a capacity of approximately 1000 cards. Should a stacker become full, the 1402 stops and a stacker light signals the operator. Cards can be removed from a stacker without interrupting the operation.

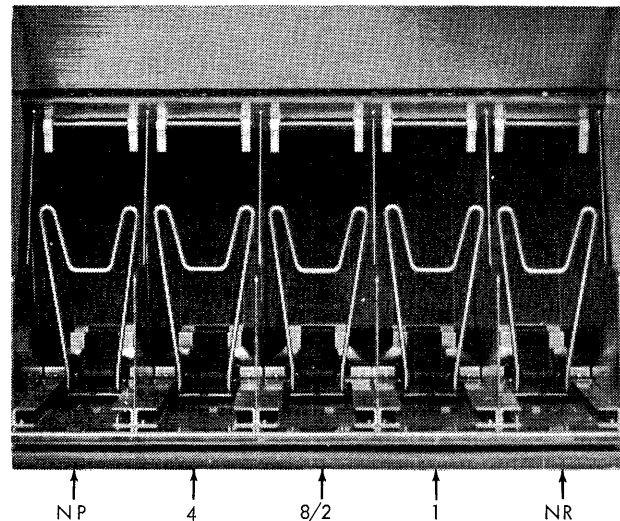


Figure 3. Radial Stackers

Cards from the read feed normally go into the NR stacker, but can be directed to stacker 1 or stacker 2 by the program. Cards from the punch feed can be rerouted from the NP stacker into stacker 4 or stacker 8 under program control.

When programming a 1402, note that cards from both feeds can be selected to the common 8/2 stacker, but machine timing considerations make merging operations impractical on a standard 1402.

## Models 1, 3, 4, 5, and 6

The keys, lights, and switches on Models 1, 3, 4, 5, and 6 are alike (Figure 4). Several of the controls are common to the entire 1402; others are specifically for the reader or punch portions.

### Common Controls

**Start Key\*** is used to initiate machine operation after a manual, programmed, or automatic stop.

**Stop Key\*** is used to stop the system. If a program step is in process, it is completed before operation stops.

**Check Reset Key** must be pressed to reset any punch or read error indication (punch check, reader check, punch stop, reader stop, transport error, or validity error), so that the start key will be effective for resuming operation. The check reset key is effective only when the feed unit in which the error occurred is cleared of cards.

**Power Light** is on when power is supplied to the machine.

**Fuse Light** indicates that something in the 1402 circuitry caused a signal fuse to burn out. A customer engineer should be notified.

**Transport Light** indicates a card jam in the transport area. After the card jam is cleared, the light turns off. Any cards beyond the read brushes in the read feed (or the punch check brushes in the punch feed) have been read (or punched) and checked.

\* Interchangeable with the same key on a system console or on an IBM 1403 Printer.

**Stacker Light** signals that a stacker is full. When enough cards are removed to allow the stacker slide to return beyond the stacker trip device, the stacker light turns off. Operations can be resumed by pressing the start key.

### Reader Controls

**Load Key** is used to start the loading of program instruction cards in the read feed. Pressing the load key operates the read feed until a card has passed the read station. The read-in area (positions 1-80 of storage) is automatically cleared, and a word mark is set in address 001.

After the first card is read at the read station, the program begins by executing the instruction punched in the first columns of the card. Continued operation, including further feeding and reading of program cards, is under program control and does not require operator intervention.

When the punch on/off switch is on, operating the load key also starts the punch.

**Nonprocess Runout Key (NPRO)** is used to clear cards from the read feed. The key is operable only when the read hopper and file feed tray are empty (or manually prevented from feeding cards), and the jogger gate is closed. In normal circumstances the last two cards that enter the NR stacker have not been read.

**Note:** The NPRO key should be operated before loading cards into the read feed for the first time after power has been turned on.

**Reader Stop Light** signals a card-feed failure, a card jam, or a clutch failure. It also comes on if the NPRO key has been pressed. The stop light can be turned off by pressing the 1402 check reset key after the condition causing the stop has been corrected.

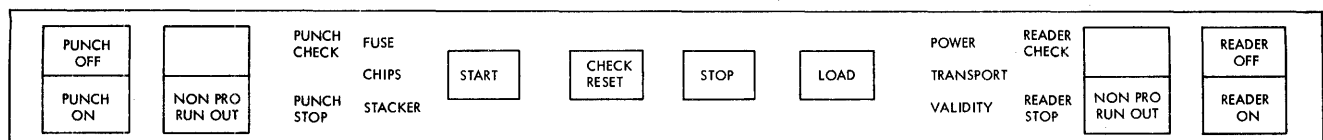


Figure 4. Operator Controls, Models 1, 3, 4, 5, and 6

Reader Check Light turns on if (1) a hole-count error is corrected during card reading or (2) the read release time is exceeded without the issuance of a read command.\* This light can be turned off by performing an NPRO operation, then pressing the 1402 check reset key. When operation stops and the reader check light is on, the last card in the NR stacker has not been processed and must be re-entered after the error is corrected.

Validity Light turns on if an invalid character is detected during a read operation. The system stops at the end of the read. The validity light can be turned off by pressing the 1402 check reset key. If the invalid punching in the card also causes a parity error, the process and storage lights on the system console also turn on.

When the validity light is the only 1402 light on when the stop occurs, the last card in the NR stacker has not been processed and must be re-entered after the error has been corrected. If the I/O check stop switch on the system console is off and a validity error is detected during a read operation, the validity light turns on but the operation does not stop. A reader error indicator is available for program testing and reset with the I/O check stop switch off.

Note: When the Punch Feed Read special feature is installed, the validity light can also indicate invalid punching.

Reader On/Off Switch controls the read feed of the 1402. When the switch is off, the read feed is inoperable.

#### Punch Controls

Nonprocess Runout Key (NPRO) is used to clear the punch feed of cards when the hopper is empty. Of the last three cards in the NP stacker after a normal nonprocess runout, the first has not been checked and the last two have not been punched. The NPRO key should be operated before loading cards into the punch feed for the first time after power has been turned on.

\* This is a programming problem. After a program using the Read Punch Release special feature has been completely checked, this condition should not occur.

Punch Stop Light signals a card-feed failure, a card jam, or a clutch failure; it also comes on if the NPRO key has been pressed. The light can be turned off by pressing the 1402 check reset key after the condition causing the stop has been corrected.

Punch Check Light turns on if (1) a hole-count error is detected in the punch feed, (2) either the A-register or the B-register detects a parity error during a punch operation, or (3) punch release time is overextended.\* The punch check light can be turned off by performing an NPRO operation, then pressing the 1402 check reset key.

Chips Light turns on and the 1402 stops when the chip box is full or improperly positioned. The light turns off after the condition is corrected. Operation can be resumed by pressing the start key.

Punch On/Off Switch controls the punch feed. When the switch is off, the punch is inoperable; when on, and all the interlock circuits in the punch are satisfied, the machine operates.

#### Model 2

Figure 5 shows the operating keys and lights for the 1402 Model 2.

#### Common Controls

Stacker Light indicates a full stacker. The reader unit and the punch unit both stop when a stacker becomes full.

Fuse Light indicates a blown fuse in the reader or punch unit. A customer engineer should be notified of the occurrence.

Power Light indicates that power is being supplied to the 1402.

Transport Light indicates a card jam in the stacker area. All card feeding in the 1402 stops until the jam is removed.

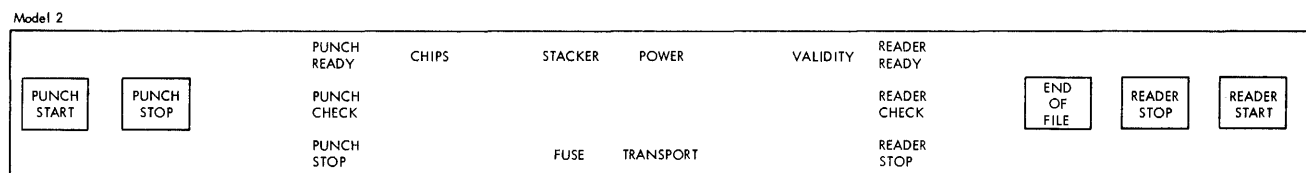


Figure 5. Operator Controls, Model 2



## Reader Controls

Reader Start Key (initial operation) feeds three cards into the read feed, fills the reader buffer with the contents of the first card, and turns on the reader-ready light. During an operation, pressing the start key after a reader stop condition turns on the reader-ready light, and allows cards to continue feeding under program control. Whenever cards are removed from the read feed hopper and the end-of-file key is not operated, pressing the start key moves the remaining two or three cards to the stacker area. This runout operation requires that the jogger gate be closed.

Reader Stop Key stops the reader and turns off the reader-ready light.

End-of-File Key causes the end-of-file latch in the channel to be turned on after data transfer from the last card. The next read instruction is interpreted as a NO-OP and reports the end-of-file condition to the channel. This key is back-lighted.

Whenever the end-of-file key is pressed, the card reader operates in one of these ways:

1. With four or more cards in the read hopper, all cards are processed and run into a stacker. Operating the stop key or processing the last card causes the end-of-file condition to be reset.
2. With three cards remaining in the feed, a card-read or card-feed instruction before operation of the end-of-file key causes the program to set the not-ready I/O channel status indicator. Pressing the end-of-file key and then the start key allows the last three cards to be processed and run into a stacker. Operating the stop key or processing the last card causes the end-of-file condition to be reset.
3. With one, two, or three cards in the read hopper, pressing the end-of-file key and then the start key feeds the card or cards, and turns on the reader-ready light after the first card passes the second read station. The card or cards are processed and run into a stacker. Operating the stop key or processing the last card causes the end-of-file condition to be reset.

Reader Ready Light indicates that the reader is either operating or ready to operate under program control.

Validity Light shows that an invalid character has been detected during a feed operation. The light remains on until the next feed instruction is started. During the read instruction, the invalid character is transferred to storage along with valid data.

Reader Stop Light indicates a feed failure or card jam during a feed operation. When this occurs, the reader stops and the reader-ready light turns off.

Reader Check Light indicates the detection of a hole-count error, parity error, or buffer timing error during a data transfer operation. The light remains on until the next feed instruction is started. During the read instruction, the data is transferred from buffer to storage, and the processing unit turns on a channel indicator for the program to test.

## Punch Controls

Punch Start Key is used to feed two cards into the punch feed and turn on the punch-ready light. After a punch stop condition, pressing the start key turns on the punch-ready light, and allows punching to resume under program control. When the cards have been removed from the punch feed hopper, pressing the start key moves the three cards remaining in the punch feed to the NP stacker. The first card that enters the NP stacker is unchecked; the other two are unpunched.

Punch Stop Key is used to stop the punch. It turns off the punch-ready and end-of-file lights.

Punch Ready Light indicates that the punch is either operating or ready to operate under program control.

Punch Stop Light indicates a feed failure or card jam during a punch operation. When this occurs, the punch stops and the punch-ready light turns off.

Punch Check Light indicates the detection of a hole-count error, parity error, or buffer timing error during a punch operation.

Chips Light shows that the chip box is full or not in place. The light goes off when the condition is corrected. To resume operation, the reader start key must be pressed.

## Restart Procedures

The restart procedures in this publication apply mainly to Models 1, 3, 4, 5, and 6. These models usually require operator attention when error conditions arise. Procedures for restarting Model 2 are explained in the SRL publications for the appropriate system. This model requires a minimum of operator attention, because most error correction routines can be programmed.

## Reader Errors

Errors detected in the read feed cause the reader stop, reader check, or validity lights to come on, either singly or in combination.

### Reader Check Light On

1. Remove cards from the read feed hopper.
2. While lifting cards in the file feed to prevent them from feeding into the lower magazine, run the two cards out of the read feed by use of the NPRO key.
3. Press CHECK RESET on the 1402.
4. Remove the last three cards from the NR stacker. Check and, if necessary, correct the first card. If a hole-count error has occurred, use a storage scan operation to determine the position in error.
5. Place the three cards removed in step 4, then the cards removed from step 1 into the read feed hopper.
6. Press START.

### Reader Stop Light On

When operation stops because of either a card feed failure or a card jam, and only the reader stop light is on, cards in the stackers and beyond the reading brushes in the read feed have been processed. If the reader stop light is on and neither a feed failure nor jam exists, a clutch failure has probably occurred. The last card in the NR stacker and any other cards past the reading brushes in the read feed may not have been processed.

1. Remove cards from the read hopper.
2. Remove any jammed cards from the read feed (refer to "Card Jam Removal" in this publication).
3. While lifting cards in the file feed to prevent them from feeding into the lower magazine, run any undamaged cards out of the read feed by use of the NPRO key.
4. Press CHECK RESET on the 1402.
5. Duplicate any damaged cards.
6. Place in the read hopper any cards that were in the read feed between the read check and read stations, and replace the cards removed from the hopper in step 1.
7. Press START.

### Validity Light On

When this light is on and a feed cycle has occurred in the read feed, the last card in the NR stacker contains invalid character. This card has not been processed. To correct and refeed the error card, follow the same procedure as described for "Reader Check Light" (except for the storage scan operation mentioned in step 4).

## Reader Stop/Reader Check/Validity Lights On

Whenever the reader check or validity light comes on with the reader stop light, the last card in the NR stacker caused the error and must be refed. However, if the cause of these lights is a card jam between the read station and the stacker, the cards must be examined to determine which card was the last card correctly processed; all cards following that card must be refed.

1. Remove cards from the read hopper.
2. Remove any jammed cards from the read feed.
3. While lifting cards in the file feed to prevent them from feeding into the lower magazine, run any undamaged cards out of the read feed by use of the NPRO key.
4. Press CHECK RESET on the 1402.
5. Duplicate any damaged cards.
6. Replace cards in the read hopper in this order.
  - a. The last card stacked in the NR pocket.
  - b. The cards removed or run out from the read feed, in their original order.
  - c. The cards removed from the hopper.
7. Press START.

## Punch Errors (1402 Models 1, 3, 4, 5, and 6 Without Punch Feed Read Special Feature)

### Punch Check Light On

1. Remove cards from the punch feed hopper.
2. Run out the three cards in the punch feed.
3. Press CHECK RESET on the 1402.
4. Remove the last four cards from the NP stacker.
5. Visually check the first of these four cards (discard the other three), and correct, if necessary. If the B-light on the system console is on (indicating a B-register parity error), perform a storage scan operation, starting at position 101, to determine and correct the position (101-180) that contains the parity error. Note the I-address for restarting after the scan.
6. Replace the cards removed from the punch feed hopper in step 1.
7. To resume operation, enter the address of punch operation code, set the mode switch to RUN, and press START. The last punch cycle repeats and information in the punch storage area is repunched.

### Punch Stop Light On

1. Remove cards from the punch feed hopper.
2. Remove any jammed cards from the punch feed and run out any undamaged cards.
3. Press CHECK RESET on the 1402.
4. Discard the last card punched, because the data will be repunched.
5. Duplicate any damaged cards.

6. Replace the cards removed from the punch feed hopper in step 1.
7. Press START.

#### Punch Stop and Punch Check Lights On

If any other light is on with the punch stop light, visually check the last card in the NP stacker and correct it if necessary. In the case of a card jam between the punch check station and the stacker, check the last card read by the punch check brushes and correct, if necessary. To resume operation, after clearing any card jams, follow the same procedure as described for "Punch Check Light On."

#### Punch Errors (1402 Models 1, 3, 4, 5, and 6 With Punch Feed Read Special Feature)

##### Punch Check Light On

1. Remove cards from the punch feed hopper.
2. Run out the three cards in the punch feed.
3. Press CHECK RESET on the 1402.
4. Remove the last four cards from the NP stacker.
5. Duplicate into new cards, the prepunched data from the first two cards. If the B-light on the system console is on (indicating a B-register parity error), perform a storage scan operation (starting at position 101) to determine and correct the position (101-180) that contains the parity error. Note the I-address for re-starting after the scan.
6. Place the two duplicated cards and the third and fourth cards in the punch feed hopper. Replace the cards removed from the hopper in step 1.
7. Press START RESET on the system console.
8. Enter a restart address to start processing at the program instruction that had previously caused the first card to be read by the punch feed read brushes. (Reconstruct internal data, if necessary.)
9. Set the mode switch to RUN and press START to resume operation.

##### Punch Stop Light On

When only the punch stop light is on and a punch-feed-read operation has occurred, all cards in the punch feed between the hopper and the punch check station should be reprocessed. Cards beyond the punch check station and in the stackers have been punched and checked. A card between the punch and the punch check stations has not been checked; operation should be restarted so that this card is repunched.

Note: If neither a feed failure nor a card jam caused the punch stop light to turn on, the stop may have been due

to a clutch failure. The last card in the NP stacker should be checked.

1. Remove cards from the punch feed hopper.
2. Remove any jammed cards from the punch feed, and run out any undamaged cards.
3. Press CHECK RESET on the 1402.
4. Duplicate, into a new card(s), the prepunched data in the card (or cards, in the case of a card jam) that was between the punch and punch check stations when operation stopped. This card was punched but not checked and must be reprocessed.
5. Place the duplicated card(s), and all other cards removed from the punch feed (between the hopper and the punch station), into the punch feed hopper in their original sequence.
6. Replace the cards removed from the hopper in step 1.
7. Press START RESET on the system console.
8. Enter a restart address to start processing at the program instruction that had previously caused the first card (duplicated in step 4) to be read by the punch feed read brushes. (Reconstruct internal data, if necessary.)
9. Set the mode switch to RUN and press START to resume operation.

##### Validity Light On

When only the validity light is on and a punch-feed-read operation has occurred in the punch feed, the card just read at the punch feed read station contains an invalid character.

1. Remove cards from the punch hopper.
2. Run out the three cards in the punch feed.
3. Press CHECK RESET on the 1402.
4. Remove the last three cards from the NP stacker.
5. Visually check the first of these three cards. (This card had been punched but not checked when the error occurred.) Correct this card, if necessary, then replace it in the stacker.
6. Correct the validity error in the second card (the error card).
7. Place the second and third cards in the punch hopper, and replace the cards removed from the hopper in step 1.
8. Press START RESET on the system console.
9. Enter a restart address that will start processing at the second card to be read by the punch feed read brushes.
10. Set the mode switch to RUN and press START to resume operation.

##### Validity and Punch Check Lights On

If the validity and punch check lights are both on, two or more error conditions have been detected in the punch feed. Follow the same restart procedure as described for

“Punch Check Light On.” Correct the invalid character in the card just read by the punch feed read brushes (third card removed from the NP stacker in step 4).

#### Punch Stop/Punch Check/Validity Lights On

If any other light is on with the punch stop light, and a punch-feed-read operation has occurred, two or more error conditions have been detected in the punch feed. To resume operation, after clearing any card jams, follow the same procedure as described for “Punch Check Light On.”

**Note:** If cards have jammed between the punch check station and the stacker, the last card read by the punch check brushes should be the first card reprocessed. Duplicate the prepunched data from this card into a new card. Also duplicate into new cards the prepunched data in all other cards that have passed the punch station. Place the duplicated cards and the other cards removed from the punch feed into the punch feed hopper in their original sequence.

#### CARD JAM REMOVAL

Most card jams in the IBM 1402 are caused by rubber bands, staples, and paper clips run in with the cards; cards with bent corners or frayed edges; missing card weights; and improperly-positioned brushes.

By following certain guides in the removal of card jams, injury to the operator and damage to the machine can be avoided. However, because of the varying circumstances involved in removing card jams, step-by-step procedures cannot be given.

#### Transport Area

When confronted with a jam in the transport area, first turn off the power to the 1402 reader and punch units, then raise the file feed tray and open the top covers of the 1402 (Figure 6). The jammed cards should be removed as nearly intact as possible, to facilitate their replacement. A hand feed wheel, inside the front cover of the 1402, allows the operator to slowly advance the read feed and transport (Figure 7).

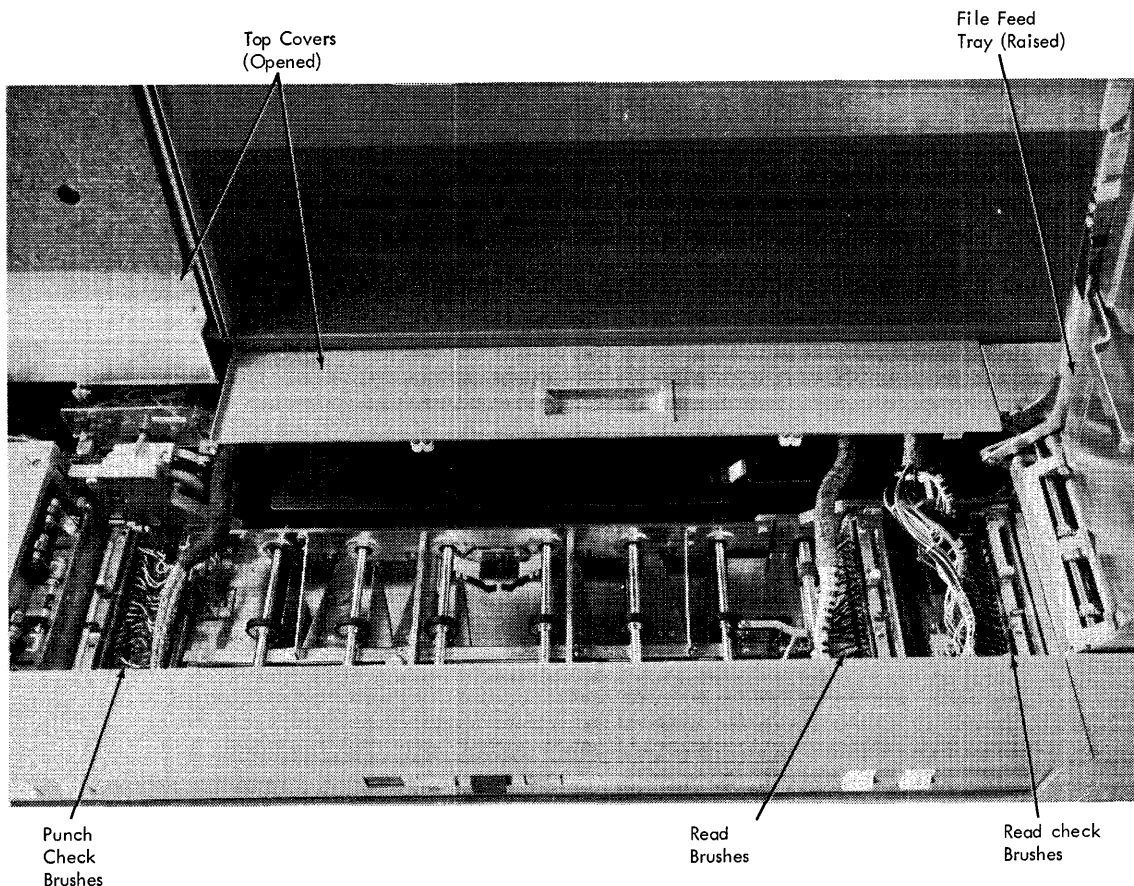


Figure 6. Access to Transport Area

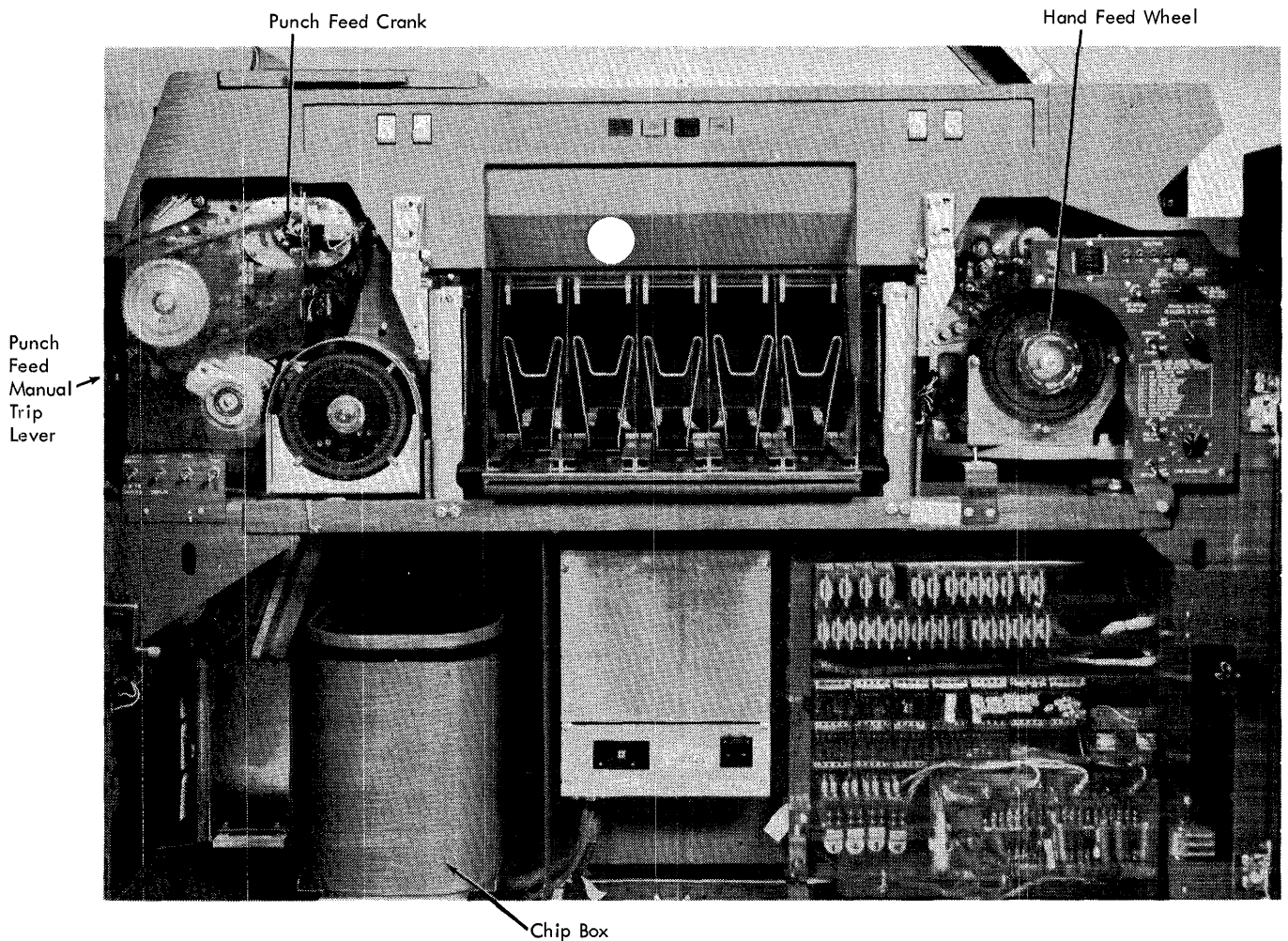


Figure 7. Front View (Covers Open)

**Note:** Should it be necessary to remove the read check, read, punch check, or punch feed reading brushes, care should be taken to avoid contact between the reading surface of the brushes and any other part of the 1402. Such contact may damage the individual brushes or, with the main system power still on, blow a fuse. Replacement of the brushes requires equal care. The hand feed wheel should be rotated as the read feed brushes are reinserted.

After removing the jam, make sure that all latching pins are snapped into place before running cards out, entering new cards, and resuming operation. Repetitive reader or punch check conditions, immediately after a brush block has been replaced and operation restarted, may indicate damaged or short-circuited brushes.

#### Punch Feed

If a jam should occur in the punch feed, first turn off power to the 1402 reader and punch units, then open the top

covers of the 1402, and try to remove the jam from the top. If this is not possible, trip the manual clutch lever behind the front cover, crank the feed to a setting between 335° and 350°, and remove the punch die (Figure 8).

#### Punch Die Removal

The punch die can be either of two types: side-locking or top-locking. The side-locking die is characterized by a pair of handles on the underside of the die assembly; the top-locking die has one handle, shaped like an inverted T.

Before the punch die can be removed, the plastic chip funnel under the die must be taken out and, on machines with a lowering frame, the lowering-frame knob must be rotated. To remove the side-locking die, grasp the two handles in one hand and squeeze them together. This releases the die from its attachment to the punch frame. With the die removed, reach into the space vacated by the die assembly and remove any cards that have jammed there. The top-locking die is removed in the same manner, only

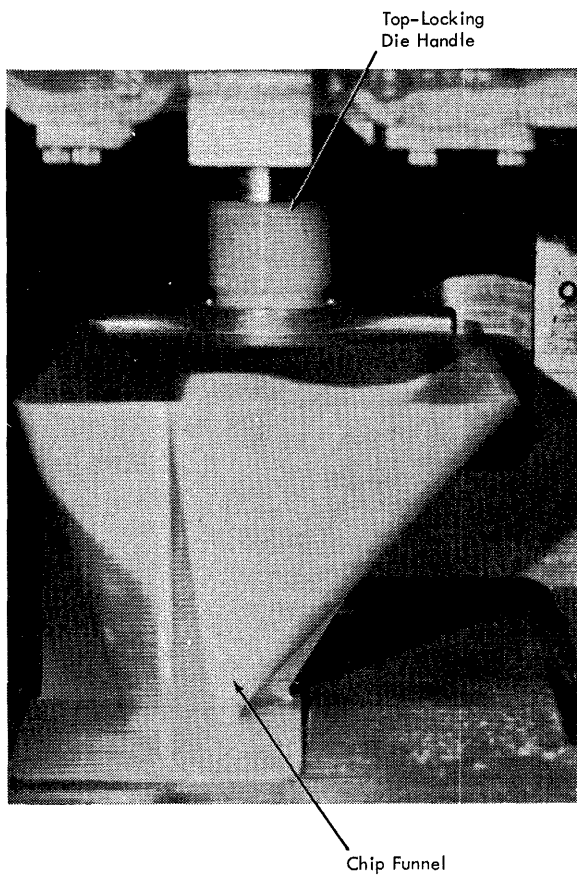


Figure 8. Punch Die (Top-Locking)

the handle (inverted T) is turned instead of squeezed. (The ejection trigger can be used to free the top-locking die after the handle has been loosened.)

#### Punch Die Replacement

When all cards and card fragments have been removed from the punch feed, the die can be replaced. The side-locking die requires squeezing the handles together, pushing the die into place, then spreading the handles apart until the die snaps into place. If the die is not properly seated, the machine will not run. The top-locking die is reinstalled by pushing it into place, then tightening the handle. Caution should be used when testing the replacement of the die. Carefully pull down on the handle; if the die is properly seated, it will not come out when the handle is pulled. After replacing the die, raise the lowering frame.

Note: Make sure all covers are closed. Interlock switches prevent machine operation when any cover is open.

### 51-Column Interchangeable Read Feed

The 51-Column Interchangeable Read Feed (including file feed) permits feeding either 51-column cards or 80-column cards into the read feed of the IBM 1402 Models 1, 2, 3, 4, and 6. Conversion of 51-column cards into 80-column cards prior to entry into the data processing system is not necessary.

During 51-column card operations, the 1402 performs all normal functions except selection of cards into the 8/2 stacker.

The file feed and the NR and 1 stackers must be positioned for 51-column cards by the operator.

### Reading and Storage Considerations

Information is read from the 51-column cards by reading brushes 15 through 65. A factor of 14 relates the card column to its corresponding position in core storage.

When the NR stacker is adjusted for 51-column operation, storage of information is automatically regulated to read into storage addresses 015 through 065. Storage address 014 is used for cycle timing; all other positions are unaltered.

In Models 1, 2, 3, 4, and 6, the loading of instructions from 51-column cards is also automatically regulated once the NR stacker has been adjusted. Operation of the load key automatically causes a word mark to be entered into storage position 015, word marks to be cleared from positions 016-065, and the I-register to be loaded with storage address 015. (The factor of 14 must be added to the standard read-in area addresses as referenced by the self-loading program cards.)

Note: The operator should be aware of these precautions concerning 51-column card operations:

1. Left-scored 51-column cards must not contain punches in columns equivalent to columns 28 and 29 of an 80-column card. These columns are at the edge of a 51-column card, and misfeeding may result if they are punched. The first punchable position of a left-scored 51-column card corresponds to column 30 of an 80-column card.
2. When changing from 51-column to 80-column operation, the operator should run a few 80-column cards through the read feed to ensure that the card transport area is clear.

### Setup Procedures, File Feed and Stackers

The file feed and stackers NR (R1) and 1 (R2) are set up for 51-column card operations as follows:

1. Position the hopper sideplates in the hopper, and fasten the sideplates to the hopper with the knurled thumb-screws. Be careful not to interfere with the bedplate springs.
2. Place the file feed tray guides on the file feed tray.
3. Reach into each stacker (Figure 9), NR and 1, and using the finger hole in the stacker guides, pull each guide forward and down until it latches.
4. Raise the small cover just above the NR and 1 stackers and partially lower the pivot plate assemblies. Slide each assembly to the rear of its stacker until it latches, then pivot the assembly all the way down.
5. Place 51-column cards in the file feed tray and begin operations.

Note: When reverting to standard 80-column card operation, follow the setup procedures in reverse sequence. Handle and store the file feed tray guides and the hopper sideplates carefully.

### Early Card Read

The Early Card Read special feature is available only for the IBM 1402 Model 1; it is a standard feature of Models 3, 4, 5, and 6.

Without Early Card Read, a standard Model 1 can attain its maximum reading rate of 800 cards per minute only when successive read cycles occur every 75 milliseconds, and the application does not require more than 10 milliseconds of each cycle for process time (the time between reading a card and issuing the next read instruction). For processing routines that require between 10 and 85 milliseconds of process time, one complete read cycle is skipped and the maximum reading rate is 400 cards per minute.

With Early Card Read, the effect of increased processing time is minimized. Additional clutch points (points at which a new read cycle can begin) are provided at 25 millisecond intervals. Consequently, a processing routine of 11 milliseconds would cause only one-third (25 ms) of a normal read cycle to be skipped, and a higher reading rate, 600 cards per minute, would be attained (Figures 10 and 11).

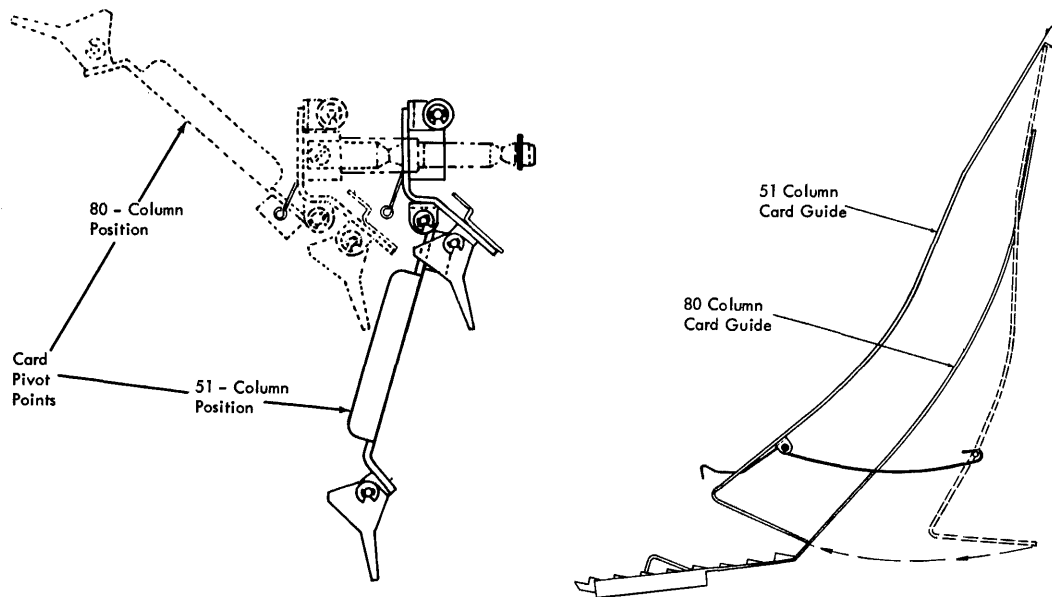
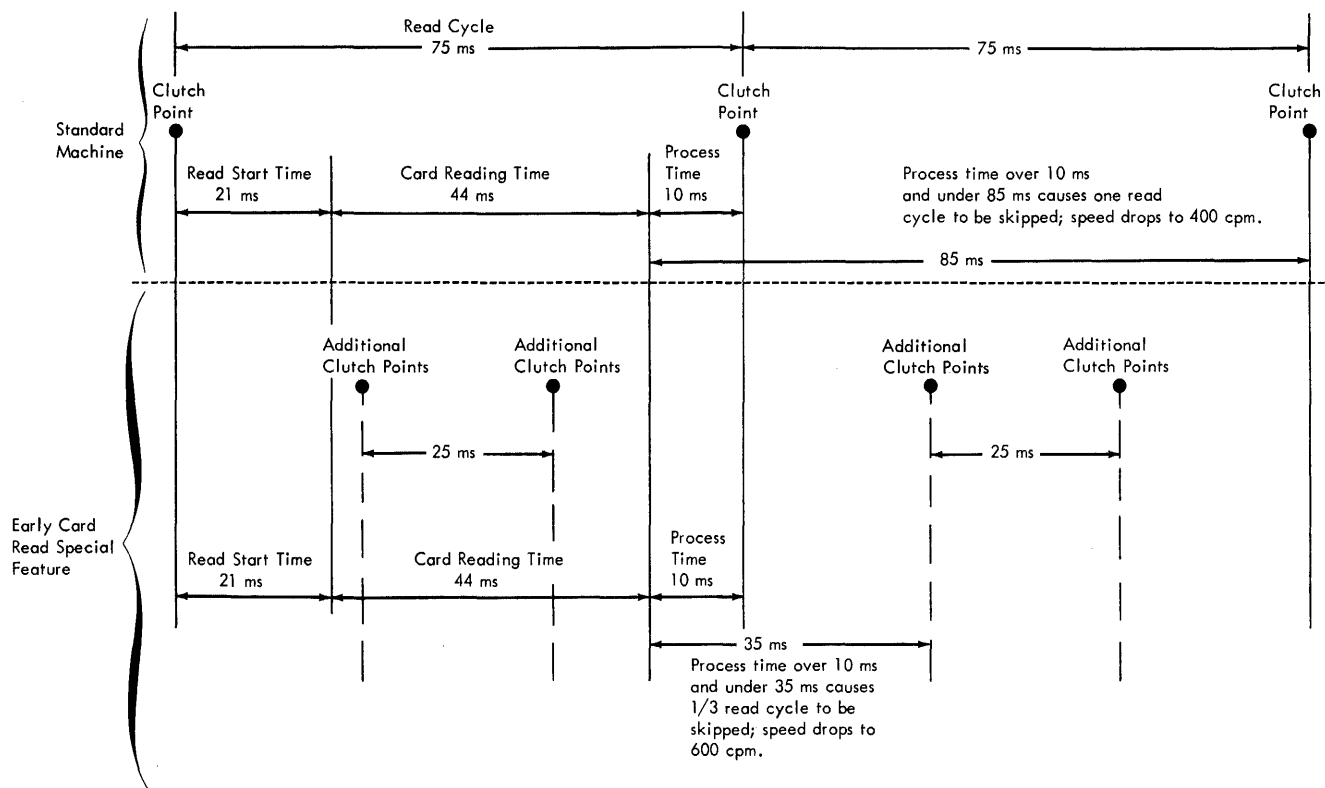


Figure 9. Stacker Adjustment, 51-Column Cards



Note: Read start time is available as process time if the Punch Release special feature is installed.

Figure 10. Read Cycle Timing



Maximum Processing Time Required (Milliseconds)	Milliseconds Between Card Read Commands	Cards per Minute (1402 without Early Card Read Feature)	Cards per Minute (1402 with Early Card Read Feature)
10	75	800	800
35	100	400	600
60	125	400	480
85	150	400	400
110	175	266	342
135	200	266	300
160	225	266	266
185	250	200	240

Figure 11. Effect of Processing Time on Reading Speed

### Punch Feed Read (Models 1, 3, 4, 5, and 6)

In some applications, it is desirable to read information into the system, then calculate and punch the results in the same card from which the input data was read. The Punch Feed Read special feature permits reading a card at the punch-feed-read station while the card ahead of it is being punched. For this operation, a special set of 80 reading brushes is added to the 1402 punch feed, one station ahead of the punch station (the blank station in Figure 2). The d-character "R" specifies that the card is to be read from the punch side of the 1402.

The normal read area in Models 1, 3, 4, 5, and 6 (storage locations 001-080) receives the information from the Punch Feed Read in the same manner as from the read feed. Validity and hole-count checks are made on each card column read from the punch-feed-read brushes. (MLP card codes cause validity errors if read by the punch-feed-read brushes on an otherwise standard 1402.)

Punching operations with Punch Feed Read are the same as for a basic 1402. Storage positions 101-180 are specified as the punch area in systems using Models 1, 3, 4, 5, and 6, and a hole-count check is made at the punch check brushes. The hole-count check of prepunched data is begun at the punch read station and is completed at the punch check station after punching has occurred.

Punching in prepunched columns is acceptable, provided that (1) the resultant character is valid, and (2) the punches read at the punch-feed-read station are not repeated. An X, for example, could be punched in a card column that already contains a 2, but punching a K (X and 2), if either an X or a 2 was already in the card, would result in a hole-count check.

### Read Punch Release

The Read Punch Release special feature is available for those IBM data processing systems using the 1402 Models 1, 3, 4, 5, and 6. With this feature, card movement in the read feed

can be initiated by either the normal read instruction or the start read feed (SRF) instruction. When the SRF instruction is used, 21 milliseconds of read start time is made available to the processing unit.

Card movement in the punch feed can be initiated by either the normal punch instruction or the SRF instruction. Use of the SRF instruction makes 37 milliseconds of punch start time available to the processing unit.

The programmer should note that failure to give the read instruction within 21 milliseconds after an SRF command will result in a reader check. Similarly, failure to issue the punch instruction within 37 milliseconds after an SRF command will cause a punch check.

### Column Binary, Read and Punch Column Binary, Binary Transfer

Column Binary (IBM 1401 Models B, C, E, and F systems), Read and Punch Column Binary (IBM 1410 and 7010 systems), and Binary Transfer (IBM 1460 systems) allow the 1402 Models 1, 2, and 3 to read and punch any combination of punches in a given card column. Validity checking by the 1402 is suspended during binary operations.

### Timing Summary

Read cycle timings for Models 1, 2, and 3 are shown in Figures 10 and 11, under the discussion of the Early Card Read special feature. Figure 12 shows the read cycle timing and reading speeds in cards a minute for Models 4, 5, and 6.

The punch timing chart for all models is shown in Figure 13.

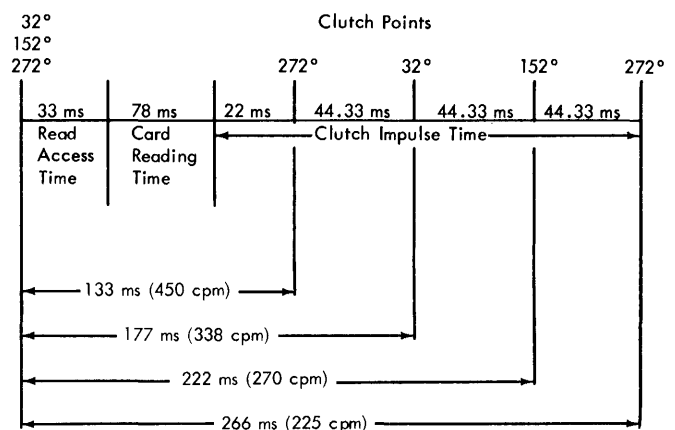


Figure 12. Read Cycle Timing Chart, Models 4, 5, and 6

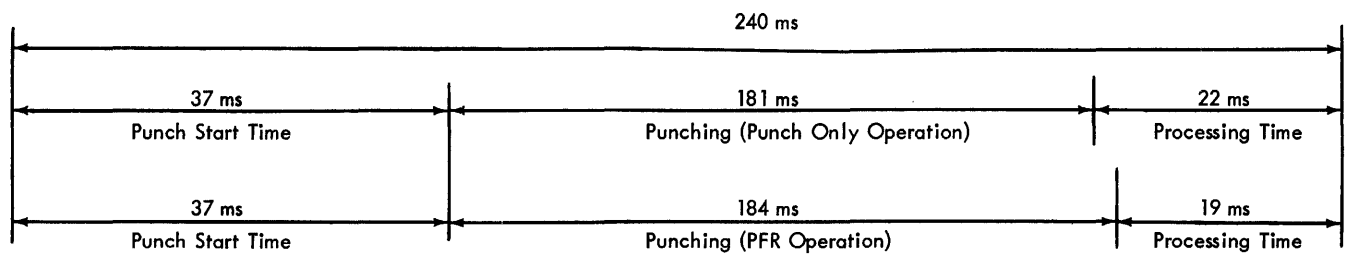


Figure 13. Punch Timing

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