File Number 1401-00
Form A24-3165-1

IBM Systems Reference Library

IBM 1401 G System Summary

This reference publication contains brief descriptions of the machine units, special features, and the simultaneous input/output unit operations, called interleaving, on the IBM 1401 Data Processing System, Model G.

Also included are sections on programs and programming systems, and timing on individual and multiple input/output operations (with and without interleaving).

For a list of related publications and abstracts, see the IBM 1401 and 1460 Bibliography, Form A24-1495.

Major Revision, June 1964

This publication, A24-3165-1, obsoletes A24-3165-0. The new publication includes a description of the IBM 1401 Processing Unit (Models G11, G12, and G13), the IBM 1402 Card Read-Punch (Models 4 and 5), and the IBM 1403 Printer (Model 6).

Copies of this and other IBM publications can be obtained through IBM Branch Offices
Address comments regarding the content of this publication to IBM Product Publications, Endicott, New York 13764

CONTENTS

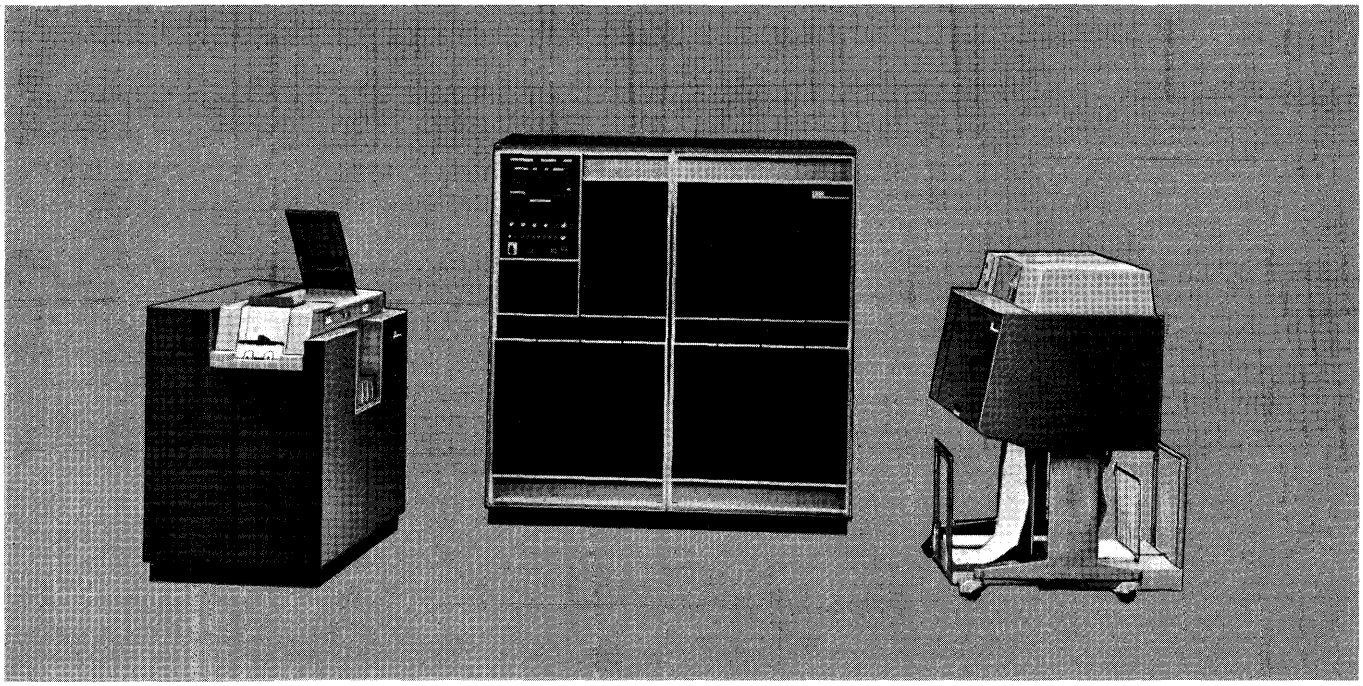

Figure 1. IBM 1401 Data Processing System, Model G

The IBM 1401 Data Processing System, Model G, (Figure 1) can assist the businessman in his transition from unit-record equipment to data processing system equipment.

Because the 1401 G system uses the same basic instructions as other models of the 1401 system, customers can change from a G system to a larger 1401 or 1460 system without incurring the costs of retraining, complete reprogramming, and operating two systems during conversion.

In addition to performing all the basic operations of a card-oriented 1401 system, the 1401 Model G system can also perform either a write-and-read or a write-and-punch operation in the time normally allotted to a read or punch operation. This simultaneous operation of two input/output units (printer and punch or reader) is called interleaving and is unique to the Model G system.

The Model G system is made up of three units:

1. The IBM 1401 Processing Unit, provided in the following models:

Model	Core-Storage Capacity
G 1	1400
G 2	2000
G 3	4000
G11	1400
G12	2000
G13	4000

2. IBM 1402 Card Read-Punch, Model 4 or 5, equipped with a 450-card-per-minute read feed and a 250-card-per-minute punch feed. Model 4 is used with any model processing unit of the IBM 1401 G Data Processing System. Model 5 is used with processing unit Models G11, G12, or G13. The IBM 1402, Model 4, has a 3000-card file-feed; Model 5 uses a 1200-card-capacity hopper.

3. IBM 1403 Printer, Model 4, 5, or 6, providing printer output media for the 1401 G. Models 4 and 5 of the IBM 1403 Printer are used with the IBM 1401 Processing Unit, Models G1, G2, and G3; the IBM 1403, Model 6, is used with IBM 1401 Processing Unit, Models G11, G12, and G13. Print positions and maximum print speeds are:

Model	Print Positions	Maximum Speed in Lines per Minute
4	100	465
5	132	465
6	120	340

Every print position of each printer can print alphabetic, numeric, and special characters.

The combinations of processing unit, card read-punch, and printer that can be used together in the 1401 G are:

1401 Processing Unit Model	1402 Card Read-Punch Model	1403 Printer Model
G 1	4	4 or 5
G 2	4	4 or 5
G 3	4	4 or 5
G11	4 or 5	6
G12	4 or 5	6
G13	4 or 5	6

IBM 1401 PROCESSING UNIT

The IBM 1401 Processing Unit (Figure 2) contains the logical circuitry and core storage used to control the system. The particular IBM 1401 Processing Unit (Models G1, G2, G3, G11, G12, or G13) should be selected according to the amount of core storage and the capabilities of the input/output devices required by the user. The internal processing speed of .0115 milliseconds per storage cycle is the same as that of other 1401 models.

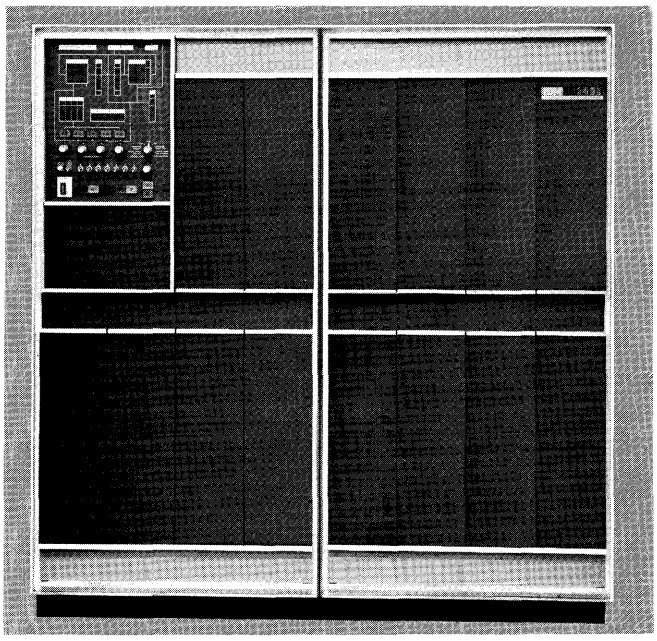

Figure 2. IBM 1401 Processing Unit, Model G

IBM 1402 CARD READ-PUNCH, MODELS 4 AND 5

The IBM 1402 Card Read-Punch (Figure 3), Models 4 and 5, provide the 1401 Model G system with punched-card input and output. With the exception of speed, the operating characteristics of the Model 4 are the same as the Model 1 used on the other 1401 data processing system configurations. The only difference between Models 4 and 5 of the 1402 is that Model 4 uses a 3000-card file-feed device from which cards are fed into the read feed; Model 5 uses a 1200-card-capacity read hopper. The Model 4 is used with the IBM 1401 Processing Unit, Models G1, G2, and G3. Either Model 4 or 5 can be used with the IBM 1401 Processing Unit, Model G11, G12, or G13.

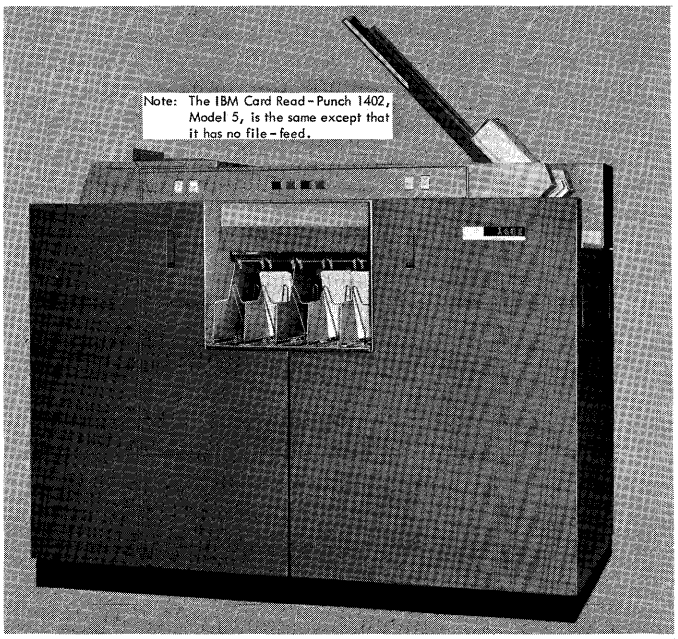

Figure 3. IBM 1402 Card Read-Punch, Model 4

The card-read portion of the 1402 can operate at a speed of 450 cards per minute (CPM). The actual card speed realized is governed by the program routine for each particular run. A card-read speed of 450 CPM results in a read cycle of 133 1/3 milliseconds (ms). Refer to Figure 4 for a timing schematic of the read cycle. Early card read, a standard feature, minimizes the decrease in card-reading speed caused by lengthy processing routines. This is done by permitting the card-reading mechanism to engage sooner.

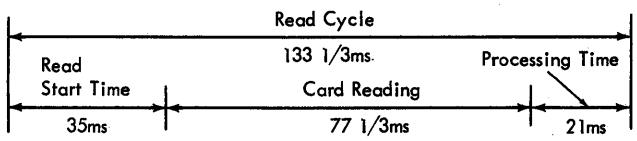

Figure 4. IBM 1402, Models 4 and 5, Read Operation—450 CPM

The card-punch portion of the 1402 can operate at a speed of 250 CPM. The actual card speed realized is governed by the program routine for each particular run. A card-punch speed of 250 CPM results in a punch cycle of 240 ms. Refer to Figure 5 for a timing schematic of the punch cycle.

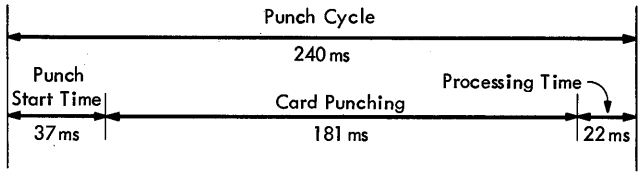

Figure 5. IBM 1402, Models 4 and 5, Punch Operation—250 CPM

A combination read and punch operation, performed on a Model G system in the same way as on any other 1401 system, results in a card reading and punching speed of 250 cards per minute with an available processing time of 22 ms.

IBM 1403 PRINTER, MODELS 4, 5, AND 6

Models 4, 5, and 6 of the IBM 1403 Printer (Figure 6) provide the 1401 Model G system with printed

Figure 6. IBM 1403 Printer

output. Model 4 has a printing capacity of 100 positions; Model 5 has a printing capacity of 132 positions; Model 6 has a printing capacity of 120 positions. Models 4 and 5 operate at a maximum rate of 465 lines per minute; Model 6 operates at 340 lines per minute. The actual printing speed realized is governed by the program routine for each particular job run. Refer to Figure 7 for a timing schematic of a print cycle on the Models 4 and 5. Refer to Figure 8 for a similar timing schematic for the Model 6.

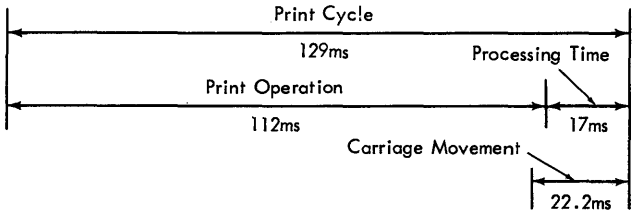

Figure 7. IBM 1403, Models 4 and 5, Print Operation—465 LPM

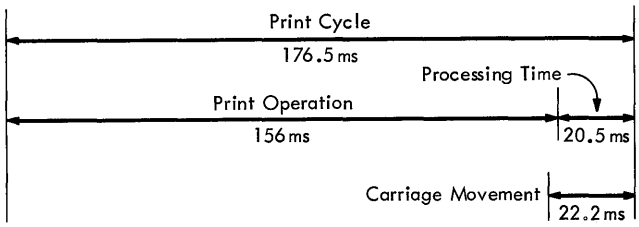

Figure 8. IBM 1403, Model 6, Print Operation—340 LPM

Models 4 and 5 have dual-speed carriages that permit short skips (less than eight lines) at 33 inches per second, and long skips (more than eight lines) at 75 inches per second. Model 6 has a single-speed carriage that operates at 33 inches per second only. With the exceptions of print speed, carriage speed in the case of Model 6, and number of print positions, Models 4, 5, and 6 are the same as Models 1 and 2 (used in other IBM 1401 Data Processing System configurations).

Models 4 and 5 of the IBM 1403 Printer are used in the 1401 G with the IBM 1401 Processing Unit, Models G1, G2, and G3. Model 6 of the 1403 is used with the IBM 1401 Processing Unit, Models G11, G12, and G13.

INTERLEAVING INPUT/OUTPUT OPERATIONS

It is possible to interleave either a read operation or a punch operation with a print operation on the 1401 Model G system.

Write and Read Operation

The write and read operation is performed by executing the print operation during the read start time and card reading time of a read cycle as shown for the IBM 1403 Printer, Models 4 and 5, in Figure 9.

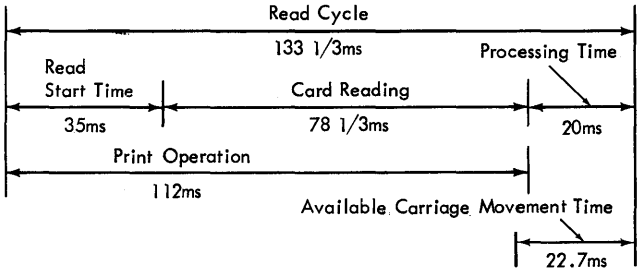

Figure 9. Write and Read Operations—IBM 1403, Models 4 and 5, and IBM 1402, Models 4 and 5

Depending on the program routine, this operation can result in a card-read speed and printing speed of 450 cards/lines per minute. A similar timing schematic is shown in Figure 10 for Model 6 of the IBM 1403 Printer. Depending on the program routine, this operation can result in a card-read speed and printing speed of 338 cards/lines per minute.

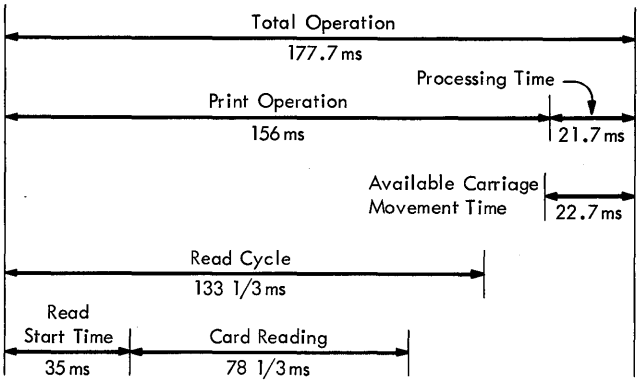

Figure 10. Write and Read Operation—IBM 1403 Printer, Model 6, and IBM 1402, Models 4 and 5

Write and Punch Operation

The write and punch operation is performed by executing the print operation during the punch start time and card punching time of the punch cycle as shown for the IBM 1403 Printer, Models 4 and 5, in Figure 11. Depending on the program routine, this operation can result in a card-punch and printing speed of 250 cards/lines per minute. Figure 12 shows a similar timing schematic for Model 6 of the IBM 1403 Printer. Depending on the program routine, this operation can result in a card-punch and printing speed of 250 cards/lines per minute.

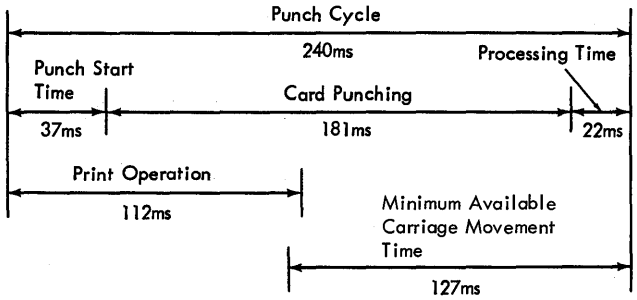

Figure 11. Write and Punch Operation—IBM 1403, Models 4 and 5, and IBM 1402, Models 4 and 5

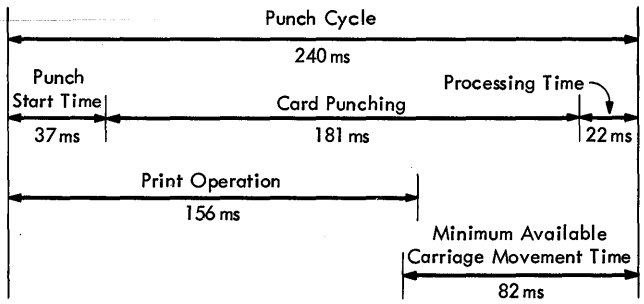

Figure 12. Write and Punch Operation—IBM 1403, Model 6, and IBM 1402, Models 4 and 5

Write, Read, and Punch Operation

The write, read, and punch operation is not completely interleaved. The write and punch portion of the operation is interleaved, and the read operation follows the interleaved operation. This operation results in a printing and card-reading/card-punching speed of 200 cards/lines per minute when Models 4 and 5 of the IBM 1403 Printer are considered. With Model 6 of the 1403 the speed is 200 cards/lines per minute.

These special features are available on the 1401 Model G system. The units and the features on these units are:

IBM 1401 G PROCESSING UNIT SPECIAL FEATURES

Adapter, 51-Column Feed

This feature provides the controlling circuitry necessary when the 51-column interchangeable read-feed special feature is installed on the IBM 1402 Card Read-Punch, Model 4.

Bit Test

This feature is a branch instruction that causes the character located at the B-address to be compared, bit by bit, with the d-character. If any bit in the character located at the B-address matches any bit in the d-character, the program branches to the specified I-address (WM and C-bits are not compared).

Expanded Print Edit

This feature provides additional editing capacity when printed documents contain fields that require special punctuation including asterisk protection, floating dollar sign, decimal control, and sign control left.

Asterisk Protection

In applications such as check-writing it is often necessary to have asterisks appear to the left of significant digits to prevent alteration of figures and amounts. The asterisk-protection feature causes multiple asterisks to be printed when specified by an asterisk written at the left of the zero-suppression code in the edit control word.

Floating Dollar Sign

When a control word is written with the $ to the left of the zero-suppression code, a dollar sign is inserted in the position to the left of the first significant digit in a printed amount field. By using this method of punctuation, amount fields used in records, such as checks and bills, cannot be easily altered, because there is no space between the dollar sign and the first significant digit.

Sign Control Left

Whenever CR or minus symbols must be printed to the left of a negative field, the sign-control-left feature is used. The appropriate negative sign is written in the high-order position of the control word. The sign of the field being edited is examined, and the CR or minus sign is inserted whenever the amount is negative.

Decimal Control

This feature ensures that decimal points print only when significant digits are in the field being edited.

High-Low-Equal Compare

This feature causes the compare instruction to store the results of a comparison in indicators that can be tested for high, low, or equal conditions. A control number in storage can be used to determine the sequence of records that have been read from tape.

Punch-Feed Read Control

This feature provides the controlling circuitry necessary when the punch-feed read special feature is installed on the IBM 1402 Card Read-Punch, Model 4 or 5.

Read Punch Release

During reading and punching operations on a 1401 Model G system, there is a 35-millisecond read-start-time interlock and a 37-millisecond punch-start-time interlock during each complete read or punch cycle. The read-punch release feature provides two operation codes to release the read and punch start-time interlocks and make extra time available for processing during read and punch cycles.

Sense Switches

Seven sense switches can be included on the 1401 Model G. The toggle switches that control them are on the console. Switch A is used to control last-card operations. Six additional sense switches (B, C, D, E, F, and G) are used for external control over the course of the stored program.

Space Suppression

This feature provides program control for space suppression on the printer attached to the system.

IBM 1402 CARD READ-PUNCH, MODELS 4 AND 5, SPECIAL FEATURES

Feed, 51-Column Interchangeable Read

The interchangeable 51-column read feed (including file feed) permits feeding either 51-column cards or standard 80-column cards in the read feed of the IBM 1402 Card Read-Punch, Model 4.

The 51-column card is commonly used for charge sales slips, postal money-order forms, installment payments, and inventory cards.

Using an interchangeable feed allows direct entry to the data processing system from the stub card. This eliminates the need for reproducing 51-column cards into standard 80-column cards.

Punch-Feed Read

This special feature makes it possible to punch output data into the same card from which the input data was read. The punch feeds in the IBM 1402 Card Read-Punch, Models 4 and 5, are modified by adding a set of eighty reading brushes one station ahead of the punch station. The card at the punch-feed station is read while the card ahead of it is being punched.

The information read from the punch-feed read brushes enters into core-storage addresses 001-080 in the same manner as information read in the read feed. A validity and a columnar hole-count check is made on each column that is read from the punch-feed read brushes.

The punching operation for punch-feed read is the same as in the basic 1401 (storage positions 101-180). A hole-count check is made at the punch check brushes.

IBM 1403 PRINTER, MODELS 4, 5, AND 6 SPECIAL FEATURES

Auxiliary Ribbon-Feeding Feature

This feature is recommended for satisfactory utilization of polyester film ribbon and can also be used for conventional fabric ribbons. This feature and the polyester film ribbon are recommended when the IBM 1403 is used to prepare paper documents heavier than 24-pound stock for optical character recognition on the IBM 1418 Optical Character Reader, IBM 1428 Alphameric Optical Reader, or IBM 1282 Optical Reader Card Punch.

Interchangeable Chain Cartridge Adapter

Many scientific and commercial applications require distinctive type styles for particular printing jobs. This special feature for the IBM 1403 Printer, Models 4, 5, and 6, allows chain cartridges to be interchanged. With this feature, an operator can insert an interchangeable chain cartridge with a different type font or special character arrangement.

PROGRAMMING SYSTEMS

Two symbolic programming systems aid users of all models of the IBM 1401 G Data Processing System by relieving them of much detailed programming effort. The two programming systems are:

SPS-1
Basic Autocoder 2K for IBM 1401.

For further information about symbolic programs, see under IBM 1401 Programs and Programming Systems in the SRL publication IBM 1401 Systems Summary (A24-1401).

SPS-1

This symbolic programming system, used on IBM 1401 systems, can also be used on any 1401 Model G. SPS-1 source programs must be coded on the 1401 Symbolic Programming System Coding Sheet (X24-1152).

BASIC AUTOCODER 2K FOR IBM 1401

This programming system is designed for use with an IBM 1401, Model G, equipped with at least 2000 positions of core storage. The user can write his Basic Autocoder 2K statements on the Autocoder Coding Sheet (X24-1350).

Basic Autocoder 2K for IBM 1401 can assemble programs for any IBM 1401 Data Processing System. The assembly program produces a machine-language program deck that is self-loading.

IBM 1401 G Printed in U.S.A. A24-3165-1

IBM

International Business Machines Corporation

Data Processing Division

112 East Post Road, White Plains, N. Y. 10601