

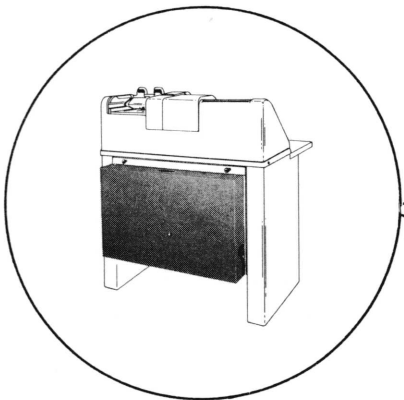
ACCESSORY CA-1 B

PUNCHED CARD COUPLER

FOR THE

BENDIX G-15 COMPUTER

ACCESSORY CA-1 PUNCHED CARD COUPLER



**CA-1 PUNCHED CARD
COUPLER MOUNTED ON
026 PUNCH-READER**

Accessory CA-1, together with a modified IBM-026 card handling unit, provides inexpensive punched card input-output facilities for the G-15 computer.

Standard eighty-column cards may be read or punched under computer control.

Cards can be read and punched on either the same or separate 026 units.

When two card-handling units are simultaneously connected to the computer, card reading and punching can occur without manual intervention.

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PUNCHED CARDS

INFORMATION CARD

A standard punched card has eighty vertical columns which are numbered from 1 through 80. Each character of input and output information is punched in a single vertical column on a card.

The card has twelve horizontal rows. Rows 12 and 11 are across the top of the card and are not imprinted in the manner of the other rows, 0 through 9.

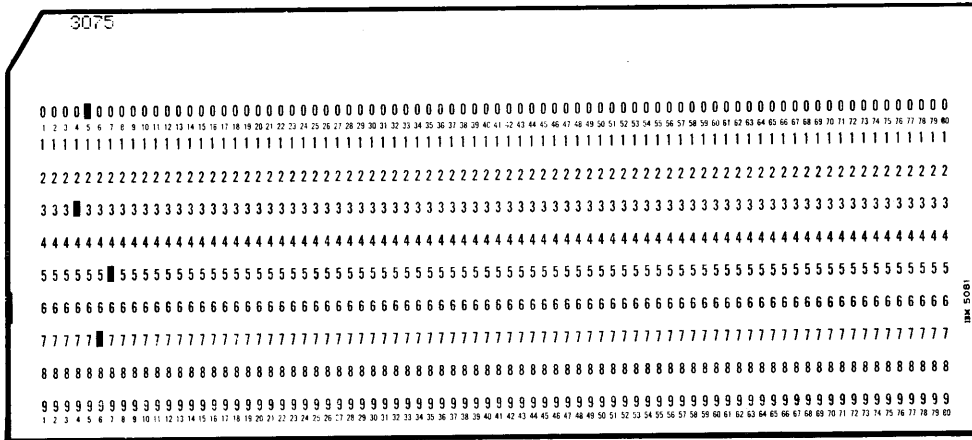


Figure 1 Standard Punched Card

An information card or data card is a standard punched card which contains numerical data.

Figure 1 shows an information card on which the number 3075 is punched in columns 4, 5, 6, and 7.

A "field" is any group of consecutive columns on a punched card; a "read field" is any group of consecutive columns on a card to be read into the computer. A "skip field" is any group of consecutive columns to be skipped, that is, the information in the columns of the "skip field" is not used by the computer.

For example, in Figure 1 if the number 3075 were to be used by the computer, columns 4 through 7 would be a "read field." Columns 1 through 3 and 5 through 80 would be "skip fields." Figure 2 illustrates the fields for the card shown in Figure 1.

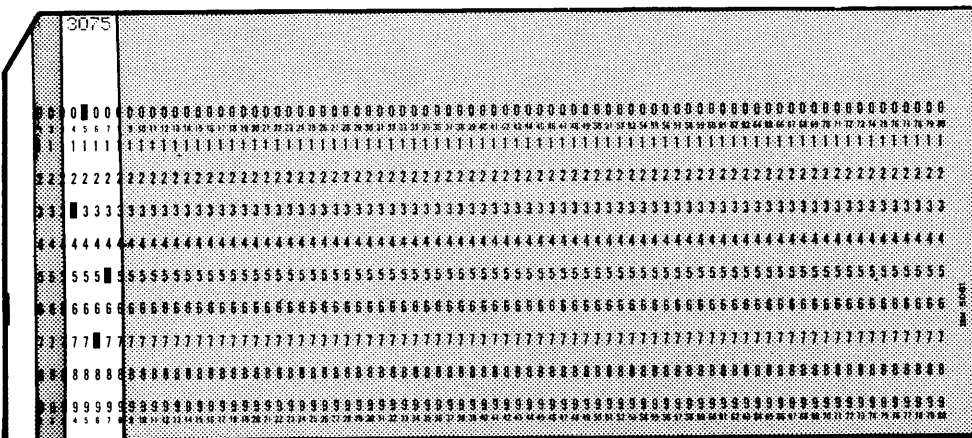


Figure 2 Read and Skip Fields

A card cycle is the processing of all information from one 80-column card.

The data punched on a card may consist of either decimal or hexadecimal digits and minus signs. In the G-15 Computer the absence of a minus is interpreted as a plus sign. Characters are punched in the standard code for 80-column cards.

Each digit is held in one column on the card. On input cards, the code signifying a minus sign may be punched in the same column as the code for a digit. Zeros **must be punched** on an IBM card; blank columns are not interpreted as zeros. The codes punched on cards and entered into the computer are illustrated in the accompanying table.

Digit	Rows Punched in Card Column	Code Entered into Computer
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
u	0 and 4	1010
v	0 and 5	1011
w	0 and 6	1100
x	0 and 7	1101
y	0 and 8	1110
z	0 and 9	1111
minus sign	11	Puts minus sign in input sign register

PROGRAM CONTROL CARD

A program control card is an 80-column, punched card which is mounted on the program drum of the IBM-026. Separate program control cards are used for input and output. The input program control card controls the selection of data columns to be read into the computer from the information card. The output program control card controls the punching of the output data on an information card.

PROGRAMMING

COMMANDS

The CA-1 Accessory operates under program control from the G-15 Computer. The commands for the CA-1 are:

Command	Code
Read Card	L, N 0 14 31
Punch Cards	L, N 0 11 31

The "Read Card" command processes the information from **only** one card. To process a deck of cards, the read command is executed repetitively.

The "Punch Cards" command punches the contents of Line 19 on cards. The process continues until Line 19 is cleared.

Subroutines are available which permit card input-output of decimal information punched in fixed or floating decimal point form. Decimal-to-binary and binary-to-decimal conversion routines are also available for both single- and double-precision operation.

SUBROUTINES

Input proceeds in the manner described on page 25 of the G-15 Operating Manual. For each digit read, a four-bit code is serially entered into Short Line 23 in the computer. Numerical values are separated from each other during input by "tab" signals. The "tab" signal transfers the sign from the input sign register to Line 23. Each number is held serially in Line 23 in the form of sign bit in the least significant bit position followed by magnitude bits. When a "transfer Line 23 to Line 19," that is, "reload" signal occurs, the contents of Line 23 are copied into Line 19. The input process is halted by a "stop" signal.

INPUT PROCESS

During the reading of a card, "tab" and "Transfer 23 to 19" signals occur at intervals selected by the programmer; the method for doing so is explained in a later section. After each card is read, a "Transfer 23 to 19" signal and a "stop" signal are generated automatically.

Line 23 is four words long and each word holds 29 bits. If each number consists of 7 digits and a sign, 29 bits will be entered into the computer for each number. The 29 bits consist of 4 bits for each digit and one bit for the sign. Therefore, if a "Transfer 23 to 19" signal occurs after 4 numbers are read from cards, each input number in Line 19 will occupy one word position; no rearrangement of data in the line is necessary.

Output proceeds from Line 19 in the manner described under "Read-Out Control" on page 25 of the G-15 Operating Manual. The output format in the computer determines the form of the output. The standard format may be used if desired and is found on page 26 of the Operating Manual.

OUTPUT PROCESS

PROGRAM CONTROL CARDS

A separate program control card is necessary for input and output data. The input program control card is mounted on the program drum of the IBM-026 before the input operation begins and replaced by the output program control card before the output operation.

INPUT PROGRAM CONTROL CARD

An input program control card may be punched in five different rows. Punches in three of the rows control the reading of data from the information card and punches in the other two rows are control signals to the G-15 computer.

READ FIELD

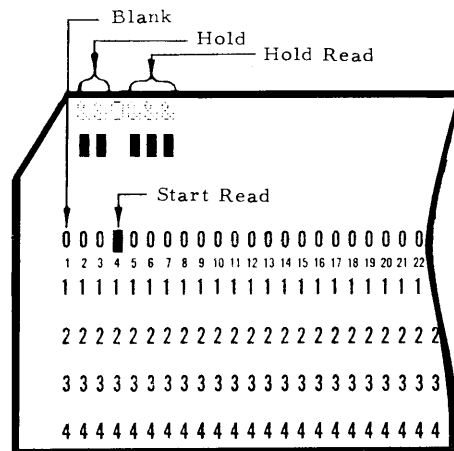
A punch is put in row zero in the first column of a read field. A punch in row 12 is placed in each consecutive column of the field to be read. The punch in row zero is called a "Start Read" punch. The punches in row 12 are called "hold" punches.

SKIP FIELD

A punch is put in row eleven in the first column of a skip field. A "hold" punch in row twelve is placed in each consecutive column of the skip field. To enter information into the computer from the skipped columns, the information must be read again with a different program control card.

COLUMN 1 CONTROL SWITCH

The column 1 control switch is on the back of the CA-1 accessory and controls the reading of column 1 from the information card. Therefore, the program control card has neither a "start skip" punch nor a "start read" punch in column 1. However, to continue the operation started by the control switch—either read or skip—"hold" punches are placed in the remaining columns of the field.



To prepare a program card for the information card shown in Figure 1:

Put no punch in column 1. The reading of column 1 is controlled by the switch on the back of the CA-1 accessory;

Columns 1 through 3 have no data. Put a "hold" punch in columns 2 and 3;

Put a "start read" punch in column 4 followed by "hold" punches in columns 5 through 7.

TAB PUNCH

The "tab" punch on the program control card enters the sign into Line 23 in the computer and must be given at the end of each number. The "tab" punch is in the same column as the last digit in the read field. Therefore, on the program control card the "tab" punch is in the same column as the last "hold" punch. The "tab" punch **must be immediately followed** by a "start skip" punch, **or** the column on the information card corresponding to the column following the "tab" punch on the program control card **must be blank**. The reason is that the "tab" punch is processed during the reading time of the column immediately following the "tab" punch.

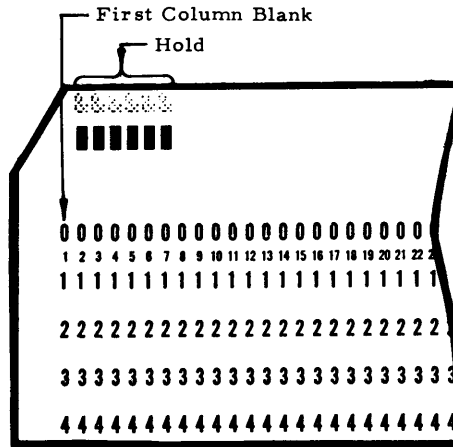
EXAMPLE 1:

To prepare a program control card for the information card illustrated in Figure 4, the operator first determines the data needed.

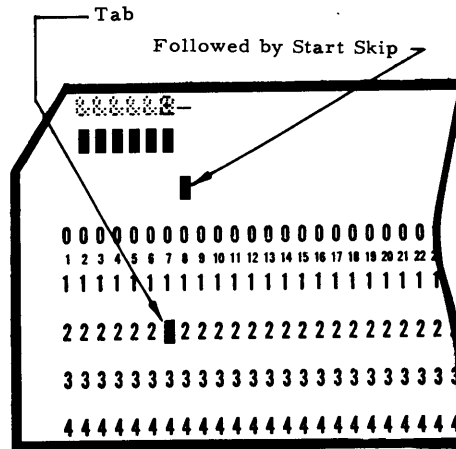
The program requires:

- The data contained in columns 1 through 7, 9 through 15, and 19 and 20;
- The sign for each set of numbers; and
- No other data columns.

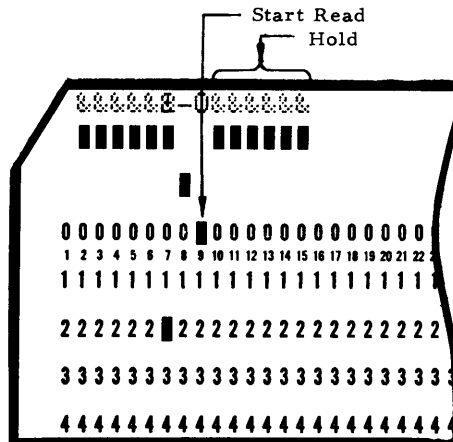
The same general procedure applies to the preparation of any program card. The step-by-step procedure to prepare the program control card to meet the requirements outlined for Example 1 is described in detail and is illustrated in the accompanying sections.



As the CA-1 provides the first "start read" signal, there is no punch in column 1. However, to continue the read operation, put a "hold" punch in columns 2 through 7. The "hold" punches continue the reading process through column 7.

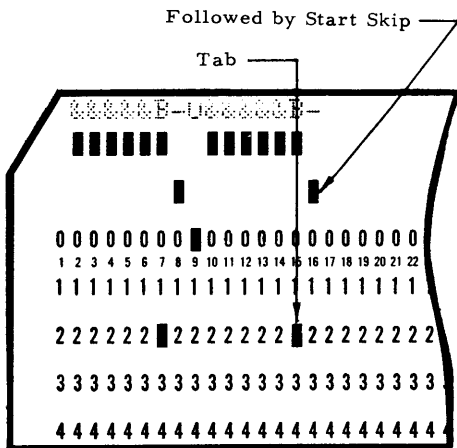


To enter the sign into Line 23, a "tab" punch is put in column 7. There are *now* two punches in column 7, a "hold" punch and a "tab" punch. The column following a "tab" punch *must have* a "start skip" punch. Therefore, column 8 has a "start skip" punch. The "tab" and "start skip" punches are always used together.

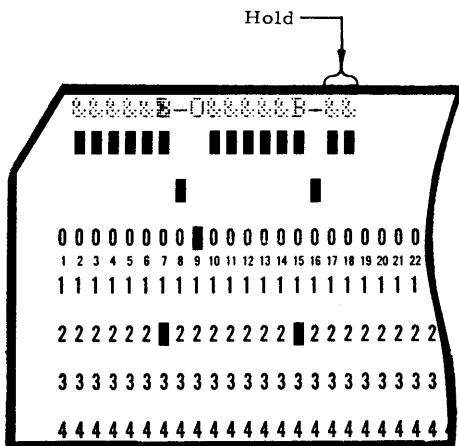


To read columns 9 through 15, a "start read" punch is put in column 9. To continue the reading, a "hold" punch is put in columns 10 through 15.

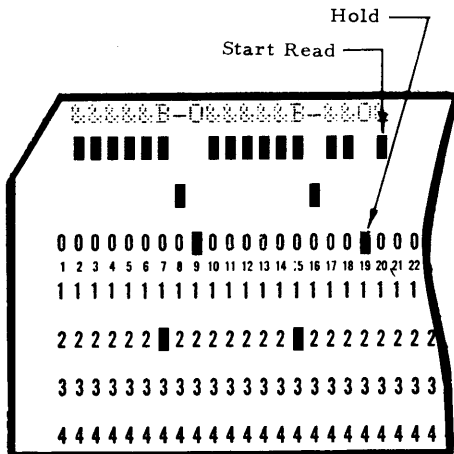
A "tab" punch enters the sign into Line 23. Put the "tab" punch into column 15, which also contains a "hold" punch. A "start skip" punch follows in column 16.



The program does not use the data from columns 16, 17 and 18 from the information card. A "hold" punch in columns 17 and 18 continues the skip operation started in column 16.



To read columns 19 and 20, put a "start read" punch in column 19 and a "hold" punch in column 20. To load the sign into Line 23, put a "tab" punch in column 20 which also has a "hold" punch. A "start skip" punch is in column 21.



To complete the program control card, continue the skip operation by putting a "hold" punch in columns 22 through 80. The computer automatically supplies the "stop" code at the end of the card cycle. Figure 5 shows the completed program control card.

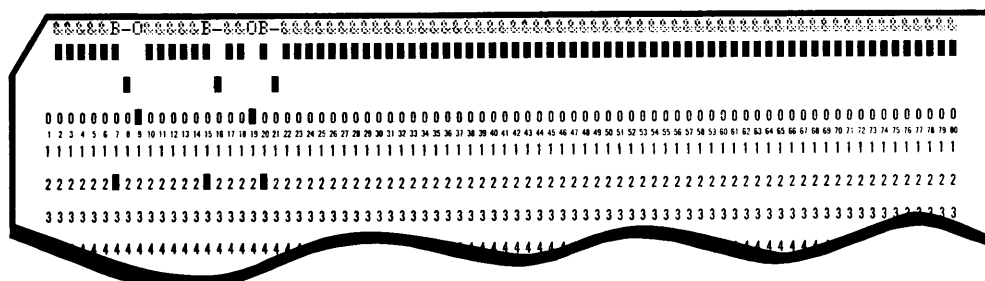


Figure 5 Completed Input Program Control Card

If a "transfer 23 to 19" code had been used in Example 1, the "Transfer 23 to 19" punch would have been put in any column from 22 to 80. The "Transfer 23 to 19" punch would have been in the same column as a "hold" punch.

Note that each column of the program control card has a control punch, that is, "start read," "start skip," or "hold." The exception is column 1, which never has a "start read," a "start skip," or a "hold."

EXAMPLE 2:

An information card, shown in Figure 6, contains the following 7-digit numbers in the columns indicated:

Number	Columns
-1234567	4 through 11
9999999	14 through 20
7654321	23 through 29
-2222222	31 through 38
5050505	41 through 47
-9876543	49 through 56

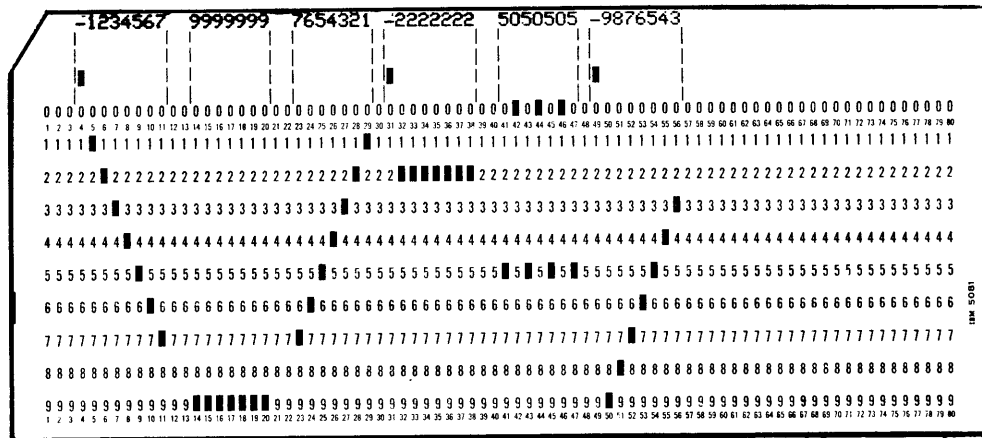
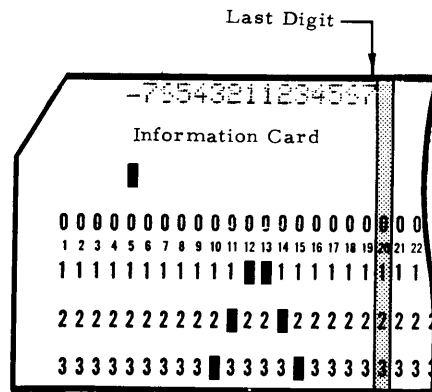


Figure 6 Information Card

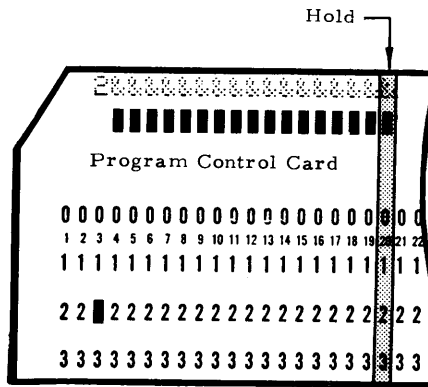
Columns 1, 2, 3, 12, 13, 21, 22, 30, 39, 40, 48, and 57 through 80 contain no data on the information card.

To prepare the program control card, shown in Figure 7:

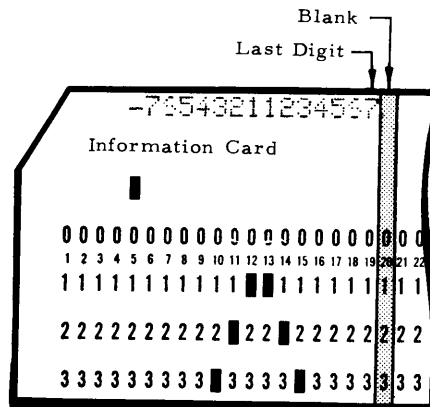
- Do not put any punch in column 1.
- Put a "start read" punch in columns 4, 14, 23, 31, 41, and 49.
- Put a "start skip" punch in columns 12, 21, 30, 39, 48, and 57.
- All other columns have a "hold" punch.
- To enter the sign into the computer, put a "tab" punch in columns 11, 20, 29, 38, 47, and 56.
- Put a "Transfer 23 to 19" punch in column 22.



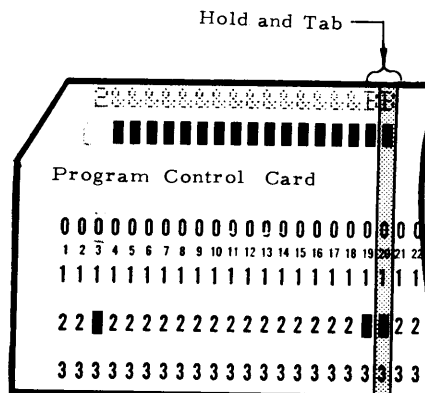
The odd numbered read fields extend by one column beyond the column on the information card containing the last digit of the double precision number. If the double precision number is in columns 5 through 19, the read field would extend to column 20.



There are two "tab" punches at the end of the odd numbered read fields. The first "tab" punch is in the column corresponding to the last digit of the double precision number. The second "tab" punch immediately follows the first "tab" punch. The column on the information card corresponding to the column containing the second "tab" punch on the program control card **must be blank**.



If the double precision number were in columns 5 through 19, columns 19 and 20 on the program control card would have both a "hold" punch and a "tab" punch. Column 20 on the information card would be blank.



The information card contains the following 14 digit numbers and signs in the columns indicated.

PREPARATION OF INPUT PROGRAM CONTROL CARD FOR DOUBLE PRECISION NUMBERS

Number	Columns
-11223344556677	3 through 17
99887766554433	21 through 34
-22222222222222	39 through 53
77777777777777	57 through 70

EXAMPLE 3:

The program requires as input the double precision numbers and their signs. Figure 8 shows the pre-punched information card containing the double precision numbers, and the corresponding program control card.

- a. Put a "tab" punch in **column 1** which corresponds to the **second column preceding** the double precision number on the information card.

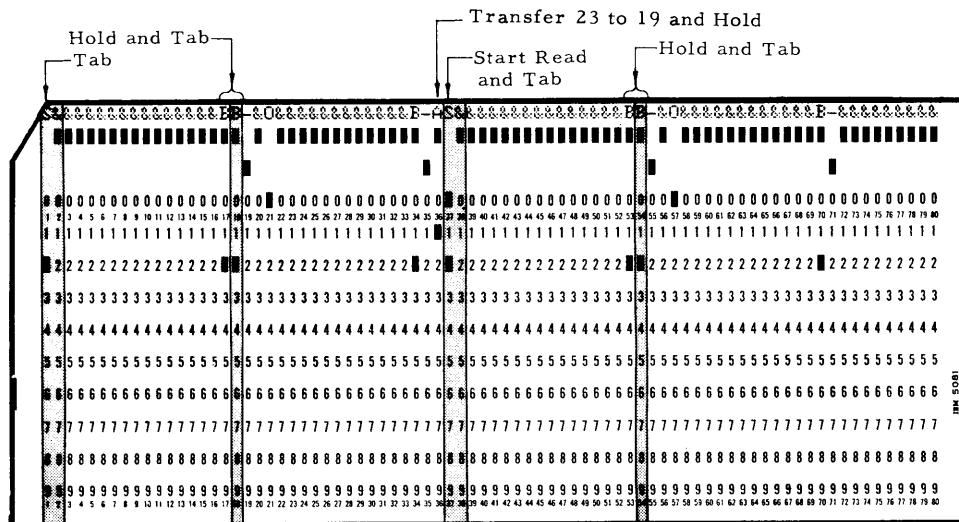
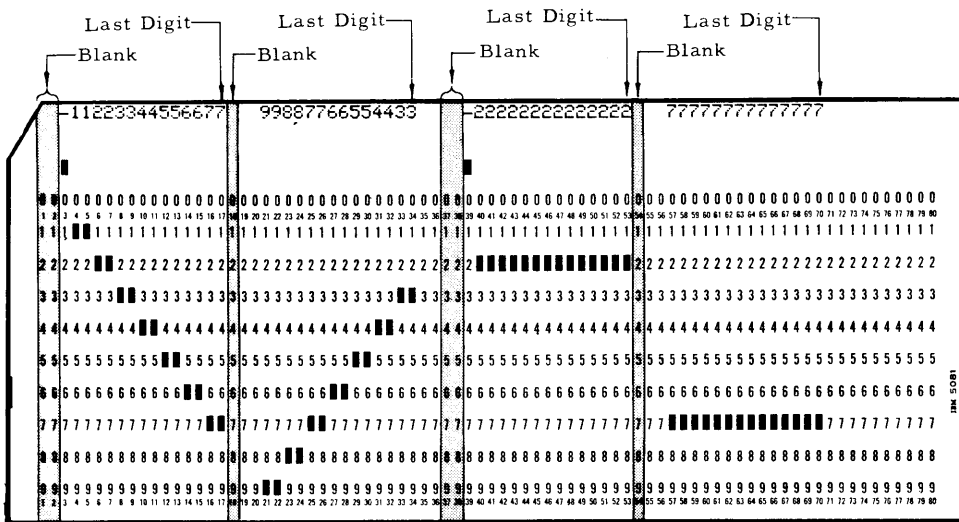


Figure 8 Upper Card—Information
Lower Card—Program Control

- b. In column 2, put a "hold" punch. Column 2 may have either a "hold" punch or a "start skip" punch. If the column has a "hold" punch, the programmer **must be certain** that the corresponding column on the information card **is blank**. If the column on the information card contains data, the corresponding column on the program control card **must have** a "start skip" punch.
- c. As a "hold" punch was used in column 2, described in Step b, continue the read field with "hold" punches in columns 3 through 18. The "hold" punches continue for **one column beyond the column containing the last digit** of the number of the information card.
- d. If a "start skip" punch were used in Step b, a "start read" punch would have been put in column 3 followed by "hold" punches in columns 4 through 18 to continue the read field.
- e. Put a "tab" punch in column 17 which corresponds to the **last digit** of the number on the information card.
- f. In column 18, put a second "tab" punch.
- g. In column 19, put a "start skip" punch followed by a "hold" punch in column 20. If the second double precision number were negative, the read field would start in column 20 with a "start read" punch.
- h. In column 21, put a "start read" punch followed by "hold" punches in columns 22 through 34. Column 34 also has a "tab" punch. The last column of the read field, column 34, corresponds with the last digit of the second double precision number.
- i. Put a "start skip" punch in column 35 and both a "Transfer 23 to 19" punch and a "hold" punch in column 36.

The process is repeated for the third and fourth double precision numbers. The read field for the third double precision number is like the read field for the first, and the fourth read field is like the second read field. The fourth read field is followed by a "skip" field. No "Transfer 23 to 19" punch is necessary after the fourth read field.

OUTPUT PROGRAM CONTROL CARD

The output program control card controls the column locations on the information card into which output data is punched. The output program control card has only two types of punches, a "start skip" punch and a "hold" punch.

The output format for Line 19 in the computer controls the sequence of output data characters. The output format in the computer and the output program control card **must be compatible**.

Once the "punch cards" command is given, the computer punches the contents of Line 19 on one information card after the other until Line 19 is cleared. Each character of output data requires one column on the information card.

All the columns on the information card do not have to be punched during output. To skip columns on the information card, put a "start skip" punch on the program control card in the first column to be skipped and a "hold" punch in each consecutive column to be skipped. The "start skip" and "hold" punches must be repeated for each series of columns to be skipped. Information is punched into all columns which are not indicated as skipped on the program control card.

The operator wants to punch data from the computer in such a way that the information card may be used to read back data into the computer using the same input program control card prepared in Example 2.

To prepare the output program control card, shown in Figure 9 :

EXAMPLE 4:

Put a "start skip" punch in column 1 and a "hold" punch in columns 2 and 3. Columns 4 through 11 have no punch.

Put a "start skip" punch in columns 12, 21, 30, 39, 48, and 57. Put a "hold" punch in columns 13, 22, 40, and 58 through 80. The punches in columns 12, 13, 21, 22, 30, 39, 40, and 48 prevent information from being punched into these columns.

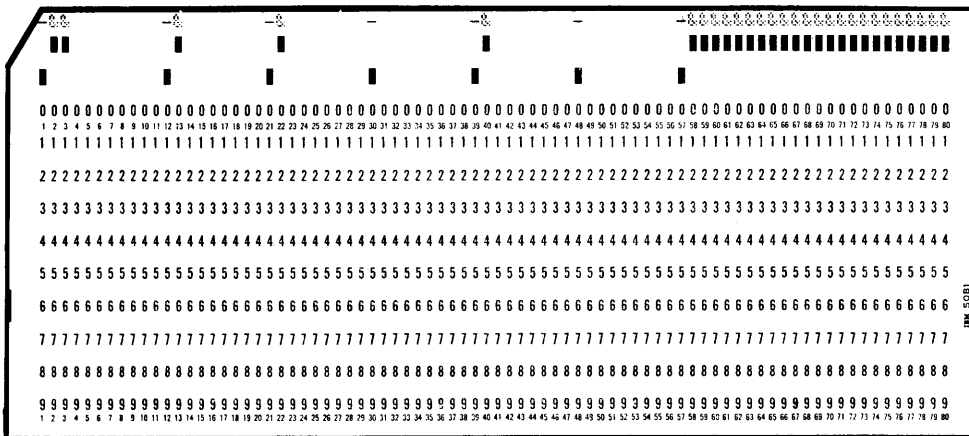


Figure 9 Output Program Control Card

OPERATION

SPEED

Cards are read at the rate of 17 columns per second and punched at the rate of 11 columns per second. Columns are skipped, that is, neither read nor punched, at the rate of 80 columns per second.

Cards that contain one column of information are read at the rate of 44 cards per minute; fully punched cards are read at the rate of 12 cards per minute.

OPERATING INSTRUCTIONS

Mount the proper input or output program control card on the program control card drum of the IBM-026.

To turn on the machine:

Put the on-off switch located on the left of the unit above the card stacker in the ON position;

Depress the program control card lever to the RIGHT; and

Put the functional control switches on the keyboard in the ON position.

Stand the deck of cards to be read or punched in the card hopper so that the cards are face forward with the edge with the "nine" row at the bottom. When reading cards, place three blank cards at the end of the deck of cards. Approximately 500 cards may be held in the hopper.

- a. Press the REL (release) key once.
- b. Depress the program control card lever to the LEFT.
- c. For input, put the column 1 control switch to the appropriate location, either read or skip. When the first read field starts in column 1, the switch is turned to the read position. If column 1 from the information card is to be omitted, the switch is turned to the skip position. Figure 10 shows the column 1 Control Switch. Press REL key twice while holding down the ALPHA key.
- d. For output, press the REL key once.

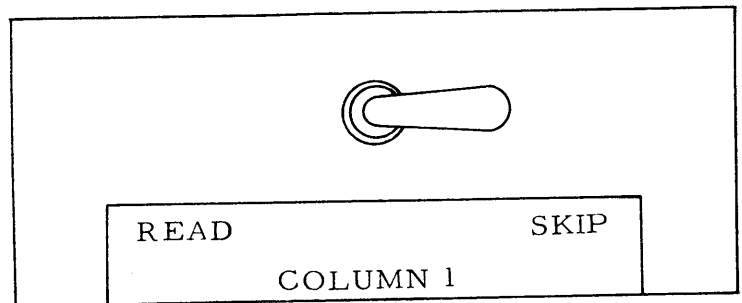


Figure 10 Column One Control Switch

PUNCHING CARDS (MANUAL)

To punch a single hole in a card column in rows 0 through 12:

Depress the program control card lever to the RIGHT;

Hold down the NUM shift key; and

Hit a key 0 through 9 for the desired row on the card. The SKIP key punches row 11 and the P key punches row 12.

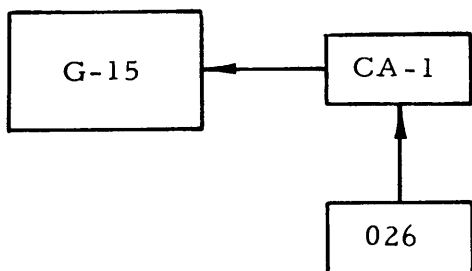
Note that there are two SKIP keys on the keyboard. One is to feed the card without punching; the other is to punch row 11. The skip key which puts a punch in row 11 is underscored, that is, SKIP.

Some columns on the program control card contain two punches. Where there is a combination of punches in a column, keys with alphabetic characters are typed and the NUM key is *not* depressed. The alphabetic character, the punches, and the meanings are listed below:

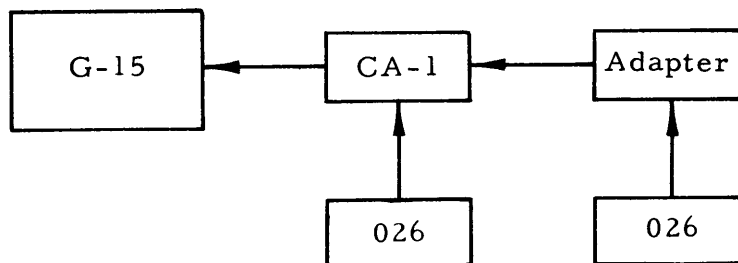
<u>Key</u>	<u>Rows Punched</u>	<u>Meanings</u>
A	Rows 12 and 1	Hold and Transfer 23 to 19
B	Rows 12 and 2	Hold and Tab
J	Rows 11 and 1	Start Skip and Transfer 23 to 19
S	Rows 0 and 2	Start Read and Tab

The CA-1 card coupler replaces the back panel of the IBM-026 unit. The output cable from the 026 plugs into the CA-1 chassis. To connect the coupler, turn off the computer and plug the JC cable from the CA-1 into the back receptacle in the G-15 marked CARD.

Plug the IBM-026 unit into a 115 volt, 60 cycle outlet capable of handling 15 amperes. (Do not use the 115 volt sockets in back of the computer.) Connect as shown in the diagram below:



If two IBM-026 units are to be connected, one to be used as a reader and the other as a punch, move the plug labelled "jump plug" in the CA-1 from the J2 to the J1 receptacle. Mount the CA-1 adapter to the back of the second 026 and connect the cable from the adapter to the JP plug in the CA-1. The units are then connected in the manner shown below:



The 026 unit may be used independently, in its standard manner of operation, by disconnecting the 026 output cable from the CA-1 and plugging the cable into the special receptacle provided for it in back of the 026.

INSTALLATION

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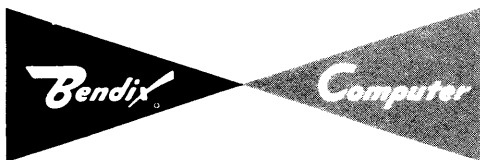
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