GENERAL ELECTRIC
COMPUTERS

GE-200 Series Punched Card Subsystems

CPB-302B

GE-200 SERIES PUNCHED CARD SUBSYSTEMS

REFERENCE MANUAL

January, 1964

Rev. August 1966

GENERAL ELECTRIC

INFORMATION SYSTEMS DIVISION

PREFACE

This manual supersedes the previous edition (CPB-302A), dated March, 1965. Changes are identified by a bar in the margin opposite the change.

Suggestions and criticisms relative to form, content, purpose, or use of this manual are invited. Comments may be sent on the Document Review sheet in back of this manual or may be addressed directly to Engineering Publications Standards, B-90, Computer Equipment Department, General Electric Company, 13430 North Black Canyon Highway, Phoenix, Arizona 85029.

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ILLUSTRATIONS

1. INTRODUCTION

GENERAL DESCRIPTION OF SUBSYSTEM EQUIPMENT

The compatible General Electric Information Processing Systems are designed to give the user versatility of operation in card subsystem equipment. There are three card readers and two card punches available with the GE-215, GE-225, and GE-235.

Card reading equipment reads information punched into tabulating cards in alphanumeric or binary modes and feeds it, through its controllers into the memory of the central processor for processing or storage. The user may choose the GE 1000 cpm card reader (Figure 1), the 400 cpm card reader (Figure 2), or the 300 cpm card reader (Figure 3) to meet his system requirements.

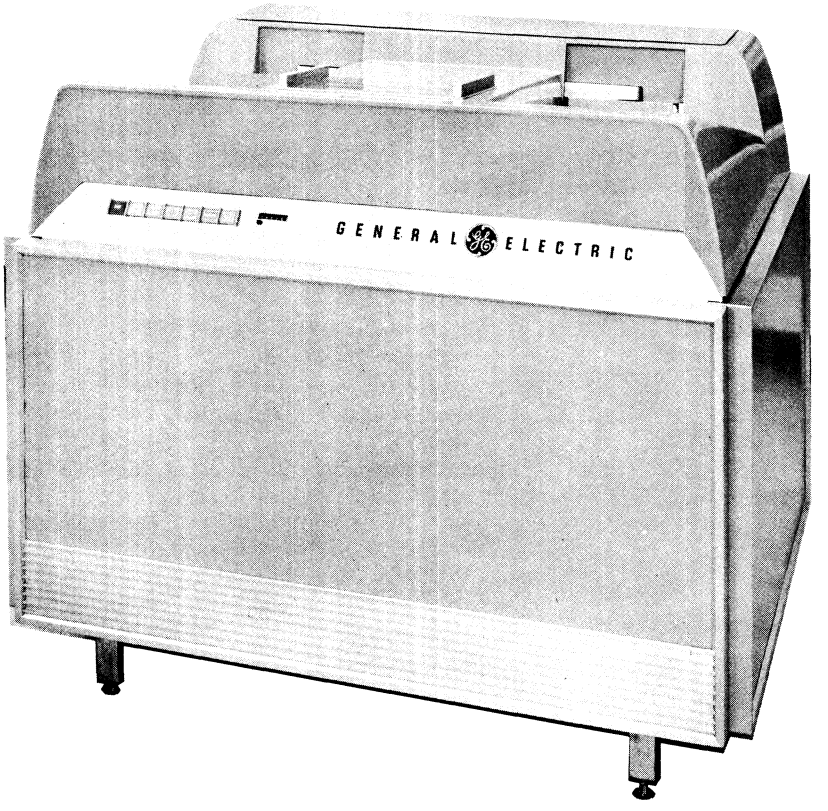


Figure 1. 1000 cpm Card Reader

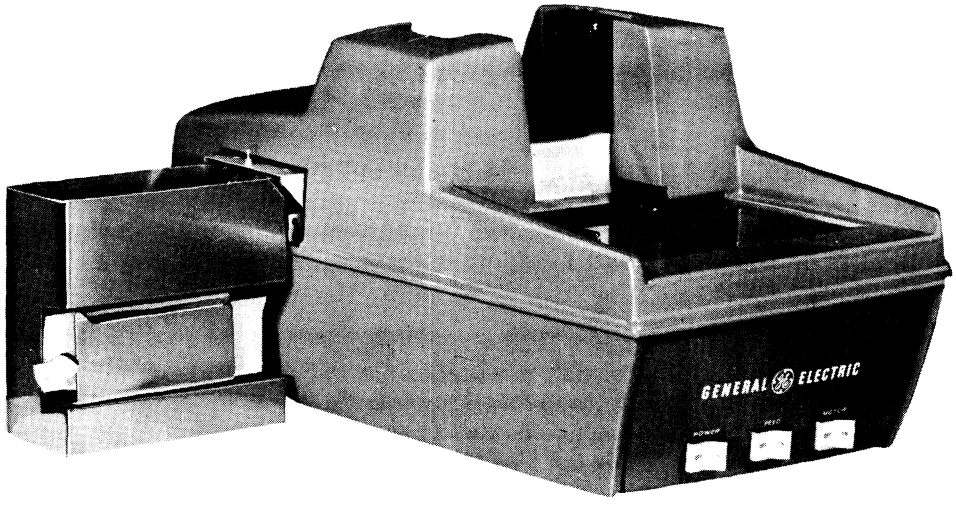


Figure 2. 400 cpm Card Reader

The card readers are engineered to:

- Handle either round-or-square-cornered cards, intermixed.
- Read cards punched in alphanumeric (binary coded decimal or Hollerith), 10-row binary, 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 input hopper, and full output stacker.

The 400 cpm card reader (when used with the GE-235) and the 1000 cpm card reader are also able to:

- Check for the presence of invalid characters
- Read alphanumeric and binary cards randomly mixed together.

In addition, the 1000 cpm card reader can check for the end of the file and card jams.

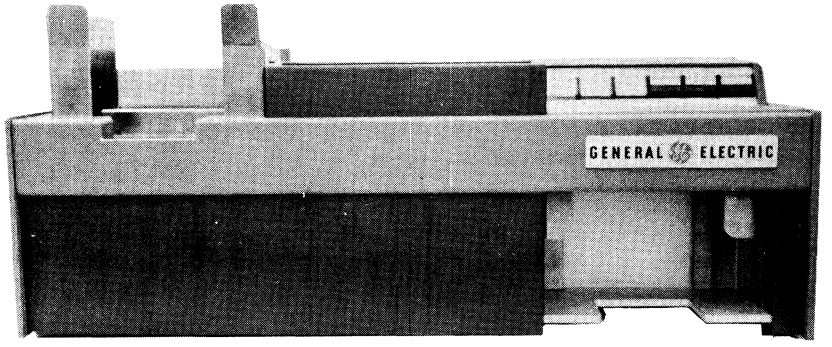


Figure 3. 300 cpm Card Reader

The 300 cpm card reader is able to:

- Read alphanumeric and binary cards randomly mixed together
- Check for card jams and end of file.

Card punching equipment permits information from the central processor to be recorded directly on cards under control of a stored program. The 300 cpm Card Punch (see Figure 4) and the 100 cpm Card Punch (see Figure 5) are available.

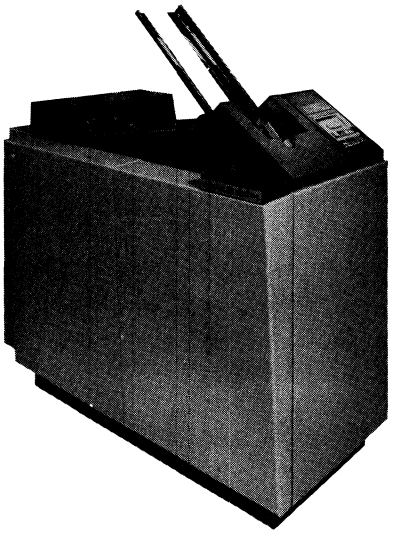


Figure 4. 300 cpm Card Punch

Both card punches are designed to:

- Punch cards in alphanumeric (binary coded decimal or Hollerith), 10-row binary, and 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.

In addition, the 300 cpm card punch can:

- Check punching accuracy by a read-after-punch hole count.

The 100 cpm card punch can:

- Check for incorrect double punches and blank columns.
- Operate off-line for gang punching.

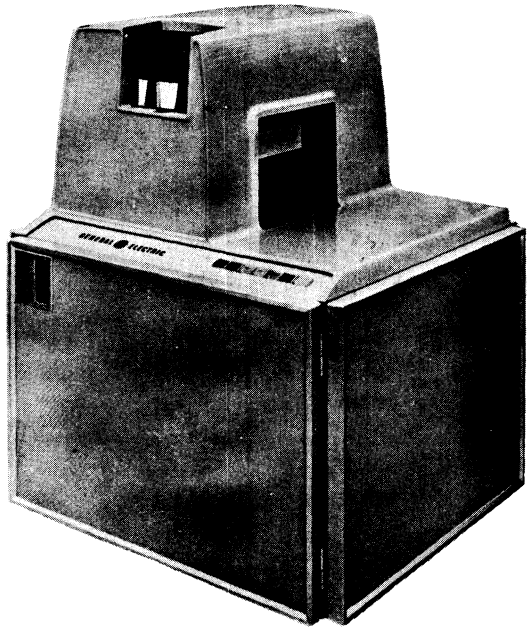


Figure 5. 100 cpm Card Punch

DETAILED DESCRIPTION OF SUBSYSTEM EQUIPMENT

Card Readers

The 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 station, and a card output stacker. The reading station is composed of a lamp and light-sensitive photocells. As a punched card passes between the lamp and the photocells, light is sensed where holes exist. Output from the photocells is fed to the logic of the card reader controller where the signals are converted to code and transferred to the memory of the central processor through the M-register.

A card reader is connected to the central processor through its controller. However, because card readers must have guaranteed access to memory while reading cards in order to prevent possible loss of data, they have the highest priority of all peripheral input-output devices. They do not operate through the controller selector.

The three card readers are compatible with each other in that programs written for the 400 cpm card reader can be run with the 300 or 1000 cpm card reader, even though the 400 cpm card reader does not indicate in its synchronization word a full stacker, empty hopper, malfunctioning photocell or card slippage condition. Indications of the conditions can be inhibited, causing the synchronization word generated by the 300 or 1000 cpm card reader to resemble that of the 400 cpm card reader. This is done by having the service engineer change the setting on a switch in module E of the card reader's controller. This switch should be in the NORMAL position when the card reader reads programs written for it; it is set to the SPECIAL position on those occasions when the 300 or 1000 cpm card reader is required to read cards for a program written for the 400 cpm card reader.

1000 CPM CARD READER

This free-standing unit has an input hopper and an output stacker, both with a maximum capacity of 2000 cards, which can be easily loaded and unloaded during operation. The reader has its own power supply, a blower source, and a vacuum source.

For applications involving large amounts of card input, this card reader can read continuously as high as 1500 cards per minute and up to 850 cards per minute under program-controlled demand. At the 1500-card-per-minute speed, card columns are read at the rate of one column every 500 microseconds. Thus, there are approximately 27 word times available for other processing and memory access between readings of adjacent card columns. During continuous read operations, the card reader uses only 3-3/4 percent of the available central processor time.

Card reading is initiated by a signal from the central processor. At this signal, a combination of a vacuum and riffle air move the cards from the input hopper to the reading station where 12 photocells operate simultaneously to read the card a column at a time. The photocells detect light passing through the holes punched in the cards and interpret it as data. The contents of each column are read into the card reader buffer and the logic then demands access to memory. The data is transferred to memory before the next card column is read by the photocells. From the reading station the card moves into the output stacker. (See Figure 6.)

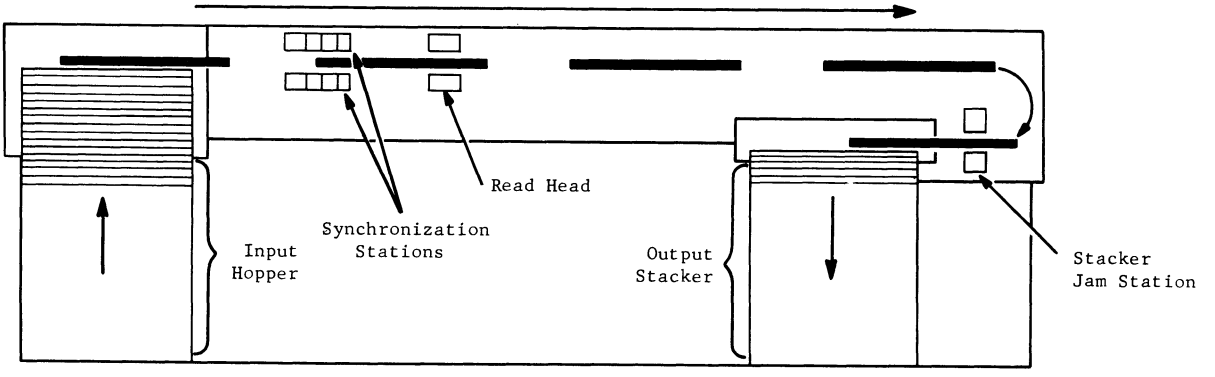


Figure 6. Feed Mechanism of 1000 cpm Card Reader
(Top View)

400 CPM CARD READER

This compact card reader is designed to sit on the desk top of the operator's console or on a separate free-standing table. The input hopper and output stacker each can hold up to 600 cards and can be easily loaded and unloaded during operation.

This card reader can read as many as 400 cards per minute when reading continuously into alternating input areas in memory. When feeding a single card at a time under program control, its speed is 320 cards per minute. At the 400 card-per-minute rate, one card column is read every 1875 microseconds. Thus, on the GE-235 there are approximately 309 word times available for other processing and memory access between reading of adjacent card columns. There are 103 word times available on the GE-225 and GE-215. During continuous read operations on the GE-235, the 400 cpm card reader uses only 3 percent of the available central processor time, leaving the other 97 percent available for other input-output or central processor operations; 99 percent of the central processor's time is available on the GE-225 and GE-215.

When the central processor gives the command to start feeding, the bottom card of the deck is moved forward into feed rollers which transport it onto the sensing platform. After a momentary pause, a pusher arm slides the card to the reading station, where it is read, a column at a time, by 12 photocells which interpret as data the light passing through the punched holes. The contents of each column are read into the card reader buffer, and the logic then demands access to memory. The data is transferred to memory before the next column is read by the photocells. When the card is approximately half read, the next card is started on its path through. After the card has moved completely past the photocells, it drops into the output stacker. (See Figure 7.)

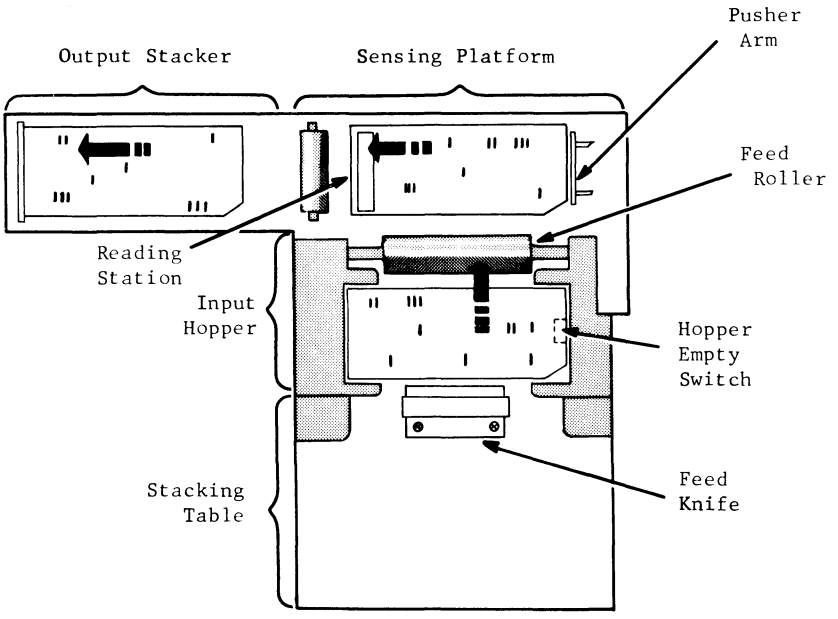


Figure 7. Feed Mechanism of 400 cpm Card Reader (Top View)

300 CPM CARD READER

This table model unit has an input hopper with a capacity of 500 cards and an output stacker with a capacity of at least 750 cards.

The card reader can read up to 360 cards per minute continuously and up to 300 cards per minute demand feeding. At the 360-card-per-minute speed, card columns are read at the rate of one column every 1200 microseconds. Thus, there are approximately 38 word times available for other processing and memory access between readings of adjacent card columns.

The reading of each card is initiated by an instruction from the central processing system, one instruction for each card to be read. The bottom card, separated from the rest of the deck by the picker knife, is pushed through the throat knife. As the card leaves the feed area, it engages a small tab on the clock belt and pushes the belt as it continues into the read area where 12 photocells read the card a column at a time. The 13th photocell picks up light through a series of holes in the clock belt which is being pushed by the moving card and generates clock signals.

From the reading area, the card moves into the output stacker.

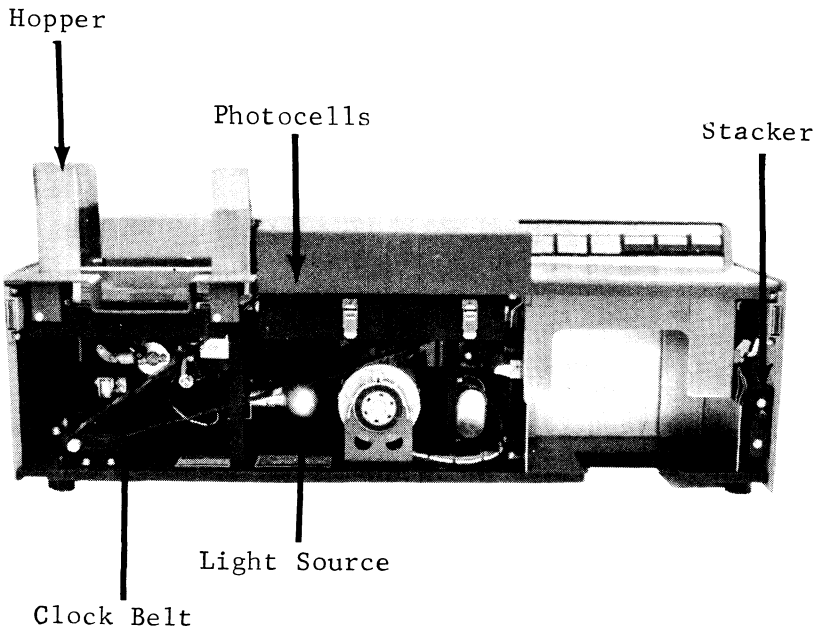


Figure 8. Feed Mechanism of 300 cpm Card Reader

Card Punches

Both the 100 cpm card punch and the 300 cpm card punch 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, and a card output stacker. The 100 cpm card punch can also operate off-line.

All information comes from memory through the M-register and the card punch controller to an 80 bit position buffer. A set of 80 dies, under control of the punch logic, punches cards a row at a time.

Since punching is accomplished independently of the central processor, other operations can occur simultaneously. The punches do not operate through the controller selector in accessing memory.

100 CPM CARD PUNCH

This card punch is a free-standing unit which can punch 100 cards per minute. It has an input hopper which holds 800 cards and an output stacker with a capacity of 750 cards. The punch uses a plugboard to check information and also to gang punch off-line. In addition, the plugboard permits a choice of formats in the location of information to be punched on the cards, as well as checking for double punching and blank columns in up to 30 pre-selected card columns.

Card fields can be arranged by program control as well as by plugboard.

When an instruction is given to begin card punching, the bottom card of the stack is pushed from the input hopper into the punching station. The 80 punching dies punch the card, a row at a time, starting with the 12-row. The card then moves into the reading station, where 80 wire brushes read it by sensing the presence or absence of holes. This information is sent to the plugboard and used for error checking or, in off-line operations, as input for the punching of subsequent cards. From the reading station the card enters the output stacker. (See Figure 9.)

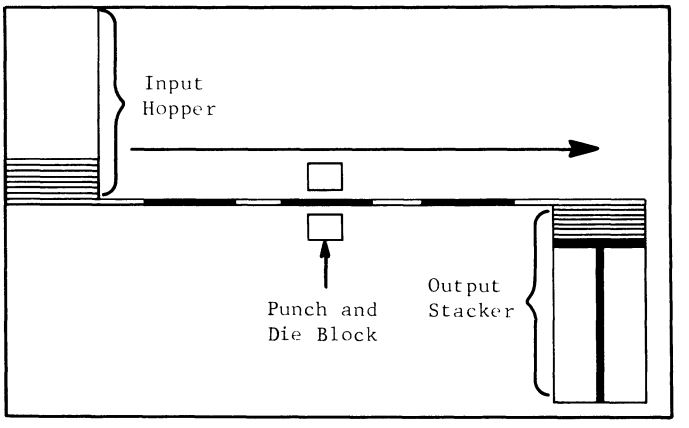


Figure 9. Feed Mechanism of 100 cpm Card Punch
(Right Side View)

300 CPM CARD PUNCH

This free-standing card punch operates on-line at the rate of 300 cards per minute. It does not function off-line except for product testing operations. It has an input hopper with a capacity of 3500 cards. The output stacker can contain a maximum of 3000 cards. Both the input hopper and the output stacker can be easily loaded and unloaded during operation. Card fields can be arranged by program control.

For maximum operating efficiency, this punch is designed so that it goes from an operate, or normal, status to a standby status (motors off but power on) if not called upon to punch cards within a specified period of time. The operate status is automatically reinstated as soon as another punch instruction is received.

When card punching is instructed to begin, the bottom card of the deck is pushed from the input hopper, through a feed mechanism, into position for punching. Cards are punched a row at a time, starting with the 12-row, by 80 punching dies. After the card is punched, it is moved to the reading station where 80 read brushes sense the presence or absence of holes and relay this information to the controller for verification. The card then goes into the output stacker. (See Figure 10.)

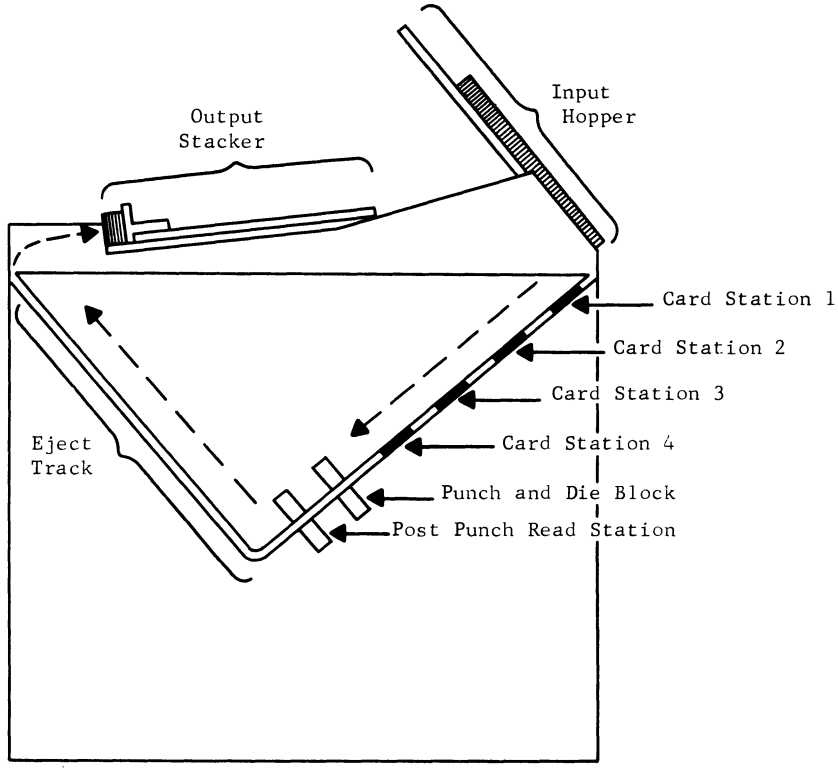


Figure 10. Feed Mechanism of 300 cpm Card Punch
(Left Side View)

CARD FORMATS

The standard punched card is 7-3/8 by 3-1/4 inches cut from .0070 inch paper card stock. For data representation, the card is divided into 80 vertical columns and 12 horizontal rows. The 12 rows are divided into two areas, zone and numeric. The zone area consists of rows 12, 11, and 0; rows 0-9 are the numeric area. Row 0 is common to both zone and numeric areas. (See Figure 11 below). Data is recorded by punching rectangular holes in one of three formats: alphanumeric (binary coded decimal or Hollerith), 10-row binary, and 12-row binary.

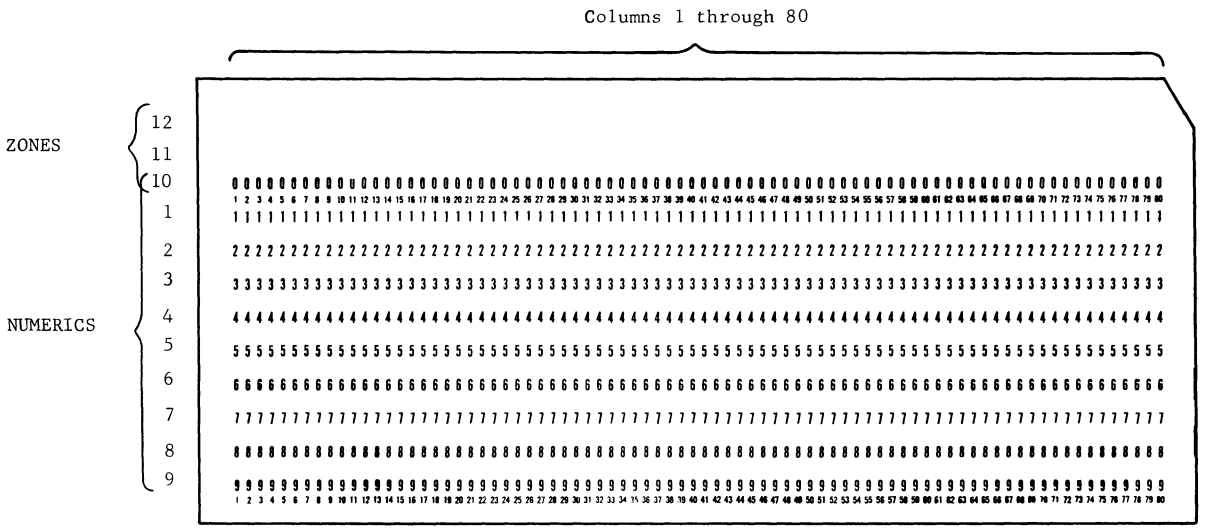


Figure 11. Standard Punched Card

Alphanumeric Format

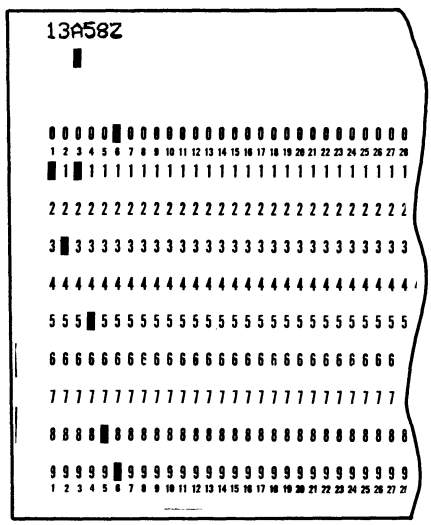
Data punched in the alphanumeric format is in Hollerith code, which can represent the 26 letters of the alphabet, the numerals 0-9, 28 special characters and punctuation marks, and blank spaces. Numerics are represented by a single punch per column. Alphabetics are represented by two punches per column, a zone punch and a numeric punch. Special characters consist of either two or three punches per column. See Figure 12 for a list of valid characters and their representation in Hollerith and BCD (binary coded decimal) codes.

Character	Hollerith (Row Punches)	BCD (Memory)	Character	Hollerith (Row Punches)	BCD (Memory)	Character	Hollerith (Row Punches)	BCD (Memory)
0	0	00	G	12-7	27	S	0-2	62
1	1	01	H	12-8	30	T	0-3	63
2	2	02	I	12-9	31	U	0-4	64
3	3	03	+0	12-0*	32	V	0-5	65
4	4	04	.	12-3-8	33	W	0-6	66
5	5	05	⊓	12-4-8	34	X	0-7	67
6	6	06	-	11	40	Y	0-8	70
7	7	07	J	11-1	41	Z	0-9	71
8	8	10	K	11-2	42	,	0-3-8	73
9	9	11	L	11-3	43	%	0-4-8	74
#	3-8	13	M	11-4	44	(	0-5-8	75
@	4-8	14	N	11-5	45	)	0-6-8	76
(Underline)	5-8	15	O	11-6	46	↑	2-8	12
=	6-8	16	P	11-7	47	↑	7-8	17
+	12	20	Q	11-8	50	Not Assigned	12-5-8	35
A	12-1	21	R	11-9	51	Not Assigned	12-6-8	36
B	12-2	22	-0	11-0*	52	Not Assigned	12-7-8	37
C	12-3	23	$	11-3-8	53	Not Assigned	11-5-8	55
D	12-4	24	*	11-4-8	54	Not Assigned	11-6-8	56
E	12-5	25	Space	Blank	60	Not Assigned	11-7-8	57
F	12-6	26	/	0-1	61	↓	0-2-8	72
							0-7-8	77

Note: With the GE-225 and GE-215, the 400 cpm card reader reads the 11-0 and the 11-2-8 punches as octal 52, and the 12-0 and the 12-2-8 punches as octal 32. With the GE-235, both the 1000 cpm card reader and the 400 cpm card reader treat the 11-2-8 and the 12-2-8 punches as invalid characters when the readers are performing the character validity check. The card punches will punch only 11-0 for octal 52 and 12-0 for octal 32.

Figure 12. Representation of Valid Characters in Hollerith and BCD Codes

Since each card column contains a single character, each card can hold 80 characters. As alphanumeric data is read from each card, each character is automatically converted into a 6-bit BCD code for storage in memory. Thus, three card columns, each containing one character, make up one memory word. Data from the first card column is read into bits 2-7 of the specified memory location, card column 2 goes into bits 8-13, card column 3 into bits 14-19. The unused bits (bits 0 and 1) are always zeros. (See Figure 13.)



Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1
Octal:	0		0			1			0			3			2			1		
			Column 1						Column 2						Column 3					

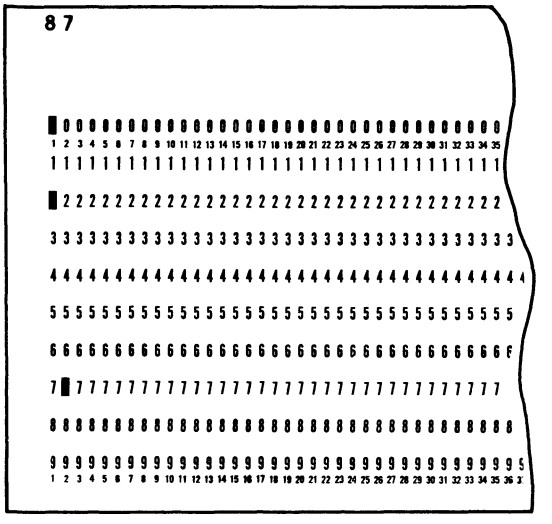
Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	1
Octal:	0		0			5			1			0			7			1		
			Column 4						Column 5						Column 6					

Figure 13. Memory Equivalent of Alphanumeric Card Data

One card can occupy a maximum of 27 memory locations, although the 27th location is not completely filled because it contains data from only two card columns (columns 79 and 80). The unused portion of this memory location (bits 14-19) is automatically filled with blanks.

10-Row Binary Mode

Card data appears in the 10-row binary mode exactly as it will be stored in memory, so no internal decoding and conversion is necessary. A punch in the card represents a binary 1 and no punch represents a binary 0. (See Figure 14.)



Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Column 1										Column 2									

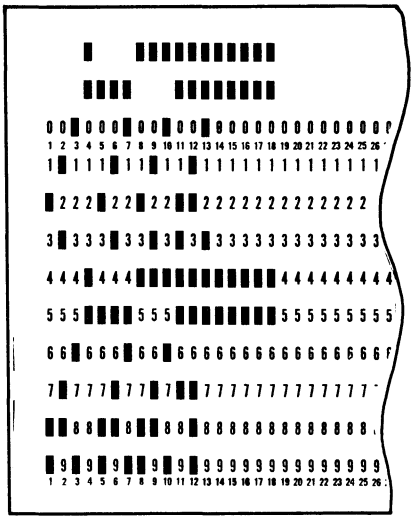
Figure 14. Memory Equivalent of 10-Row Binary Card Data

Only card rows 0-9 are used; thus two card columns fill one 20-bit memory location, and one card can fill up to 40 memory locations. Data from the first column is read into bits 0-9 of the specified memory location and data from the second column goes into bits 10-19 of the same location. When using this mode, the first card column of the pair required to fill one memory location (always an odd-numbered column) is considered to be the most significant of the two; the second (always an even-numbered column) is considered the least significant.

12-Row Binary Mode

The 12-row binary mode of data representation uses all 12 punching positions of the card and permits use of punched card output from other data processing systems. As with 10-row binary, data appears on the card exactly as it will be stored in memory; a punch represents a binary 1 and no punch represents a binary 0. (See Figure 15.)

Because one memory location contains data from only one card column, one card fills 80 memory locations. The 12 punching positions occupy the 12 least significant bits of the memory word, bits 8-19. Bits 0-7 do not contain data and are automatically set to zero.



Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
									Column 1											

Figure 15. Memory Equivalent of 12-Row Binary Data Card

2. PROGRAMMING

PROGRAMMING FOR CARDS

All card subsystem instructions, in their basic format, require two word times for the central processor to initiate action. However, since the compatible systems operate at different speeds, the amount of time covered by a single word time varies between the systems as follows:

System	Length of Word Time
GE-235	6 microseconds
GE-225	18 microseconds
GE-215	36 microseconds

When writing programs using card reader and card punch instructions, it may be helpful to the programmer to have detailed knowledge of the bit configuration of the instructions in case he wishes to use or interpret absolute coding. The significance of bits in a read card or write card instruction is shown below.

0 1 2 3 4	5 6	7 8	9 10 11 12	13 14 15	16 17 18 19
General Instruction Code	Programmed Address Modif.	I/O or Branch Code	Address	Zeros	Instruction Modification

General Instruction Code

The code indicating a general instruction is octal 25, which appears in memory in bit positions 0-4 as 10 101. This code designation is used with all input-output, test-and-branch, and data transfer instructions.

Programmed Address Modification

Bits 5 and 6 of the instruction are reserved for designation of address modification words:

Bits 5	6	
0	1	indicate address modification word 1
1	0	indicate address modification word 2
1	1	indicate address modification word 3

I/O or Branch Code

In bits 7 and 8 of the instruction appears the configuration to indicate whether it is an input-output or a test-and-branch instruction:

Bits 7	8	
0	0	indicate input-output instructions
1	1	indicate test-and-branch instructions

Address

Regardless of the mode of the punched card data, the starting address in memory into which it is read or from which it is extracted must be a multiple of 128 but less than 2048. Thus, the following memory locations can be used as starting addresses for card read and punch instructions:

Memory Location	= Octal Representation
0000	000
0128	200
0256	400
0384	600
0512	1000
0640	1200
0768	1400
0896	1600
1024	2000
1152	2200
1280	2400
1408	2600
1536	3000
1664	3200
1792	3400
1920	3600

Although location 0000 is technically a permissible starting address, it is normally reserved for other uses.

If the system contains the Automatic Program Interrupt feature and/or, on the GE-235, the AAU floating point trapping mode which make use of location 0128, the lowest address which may be used to read in card data is 0256. However, it is recommended, even in installations not having Automatic Program Interrupt or the floating point trapping mode, that memory location 0128 not be used as a card read-in or punch-out area because of the possibility of this feature being incorporated into the system at some future date.

To represent in binary the full octal equivalent of the available memory locations listed above requires 12 bit positions. However, since each of these addresses, when translated into binary, will always contain zeros in the first of the 12 positions as well as in the 7 last positions, the required memory address can be indicated by the use of only 4 bits, bits 9-12 of the instruction word. The bits of the instruction word containing zeros, bit 8 and bits 13-19, are thus available for other uses. Bit 8 is used, along with bit 7, to indicate whether the instruction is of the input-output or the test-and-branch type (see "I/O or Branch Code" on the previous page). The uses of bits 13-15 and 16-19 are described below.

Zeros

Bit positions 13-15 will always contain zeros.

Instruction Modification

Bits 16-19 indicate the specific read or write mode.

Bits 16	17	18	19	
0	0	0	0	represent the final 00 of the RCD instruction
0	0	0	1	represent the final 01 of the RCB instruction
0	0	1	0	represent the final 02 of the WCD instruction
0	0	1	1	represent the final 03 of the WCB instruction
0	1	0	0	represent the final 04 of the HLT instruction
1	0	0	0	represent the final 10 of the RCF instruction
1	0	1	0	represent the final 12 of the RCM instruction
1	1	1	1	represent the final 17 of the WCF instruction

For example, according to the above designations, an RCB instruction, with no address modification, to be read into memory location 0256 would appear as:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

A WCF instruction causing data to be read from memory location 0512, as modified by the contents of address modification word 1, would appear as:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	1	1	1	1

CARD READER PROGRAMMING

Input Instructions

Card input operations make use of the following five instructions.

HALT CARD READER

HCR	2500004	Word Times: 2

This instruction halts the feeding of cards into the card reader and is normally used following the continuous read instructions, RCD and RCB, when it is desired to read only one card at a time.

In most programs, it is easier for the programmer to read a card and halt than to read continuously. However, when the HCR command is used, the operating speed of the card reader decreases as shown below.

	Card Reader Speed (cpm)	
	Continuous	Noncontinuous
1000 cpm Card Reader	1500	850
400 cpm Card Reader	400	320

When the 300 or 1000 cpm card readers are operating in the continuous mode, a maximum of 37 milliseconds is available for processing between cards. If during a continuous read, an HCR command is given within 2 milliseconds after the sync (synchronization) word is set on the card just read, only one more card enters memory before the card reader halts.

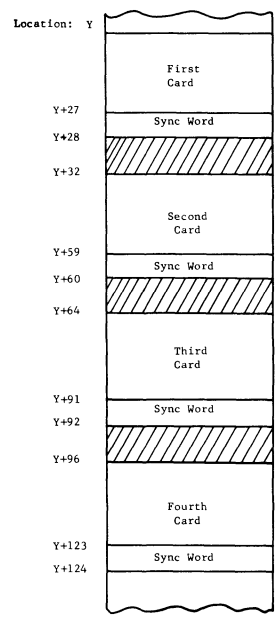
If the first half of a card is being read at the time that HCR is given, the reading of this card into memory will be completed, but no further cards will be read until another read instruction is given. If the second half of the card is being read and another card has entered the feed area, both the card being read and the card in the feed area will be read before the card feed stops. This instruction does not delay the central processor while the last card is being completely read; the program continues in sequence, and a delay must be programmed to insure that the data is in memory before attempting to use it.

READ CARDS DECIMAL

RCD	Y	250YY00	Word Times: 2

Cards punched in alphanumeric format are continuously read into memory starting at location Y. Once reading begins, it is continuous until the card reader is stopped by either a halt card reader (HCR) instruction, an empty input hopper condition, or a machine malfunction. The data of the first card enters locations Y through Y+26, the second enters Y+32 through Y+58, the third enters Y+64 through Y+90, the fourth enters Y+96 through Y+122. The fifth card enters the same memory location as the first card (Y through Y+26). After each card is read, the sign bit of the sync word (synchronization word) which is the first memory word after the last card data word (Y+27, Y+59, Y+91, or Y+123), is set to minus.

Five words of memory are automatically skipped after each area containing data from one card. In the following diagram, memory locations 0283 - 0287 are skipped between the first and second cards; locations 0315 - 0319 are skipped between the second and third cards; etc. The first word of each skipped group (locations 0283, 0315, 0347, and 0379) is for the sync word generated by the card reader. The sync word reflects the results of the checks made by the card reader. The last four locations of each skipped group may be used by the programmer for storage of constants or other program data.



Example: Read cards in the alphanumeric format into memory beginning at location 0256.

General Assembly Program Coding:

Symbol	Opr	Operand	X	REMARKS
1 2 3 4 5 6	8 9 10	12 13 14 15 16 17 18 19	20	31
	B C N			
	B R U	* - 1		
	R C D	2 5 6		
	H C R			
	B C N			
	B R U	* - 1		

Before a read instruction is given, a test is made to be sure that the card reader is ready (BCN). If the card reader is not in a ready status when the RCD instruction is given, the central processor halts and the C READER ECHO ALARM indicator on the GE-235 operator's console glows red to indicate an error. On the GE-225 and GE-215 consoles this condition is indicated when both the CARD READER and the ECHO ALARM indicators begin to glow.

After it has been determined that the card reader is ready, card reading begins. The card reader halts after reading each card. The contents of each card are stored in memory beginning with location 0256.

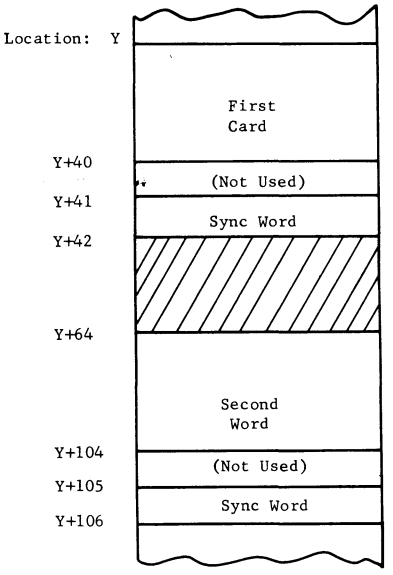
There are two methods of testing to determine when a card has been completely read. One method is by means of a BCN instruction (as shown in the above example). The other method of determining read completion is by testing the synchronization word (as shown below in the example accompanying the RCM instruction and further explained under "Special Considerations" at the end of this section). This second method is used when reading cards continuously since, in this mode of operation, the card reader is never in a not-busy state and a BCN, thus, would be meaningless.

READ CARDS BINARY

RCB	Y	250YY01	Word Times: 2

Cards punched in the 10-row binary format are continuously read into memory starting at location Y until a halt instruction (HCR) is given to stop reading. The data of the first card is read into memory locations Y through Y+39, the data of the second into Y+64 through Y+103. The data from the third card is read into the same memory locations as that from the first card (Y through Y+39), etc. With this instruction the first memory word following the last data word from each card (Y+40 and Y+104) is not used. The sync word is the second memory word following the last data word (Y+41 and Y+105) and its sign is set to minus after the card has been completely read into the memory area preceding it.

There is an area of 24 memory locations between the end of the first card area and the beginning of the second card area, as shown below. Of these 24 intervening locations, one is not used, one is the sync word, and the remaining 22 locations are available to the programmer for storage of constants or other program data.



Example: Read cards in the binary format into memory beginning at location 0256.

General Assembly Program Coding:

Symbol	Opr	Operand	X	REMARKS
1 2 3 4 5 6	8 9 10	12 13 14 15 16 17 18 19	20	31
	B C N			
	B R U	* - 1		
	R C B	2 5 6		
	H C R			
	B C N			
	B R U	* - 1		

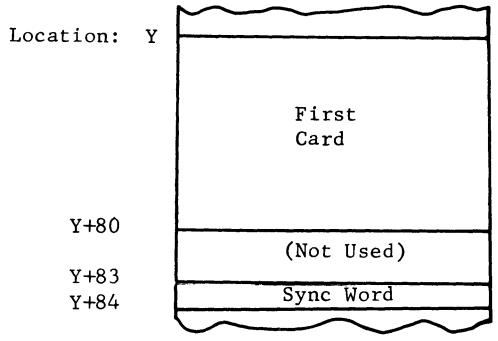
The BCN test is made first to determine whether or not the card reader is ready to begin reading. If it is not ready when the RCB instruction is given, the central processor halts and the C READER ECHO ALARM light (or the CARD READER and ECHO ALARM lights on the GE-225 and GE-215) on the operator's console glows red to indicate an error. The contents of each card are read into memory beginning with location 0256 and the card reader halts after each card. The BCN test is again used to determine when each card has been completely read.

READ CARDS FULL

RCF	Y	250YY10	Word Times: 2

Cards punched in the special 12-row binary format are read into memory beginning at location Y. The 12 punching positions of each column, starting with column 1, are placed in the 12 least-significant bit positions of successive memory locations. The data of the first card is read into memory location Y through Y+79. Data from the second card goes into the same locations. The card reader automatically halts after one card is read. If another card is to be read, another RCF instruction must be given.

With this instruction the first three memory locations following the last data word are not used, as shown below. The sync word appears in the fourth memory location following the last data word (Y+83) and its sign is set to 1 (minus) after the card has been completely read.



Example: Read cards in the special 12-row binary format into memory beginning at location 0256.

General Assembly Program Coding:

Symbol	Opr	Operand	X	REMARKS
1 2 3 4 5 6	8 9 10	12 13 14 15 16 17 18 19	20	31
	B C N			
	B R U	* - 1		
	R C F	2 5 6		
	B C N			
	B R U	* - 1		

First the BCN test is made to see that the card reader is ready to begin reading. If it is not ready when the RCF instruction is given, the central processor halts and the C READER ECHO ALARM light (or the CARD READER and ECHO ALARM lights on the GE-225 and GE-215) on the operator's console glows red to indicate an error. Each card is read into memory beginning with location 0256. In order to test for completion of card read (BCN), it is not necessary to first issue an HCR instruction since the card reader automatically stops after each card when the RCF instruction is given.

READ CARDS MIXED (This instruction is an option)

RCM	Y	250YY12	Word Times: 2

This optional instruction is available in the GE-235 with all card readers. In the GE-225 and GE-215 systems it is provided with the 1000 cpm card reader and with the 300 cpm card reader when it is using the high-speed controller. It enables the programmer to read randomly intermixed binary and alphanumeric 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 as containing alphanumeric data. If either or both of these two punches is missing, the card is read as a binary card. 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 alphanumeric punch configuration in column 1 for the special identifying 7 and 9 punches of a binary card. The first memory word from a binary card appears with bit 1 on. When using the RCM instruction, the card reader automatically halts after one card is read. If another card is to be read, another RCM instruction must be given.

General Assembly Program Coding:

Symbol	Opr	Operand	X	REMARKS
1 2 3 4 5 6	8 9 10	12 13 14 15 16 17 18 19	20	31
	B C N	*		
	R C M	C R D I N		
	L D A	C R D I N + 8 3		
	B P L			
	B R U	* - 2		

The above example shows typical coding with the use of the RCM instruction. After it is determined by use of BCN that the card reader is not busy, the RCM instruction is given to read a card in a mixed deck into the memory beginning at the location symbolically labeled CRDIN. After the card has been completely read, the sign of the sync word (bit position 0) in CRDIN+83 is set to 1 (minus). The programmer can determine when the card has been completely read by testing for a minus sign in this word.

A typical binary card with punches in the 7 and 9 positions of column 1 is shown in Figure 16.

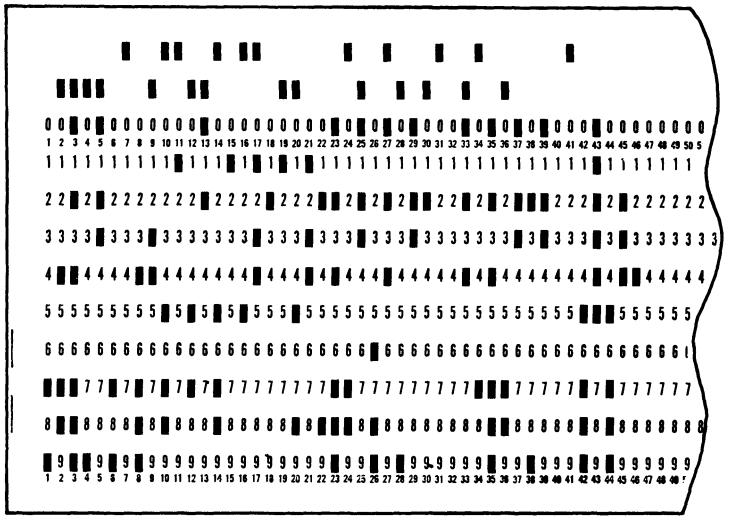


Figure 16. Binary Card for RCM Instruction

Test-and-Branch Instructions

The following instructions are provided to enable the programmer to determine whether or not the card reader is ready to receive a read card instruction. He can thus delay or perform other tasks until the reader becomes ready.

BRANCH ON CARD READER READY

BCR	2514006	Word Times: 2

If the card reader is ready to read cards and the input hopper is not empty, the central processor executes the next sequential instruction; if the card reader is not ready, the next instruction is skipped and the second sequential instruction is executed.

BRANCH ON CARD READER NOT READY

BCN	2516006	Word Times: 2

If the card reader is not ready to read cards or if the input hopper is empty, the central processor executes the next sequential instruction; if the card reader is ready, the next instruction is skipped and the second sequential instruction is executed.

The examples on the following page show typical use of these instructions.

Example 1: In this example, processing does not commence until the card is completely read and checked for accuracy. Where a card read operation is only an interruption of the main program, this approach would not be adequate.

General Assembly Program Coding:

Opr	Operand	X	REMARKS
8 9 10	12 13 14 15 16 17 18 19	20	31 75
R C D	B 4		READ CARD DECIMAL MODE
H C R			HALT CARD READER
B C R			TEST FOR COMPLETION OF READING
B R U	* + 2		BRANCH AND PROCESS CARD
B R U	* - 2		BRANCH BACK TO TEST UNTIL CARD IS READ
L D A	B 4 + 2 7		LOAD SYNC WORD
S U B	* + 4		SUBTRACT GOOD SYNC WORD IMAGE
B N Z			TEST FOR ERROR INDICATION
B R U	E R R O R		IF ERROR, GO TO ERROR ROUTINE
B R U	P R O C E S		IF NO ERROR, CONTINUE PROCESSING
O C T	2 6 0 6 0 7 7		

Example 2: Check to see that the card reader is ready, read a card, and delay further processing until card reader again becomes ready.

General Assembly Program Coding:

Opr	Operand	X	REMARKS
8 9 10	12 13 14 15 16 17 18 19	20	31 75
B C N	*		CHECK FOR CARD READER READY
R C D	C R D I N		READ CARD DECIMAL
H C R			HALT CARD READER
B C N	*		DELAY FOR COMPLETE CARD READ BEFORE
			FURTHER PROCESSING

Special Considerations

SYNCHRONIZATION WORD

Extensive checking of card reader operations accompanies the reading of each punched card. The results of these checks are stored in a specific memory location by the card reader logic. This check word is referred to as the synchronization word, or sync word.

Regardless of the mode in which a card is read, the logic of the card reader generates 84 read-pulses, even though only 80 columns of information are read from the card. Pulses 81, 82, 83, and 84 affect the bit configurations of the sync word and its location in memory differently depending upon the read mode.

When alphanumeric data is being read, the sync word appears in the first memory location following the last data word from the card. In the 10-row binary mode, the sync word appears in the second memory location following the last data word from the card. The 12-row binary mode has its sync word in the fourth memory location following the last data word.

The presence or absence of certain conditions within the card reader changes the status of specific bits in the sync word. By examining specific bits in the sync word, the program can identify what conditions occurred.

In the card readers, the following conditions are indicated in the sync word as shown:

Bit Position	Contents	Operating Condition
0	0	Card not yet completely read into memory.
0	1	Card is completely read into memory.
1	0	Input hopper contains cards.
1	1	Input hopper is empty.
18 *	0	Invalid characters exists.
18	1	All characters are valid.

*This check exists with both 400 and 1000 cpm card readers when used with the GE-235. With the GE-225 and GE-215 it is available only with the 1000 cpm card readers. The check of each column for invalid characters is made only in the decimal mode of operation with alphanumeric card formats. An invalid character is one other than shown in Figure 12. When an invalid character is detected, bit 0 of the word read is set to 1 in addition to the indication made in the sync word.

In addition, the 300 and 1000 cpm card readers are able to check for the following conditions.

Bit Position	Contents	Operating Condition
16	0	Output stacker is full.
16	1	Output stacker is not full.
17	0	There is a malfunctioning photocell or card slippage.
17	1	All photocells are functioning properly and there is no card slippage.
19	0	Input hopper is empty and EOF switch is set.
19	1	Input hopper is not empty or EOF switch is not set.

For example, on a normal read with no synchronization errors, the sync word appears as:

Decimal Mode:

Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	1	1	1	1
Octal:	2		6		0		6		0			7			7					

10-Row Binary Mode:

Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
Octal:	2		0		0		1		7			7			7					

12-Row Binary Mode:

Bits:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Octal:	2		0		0		7		7			7			7					

END-OF-FILE CARD

The EOF (end-of-file) card is one which, by programming convention, contains a special configuration of punches to indicate to the program that there are no more cards in the file.

Alphanumeric Deck

The recommended EOF card of a deck of cards containing alphanumeric data contains punches in rows 0, 7, and 8 of columns 1, 2, and 3, and has the code for the word END punched in columns 4 through 6. See Figure 17.

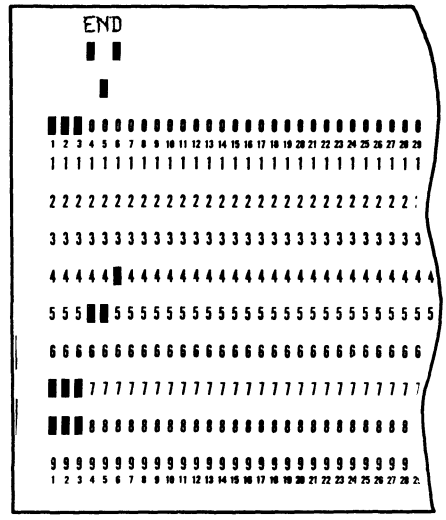


Figure 17. End-of-File Card for Alphanumeric Data

Binary Deck

For both 10-row binary and 12-row binary card formats, the recommended EOF card contains punches in rows 0 through 9 in columns 1, 2, and 3, and has the word END punched in columns 4 through 6. See Figure 18.

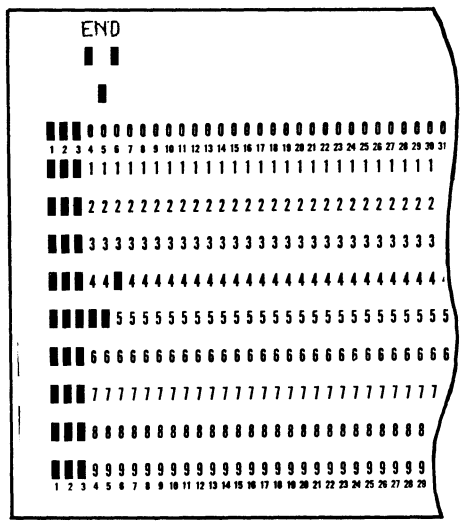


Figure 18. End-of-File Card for Binary Data

CARD PUNCH PROGRAMMING

Output Instructions

Card output operations make use of the three instructions given below. These instructions cause the punching of a single card, regardless of the punch mode. The card punch sets up and punches information on the card a row at a time with the 12-row first, then the 11-row, the 0-row, etc., and the 9-row last.

WRITE CARD DECIMAL

WCD	Y	250YY02	Word Times: 2

The information in memory locations Y through Y+26 is punched into a card in alphanumeric format. This instruction results in the three 6-bit BCD characters of each word in the memory punching area being converted into the equivalent alphanumeric code and punched into the card. Twenty-seven successive memory words are needed to fill one 80 column card. Bit positions 0 and 1 of each word are not punched.

If the card punch is not in a ready status when this instruction is given, the central processor halts and the C PUNCH ECHO ALARM (CARD PUNCH on GE-225 and GE-215) light on the operator's console glows red to indicate an error.

WRITE CARD BINARY

WCB	Y	250YY03	Word Times: 2

The information in memory locations Y through Y+39 is punched into a card in 10-row binary format. One 20-bit memory word occupies two 10-row binary card columns; thus, 40 consecutive memory words fill one card. Card rows 12 and 11 are not used.

If the card punch is not in a ready status when this instruction is given, the central processor halts and the C PUNCH ECHO ALARM (CARD PUNCH) light on the operator's console glows red to indicate an error.

WRITE CARD FULL

WCF	Y	250YY17	Word Times: 2

The information in memory locations Y through Y+79 is punched into a card in 12-row binary format. The 12 bits punched are the least significant bits of successive memory locations. Bit position 8 is punched in row 12 and bit position 19 is punched in row 9. In this mode, 80 consecutive memory words are needed to fill one card.

If the card punch is not in a ready status when this instruction is given, the central processor halts and the C PUNCH ECHO ALARM (CARD PUNCH) light on the operator's console glows red to indicate an error.

Test-and-Branch Instructions

Before punching a card, the punch must be in a ready status or a card punch error results and the central processor halts. The following instructions enable the programmer to determine whether the punch is ready.

BRANCH ON CARD PUNCH READY

BPR	2514007	Word Times: 2

If the card punch is in a ready status, the central processor executes the next sequential instruction. If the punch is not ready, the central processor skips the next instruction and executes the second sequential instruction.

BRANCH ON CARD PUNCH NOT READY

BPN	2516007	Word Times: 2

If the card punch is not in a ready status, the central processor executes the next sequential instruction; if it is ready, the central processor skips the next instruction and executes the second sequential instruction.

Card punching can be time consuming, and it is to the programmer's advantage to punch at maximum speed. When a punch instruction is given, a single card is punched. To punch at maximum speed, another punch instruction must be given within 10 milliseconds after completion of punching the previous card. Failure to meet this timing requirement causes the punching speed to slow to 50 cpm for the 100 cpm punch and to 150 cpm for the 300 cpm punch.

Example 1: Test for punch ready and punch card from symbolic memory address PUNCH.

General Assembly Program Coding:

Opr	Operand	X	REMARKS
8 9 10	12 13 14 15 16 17 18 19	20	31 75
B P N	*		DELAY UNTIL PUNCH READY
W C D	P U N C H		PUNCH HOLLERITH CARD

Example 2: Multiple punch areas can be used with the actual punching coming from one area while the other punch area is being loaded. Normally, a subroutine is written to accomplish punching. A sample routine is shown below.

General Assembly Program Coding:

Symbol	Opr	Operand	X	REMARKS	Sequence
1 2 3 4 5 6	8 9 10	12 13 14 15 16 17 18 19	20	31 75	76 77 78 79 80
P U N C H	B P N	*		TEST FOR PUNCH READY	5
	D L D	A R E A S		PUNCH AREAS	10
	S T A	* + 3		SET-UP PUNCH INSTRUCTION	15
	X A Q			EXCHANGE PUNCH INSTRUCTIONS	20
	D S T	A R E A S			25
	N O P			PUNCH CARD	30
	B R U	1	1	EXIT (SPB ENTRY USED)	35
A R E A S	W C D	3 8 4		PUNCH #1	40
	W C D	5 1 2		PUNCH #2	45

3. OPERATING PROCEDURES

CONSOLE OPERATIONS AFFECTING THE CARD SUBSYSTEM

Console Switches and Indicators

Besides the various switches and indicators on the card reading and punching equipment, there are others on the operator's console which have a direct bearing on the operation of the card subsystems. The consoles for the three compatible General Electric Information Processing Systems are shown in Figures 19 and 20. Throughout this section of the manual, wherever switch and panel markings vary slightly from system to system, the label for the GE-235 is given first followed, in parenthesis, by the corresponding one for the GE-225 and the GE-215.

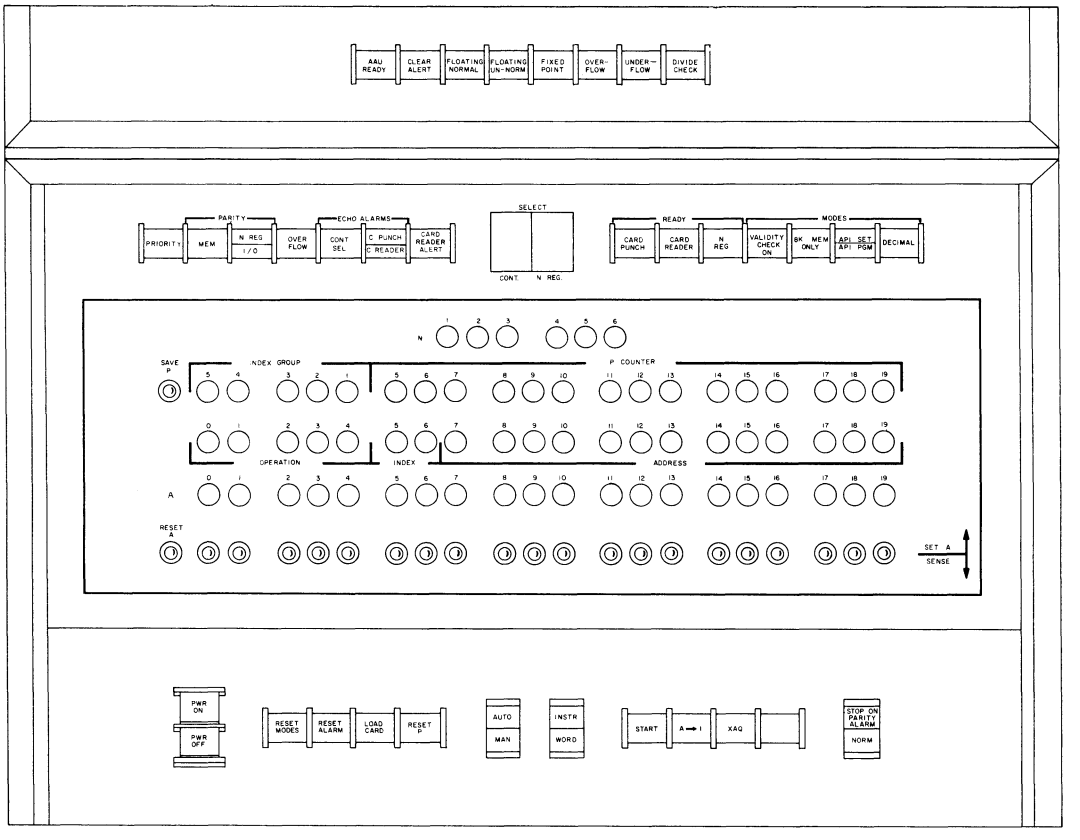


Figure 19. GE-235 Operator's Console

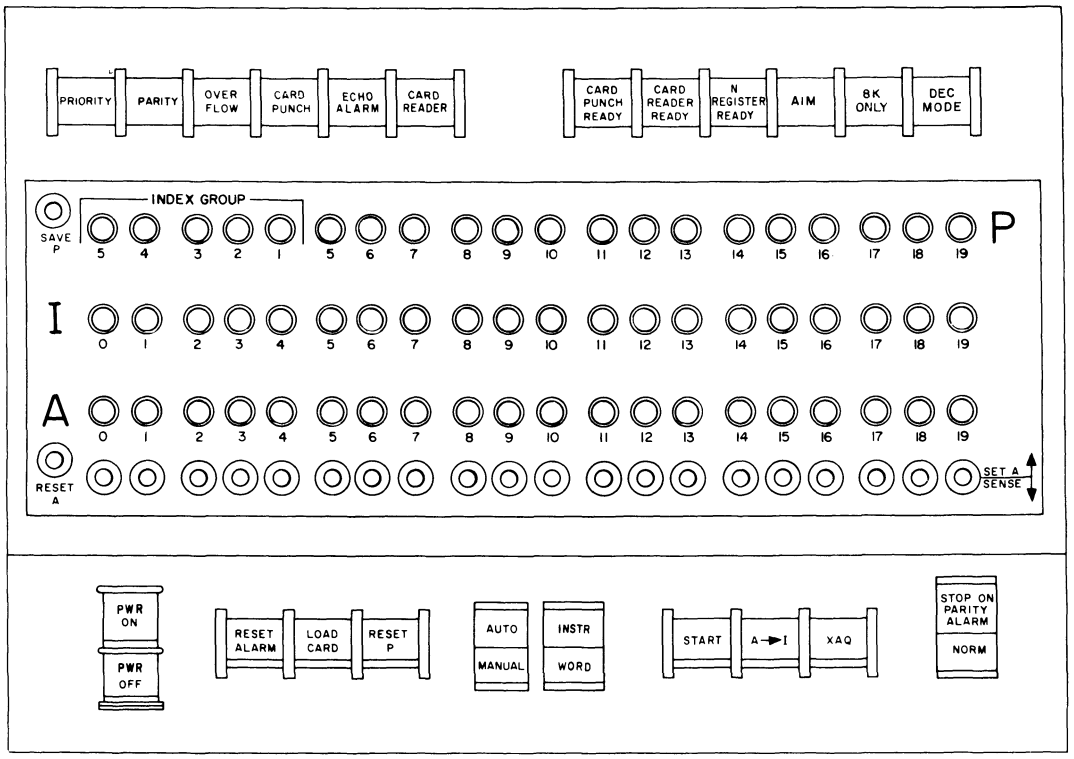


Figure 20. GE-225/GE-215 Operator's Console

PRIORITY Indicator

On the GE-235 the PRIORITY indicator glows amber (red on the GE-225 and GE-215) whenever a peripheral has access to memory and/or the central processor is in a halted condition.

MEM PARITY (PARITY) Indicator

The MEM PARITY (PARITY) indicator glows red whenever a parity error is detected in data being read from memory to the card punch. In this case, the I/O PARITY indicator also comes on. If the STOP ON PARITY ALARM switch on the console is on when this light glows, both the central processor and the card reading or punching stop.

I/O PARITY (PARITY) Indicator

The I/O PARITY (PARITY) indicator glows red when a parity error is detected on the controller selector data bus (read or write) or in a data word going from memory to the card punch.

Note: On the GE-225 and GE-215 a single indicator, PARITY, covers the conditions indicated by both the MEM PARITY and the I/O PARITY indicators on the GE-235.

Note: There are other conditions, not directly connected with card reading and punching, which also cause the above indicators to come on.

C PUNCH ECHO ALARM (CARD PUNCH) Indicator

The C PUNCH ECHO ALARM (CARD PUNCH) indicator glows red to indicate an attempt to execute a WCB, WCD, or WCF instruction when the card punch is not in a ready condition. The central processor halts when this light comes on. When this light glows, the CARD READER READY indicator always goes off. This alarm also causes the PRIORITY indicator to glow.

On the GE-235 this light and the C READER ECHO ALARM light form a split indicator.

C READER ECHO ALARM (CARD READER) Indicator

The C READER ECHO ALARM (CARD READER) alarm light glows red to indicate an attempt to execute an RCB, RCD, RCF, or RCM instruction when the card reader is not in a ready condition because there is no card positioned on the sensing platform or because the card reader is reading another card. When this light glows, the central processor halts, continuous feeding of cards stops, and the CARD READER READY indicator goes off. This alarm also causes the PRIORITY indicator to glow amber. When this condition occurs on the GE-225 or GE-215, both the ECHO ALARM and the CARD READER indicators are lighted.

On the GE-235 this light and the C PUNCH ECHO ALARM light form a split indicator.

CARD READER ALERT (CARD READER) Indicator

The CARD READER ALERT (CARD READER) alarm light glows red to indicate one of the following error conditions on either of the card readers:

1. Card reader is not turned on.
2. A card is not positioned on the sensing platform of the reader.

When using the 400 cpm card reader, this light also indicates the additional error conditions:

1. Input hopper of card reader is empty.
2. Stacker of card reader is full.
3. A misfeed or card jam has occurred.
4. A phantom feed is detected.

(When using the 1000 cpm card reader, these error conditions are indicated on the card reader's control panel.)

Note: On the GE-225 and GE-215 a single indicator, CARD READER, covers the conditions indicated by both the C READER ECHO ALARM and the CARD READER ALERT indicators on the GE-235.

ECHO ALARM Indicator

The ECHO ALARM indicator appears only on the GE-225 and GE-215. It glows red when the central processor's attempt to select a controller is unsuccessful because:

1. The controller is busy.
2. The controller is not connected to the proper channel.
3. The controller is in the off-line status.
4. There is a controller malfunction.
5. The controller's power is off.
6. A read instruction is given to the card reader when it is in a not-ready state.

Whenever this light comes on, the central processor halts and continuous feed on the card reader stops.

SELECT CON/N REG Indicator

The SELECT CONT/N REG display light is a feature of the GE-235 only. When the card reader or card punch are being accessed by the central processor, a CR or a CP appears on the left half of this lighted indicator.

CARD PUNCH READY Indicator

The CARD PUNCH READY indicator glows green to indicate that the card punch is ready to operate.

CARD READER READY Indicator

The CARD READER READY indicator glows green to indicate that the card reader is ready to operate.

VALIDITY CHECK ON Switch

The VALIDITY CHECK ON switch appears only on the GE-235 operator's console. When depressed, it glows white and enables the BCD validity check circuitry on the card reader.

RESET ALARM Switch

The RESET ALARM switch is effective only when the AUTO/MAN switch is in the MAN position. Depressing this switch turns off the alarm lights and resets flip-flops so that the central processor can continue operation. It does not clear the cause of the alarm.

LOAD CARD Switch

The LOAD CARD switch is effective only when the AUTO/MAN switch is in the MAN position. When depressed, it allows one card to be sent through the card reading mechanism. The contents of the card are read in 10-row binary mode into memory starting at location 0000. This switch provides a method for reading the first program card into memory in "bootstrap" operations.

RESET P Switch

The RESET P switch is effective only when the AUTO/MAN switch is in the MAN position. It clears the P-counter to zeros.

AUTO/MAN Switch

When the AUTO/MAN switch is placed in the MAN position, automatic processing of the program stops, the central processor halts, and continuous feed of cards ceases. This switch must be placed in the MAN position before the RESET ALARM and the LOAD CARD switches are depressed.

START Switch

In the automatic mode, depressing the START switch initiates action. After the operation begins, the program runs automatically and depressing the START switch again has no effect. In the manual mode, depressing the START switch causes the execution of one instruction or one word time, depending upon the setting of the INSTR/WORD switch.

STOP ON PARITY ALARM/NORM Switch

When the STOP ON PARITY ALARM/NORM switch is in the STOP ON PARITY ALARM position, any parity error which is detected causes the central processor to halt, the MEM PARITY (PARITY) light to glow red, and continuous reading of cards to stop. The PRIORITY indicator also glows amber when a parity error is encountered.

Locations	Control or Indicator	Function
Operator's Console	PRIORITY indicator (amber on GE-235, red on GE-225 and GE-215)	Indicates that a peripheral has access to memory and/or the central processor is halted.
	MEM PARITY (PARITY) indicator (red)	Indicates a parity error on data being read from memory.
	I/O PARITY (PARITY) indicator (red)	Indicates a parity error on data coming in from reader or going to the punch.
	C PUNCH ECHO ALARM (CARD PUNCH) indicator (red)	Indicates unsuccessful attempt to punch a card because card punch is not ready.
	C READER ECHO ALARM (CARD READER) indicator (red)	Indicates unsuccessful attempt to read a card because card reader is not ready.
	CARD READER ALERT (CARD READER) indicator (red)	Indicates that card reading was attempted while the card reader was not ready (not set up, busy, misfeed, or card jam).
	ECHO ALARM indicator (GE-225 and GE-215 only) (red)	Indicates central processor's unsuccessful attempt to select a controller. Continuous card feeding stops; central processor halts.
	SELECT CONT/N REG indicator.	Indicates which peripheral is being accessed by the central processor.
	CARD PUNCH READY indicator (green)	Indicates card punch is in a ready status.
	CARD READER READY indicator. (green)	Indicates that the card reader is in a ready status.
	VALIDITY CHECK ON switch. (GE-235 only)	Enables card reader BCD validity check circuitry.
	RESET ALARM switch.	Clears any alarm condition (AUTO/MAN switch must be in MAN position before this switch is effective).
	LOAD CARD switch.	Causes feeding and reading of one card (punched in binary format) into memory location 0000 (AUTO/MAN switch must be in MAN position before this switch is effective).
	RESET P switch.	Resets the P-counter to zero.
	AUTO/MAN switch.	Sets mode of operation to automatic or manual.
	START switch.	In automatic mode of operation, initiates continuous operation of central processor; in manual mode of operation, causes execution of one instruction.
	STOP ON PARITY ALARM/NORM switch.	Causes the central processor to halt when parity errors are detected in data coming from memory.

Figure 21. Summary of Operator's Console Controls and Indicators affecting Card Operations

CARD READER OPERATIONS

Operation of the three card readers, including a detailed discussion of controls and indicators, setup procedures, error conditions and operator corrective action, and special procedures, is given below.

Special Procedures

Reproducing Cards

When a card is damaged, it is necessary to replace it. Many times it may be desirable to reproduce the card on the spot even though this is not efficient use of system operation time. This is done as follows:

1. Place the card to be reproduced in position for reading at the feed throat of the input hopper, and place the feed plate against the card.

2. With the central processor in the manual mode, place in the A-register the instruction RCD (octal 2500000) for an alphanumeric card or RCB (octal 2500001) for a binary card. Transfer the contents of the A-register to the I-register by depressing the A→I switch.

3. Depress the START switch on the operator's console. The card reader will read that card into memory starting at location 0000.

4. Place in the A-register the instruction WCD (octal 2500002) to punch an alphanumeric card or WCB (octal 2500003) to punch a binary card. Transfer the contents of the A-register to the I-register and press the START switch. The card punch will punch a card from memory starting with location 0000.

5. Remove the reproduced card from the card punch and visually compare it to the original card by placing the two cards together and looking through the punched holes. If the new card is not correct, repeat the reproduction procedure. If a correct card is not produced after the third try, the original card probably cannot be read and must be reproduced by other means.

Reconditioning Cards

Mutilated cards should be replaced as soon as possible. However, cards may be reconditioned in an emergency. When the edges of a card are slightly damaged, they may be improved by rubbing them with the back of a fingernail or by drawing the card over the edge of the stacking table. When a card has been folded in a jam, it is difficult to straighten although this procedure may restore the card sufficiently to allow successful reading.

Caring for Cards

Cards are sources of precision data and must not be bent, folded, or otherwise damaged by improper handling, storage, or use. They should not be handled roughly or held together by rubber bands, paper clips, or staples. Every effort should be made to avoid getting dirt or moisture on the cards.

Inspect the deck for cards in poor condition and remove all those that are nicked, frayed, split, or warped, particularly on the leading edge. Replace these cards before processing begins.

One of the most important phases in the preparation of cards for the 400 cpm card reader is that of jogging the input deck. Many misreads and damaged cards can be avoided if the cards are put in the proper working condition before they are placed in the input hopper. Cards should be first riffled to eliminate static electricity. Place against the stacking table the number of cards which can be easily held in one hand. While holding the cards lightly with one hand, butt the leading edge of the deck against the table, and with the other hand gently slap the cards until their edges are aligned.

If a card deck is to be retained for rerun, it must be properly stored. This necessitates some method of keeping the card deck under pressure while in storage to prevent curling, buckling or bending. When cards are in a tray or open carton, keep them pressure blocked. Compressors are standard on card trays for this purpose. In open cartons, a piece of metal, wood, or folded cardboard may be used. For extremely small decks, the use of cardboard, cut slightly larger than the cards and bound with a rubber band will provide adequate protection. Cards and card cartons must be placed so the cards remain standing on edge while stored.

Temperature and humidity have a decisive effect on cards and should be constantly considered, especially when cards have been exposed to improper conditions during shipment or storage. High temperature may cause cards to become brittle and to tear or wear excessively while being read. Dryness can cause cards to flake or wear excessively. High humidity may cause cards to curl or warp.

Recommended conditions for cards in constant use are:

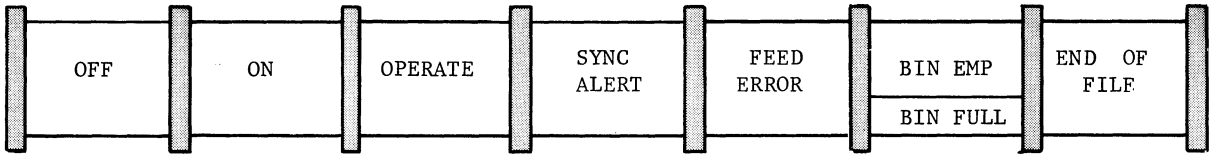
Temperature:	65-85 F.
Humidity:	40-60 percent

However, if the cards are stored in an area where the temperature and humidity differ greatly from that of the computer room, prior to use the cards must be conditioned at the proper computer room temperature and humidity. Actual conditioning time required depends upon the temperature and humidity of the area where the cards were stored or transported and the length of time the cards were exposed to the out-of-limits conditions. If cards were away from computer room conditions for more than 12 hours, they normally require 24 hours of conditioning; if for less than 12 hours, the conditioning time should be twice the time of exposure. The supply of blank cards must also be stored in areas of approximately the same relative humidity as the computer room. If this is not possible, at least a week's supply of cards should be kept in the computer area.

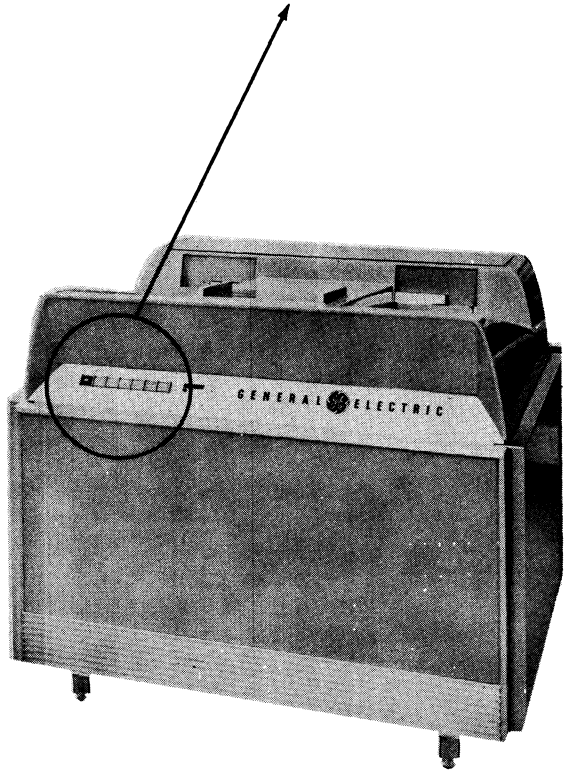
1000 cpm Card Reader

CONTROLS AND INDICATORS

The control and indicator panel for the 1000 cpm card reader is located on the left side of the front panel. (See Figure 22.)



CONTROL AND INDICATOR PANEL



OPERATE Switch and Indicator

When depressed, the OPERATE switch readies the circuitry for on-line operation of the card reader. When the equipment is ready, the color of this indicator changes from red to green.

SYNC ALERT Switch and Indicator

The SYNC ALERT indicator glows red to indicate a synchronization error or a malfunctioning photocell in the read area of the card reader. This light goes off when the next card is fed into the read area unless the program halts the equipment when a sync error is detected. In case of a programmed halt, the operator usually is provided with a corrective procedure to follow. The SYNC ALERT switch, when depressed, turns off the alarm indicator and causes cards to resume feeding.

FEED ERROR Indicator

The FEED ERROR indicator glows red to indicate that no card has been fed in response to a feed card instruction although there are cards in the input hopper. When this light comes on, the OPERATE indicator glows red and on the operator's console the CARD READER READY light goes off.

BIN EMP/BIN FULL Indicator

The upper half of the BIN EMP/BIN FULL split indicator glows red when the card input hopper is empty. The lower half glows red when the card output stacker is almost full. When the stacker becomes completely full, the OPERATE light glows red while, on the operator's console, the CARD READER READY light goes off.

END OF FILE Switch and Indicator

When depressed, the END OF FILE indicator glows amber and sends an EOF signal to the central processor when the last card in the deck is read. If this switch is not depressed, the equipment assumes that an empty input hopper condition does not indicate the end of the file and that more cards will be read as a part of that file.

The input and output areas of the 1000 cpm card reader contain other switches which normally are activated by the movement of the cards.

Hopper Empty Switch

The circuitry of the Hopper Empty switch is activated when the absence of cards in the input hopper relieves pressure against it. When enabled, it causes the card reader to halt, the BIN EMP and OPERATE indicators on the card reader to glow red, and the CARD READER READY light on the operator's console to go off.

Stacker Warning Switch

The Stacker Warning switch, when depressed by the increasing number of cards in the output stacker, causes the BIN FULL Indicator on the card reader to glow red while card reading continues.

Stacker Full Switch

The Stacker Full switch, when depressed by cards, indicates that the stacker has reached its capacity. It causes the card reader to halt, the OPERATE indicator on the card reader to glow red, and the CARD READER READY light on the operator's console to go off.

Stacker Riffle Air Switch

The Stacker Riffle Air switch, when activated by the cards, provides riffle air to prevent card damage.

Card Removal Mark

The Card Removal Mark indicates the point beyond which cards should not be removed from the output stacker while a deck is being read.

Figure 23 summarizes information on the 1000 cpm card reader controls and indicators.

Location	Control or Indicator	Function
Front of Card Reader	OFF switch	Turns off power to card reader.
	ON switch and indicator (amber)	Turns on power to card reader.
	OPERATE switch and indicator (green/red)	Readies circuitry for on-line operation.
	SYNC ALERT switch and indicator (red)	Indicates a malfunctioning photocell in the read area or a synchronization error.
	FEED ERROR indicator (red)	Indicates that program called for a card but no card was fed even though cards are in the input hopper.
	BIN EMP indicator (red)	Indicates that card input hopper is empty.
	BIN FULL indicator (red)	Indicates that card output stacker is full.
	END OF FILE switch (amber)	Sends end-of-file signal to the central processor when the input hopper becomes empty.
Top of Card Reader	Hopper Empty switch	Causes card reader and central processor to halt when input hopper is out of cards.
	Stacker Warning switch	Causes the BIN FULL indicator to warn of near-full output stacker.
	Stacker Full switch	Causes card reader and central processor to halt because output stacker has reached its capacity.
	Stacker Riffle Air switch	Activates air riffle in output stacker.
	Card Removal Mark	Indicates point in stacker beyond which cards should not be removed during a run.

Figure 23. Summary of 1000 cpm Card Reader Controls and Indicators

SETUP PROCEDURES

The card input and output areas of the 1000 cpm card reader are on the top surface of the equipment as shown in Figure 24 below.

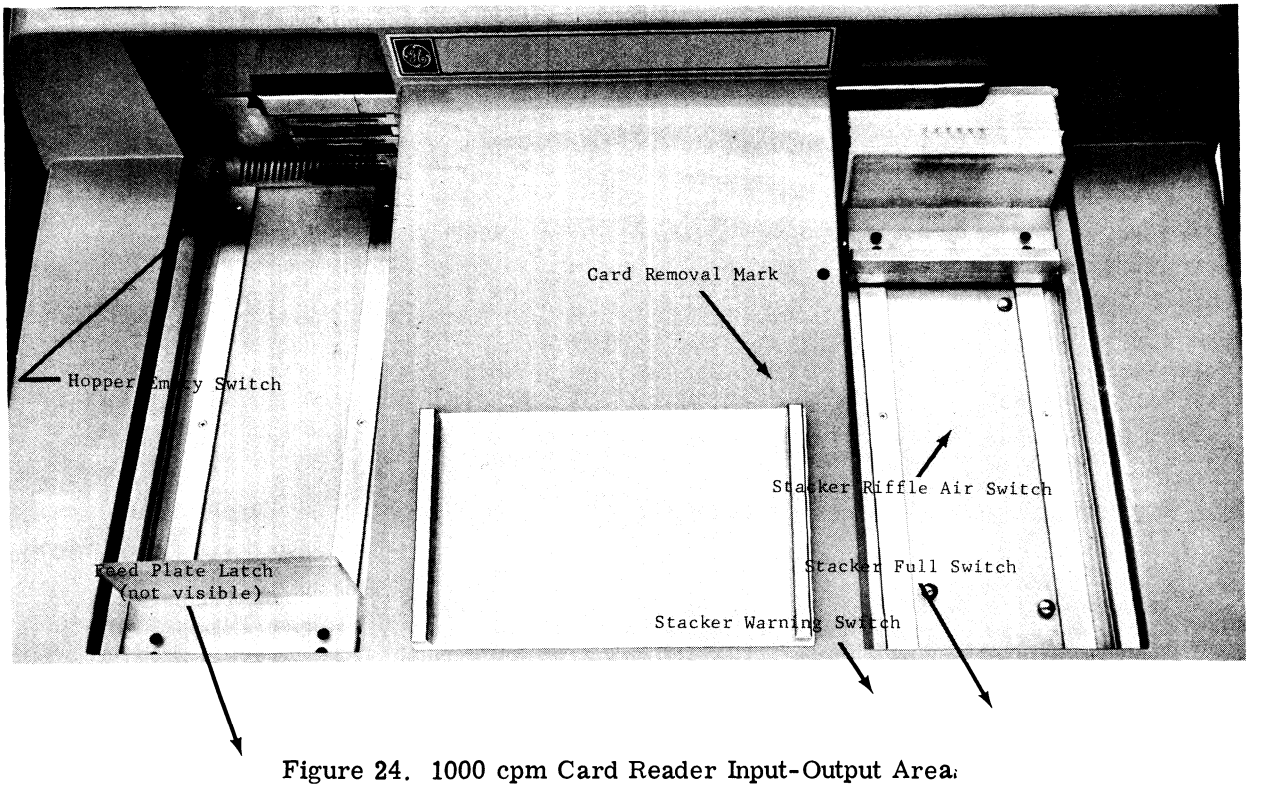


Figure 24. 1000 cpm Card Reader Input-Output Area

Reading Cards

Initiate card reading as follows:

1. Set the AUTO/MAN switch on the operator's console to the MAN position.

2. Depress the card reader power ON switch. After the indicator glows amber, wait approximately 6 seconds for the sound of the blowers before proceeding.

3. Load cards into the input hopper on the top left of the card reader as follows:

   a. Pull the input hopper's feed plate to the top of the hopper where it will be held by a magnetic latch. The BIN FULL indicator then glows red.

   b. Place the first card of the deck, standing upright and facing the back of the reader, so that its leading edge is in the feed throat and flat against the riffle air housing, thereby raising the Hopper Empty switch. If the first card is not loaded in this manner, a misfeed results.

c. Jog the cards to align them.

d. Place the card deck in the input hopper standing upright and facing the back of the card reader.

e. Gently slide the feed plate down against the card deck. If the plate snaps against the deck, the pressure may cause the first card to feed. When the plate is firmly against the cards, the BIN FULL indicator goes off.

4. If cards are loaded before the power is turned on, the entire deck may be loaded in the normal fashion. It is not then necessary to load the first card in the manner described in step 3b. above.

5. Check to see that the pusher plate of the output stacker rests against the output gate at the bottom of the area.

6. If the SYNC ALERT indicator is glowing red, depress it to turn out the light and clear the circuitry.

7. Depress the OPERATE switch. The OPERATE indicator glows green if the BIN EMP and BIN FULL indicators are not lit. This action also turns off the FEED ERROR indicator if it is on.

8. Check to be sure that the END OF FILE switch is set correctly. The END OF FILE indicator light should be off unless the programmer has specified that the switch be on after loading cards.

9. Follow the applicable procedure at the operator's console.

When loading a program deck, be sure that the first card of the deck is a loader card punched in binary format and that there are two blank cards at the end of the deck. Then follow the procedure below at the operator's console:

1. Depress the RESET ALARM switch.

2. Depress the RESET MODES switch (GE-235 only).

3. Depress the LOAD CARD switch. This loads the first card image into memory (in binary) beginning with location 0000.

4. Depress the RESET P switch.

5. Return the AUTO/MAN switch to the AUTO position.

6. Depress the START switch to begin automatic feeding of the cards under program control.

Adding Cards

Although the input hopper holds 2000 cards, it is sometimes necessary to add cards while the reader is in operation and the hopper is partially full. Cards should not be added if the card deck remaining in the input hopper is less than five inches thick since, if too few cards remain, they fall over at the feed gate when the feed plate pressure is released and cause a misfeed. Additional cards, with edges aligned, are placed in the input hopper in the same manner as the original cards except that the feed plate is not pulled back to its latched position. If the feed plate is latched during reading operations, card feeding stops, the OPERATE indicator on the card reader glows red, and on the operator's console the CARD READER READY light goes off.

After the last card of the program or data has been loaded, the END OF FILE switch may be turned on.

Removing Cards

When the card deck numbers more than 2000, it is necessary to remove cards while the program is running.

1. Slide the stacker plate back, but not far enough to depress the stacker warning and stacker full switches. If these switches are depressed, the BIN FULL and the OPERATE indicators on the card reader panel glow red, on the operator's console the CARD READER READY light goes off and the feeding of cards stops. To resume card reading, the OPERATE switch must be depressed.

2. Remove cards to, but not beyond, the red button on the inside edge of the stacker (labeled the "card removal mark" in Figure 24). This button indicates the point at which cards activate the stacker riffle air switch. Cards should be removed without exerting downward or forward pressure on the remaining card stack since this may cause a card jam.

3. Slide the stacker plate down until it rests against the remaining cards.

ERROR CONDITIONS AND OPERATOR CORRECTIVE ACTION

The various error conditions which may occur in the operation of the 1000 cpm card reader are:

1. Feed errors - A feed error occurs when there are cards in the input hopper and an instruction is given to feed, but the cards do not move.

2. Phantom feeds - When this occurs, a card passes through the reader although no instruction has been given for it to do so.

3. Read errors - A read error is indicated when there is incorrect timing and synchronization of a card or failure of a photocell.

4. Empty input hopper - There are no cards remaining in the input hopper.

5. Full output stacker - The output stacker has reached its capacity of 2000 cards.

6. Invalid characters - When the central processor is in the decimal mode of operation, an unauthorized character is found to appear in the punched configuration of the card.

7. Card jams - A card is blocked in its normal passage through the reader.

8. End of file - This check determines whether or not an empty input hopper condition indicates the end of the file or if more cards are coming.

The card reader will not operate properly and may cause a system halt under any one of the following conditions:

1. Failure to turn on card reader power.

2. Failure to depress the OPERATE switch.

3. Failure to set up deck correctly (superfluous cards, incorrect loader and transfer cards, no blank cards at end of deck).

4. Failure to align edges of cards.

5. Failure to release the feed plate of the input hopper.

6. Failure to clear the CARD READER ALERT (CARD READER) indicator on the operator's console by depressing the RESET ALARM switch.

In addition, the operator is usually responsible for correcting card jams (serious card jams are handled by the service engineer). Jams can result from either malfunctioning equipment or from cards in poor condition. Each time a card is read, a photocell checks the rate of its passage from the reading station to the gate of the output stacker. If the interval exceeds the normal 30 milliseconds, card feed halts and a jam condition is indicated by the FEED ERROR light on the card reader glowing red. The CARD READER READY light goes off. By using fingers only and working from outside the equipment, the operator may remove the jammed cards; at no time may sharp tools be used. The operator may clear most card jams in the 1000 cpm card reader in the following manner:

1. Remove the cover to the transport area by sliding the upper panel toward the back.

2. Locate the area of the jam. It will most likely be the read station or the output gate.

3. Remove the tension on the jammed card and the transport belt by pulling the hooks attached to the tension roller or rollers closest to the card. In this manner, the roller can be moved approximately 1/4 inch away from the belt, thus freeing the card.

4. Remove the cards or any pieces of cards.

5. If a card has been torn and there is any possibility that pieces of it remain in the transport area, move two or three cards by hand from the feed gate to the output gate. To do this, place a card in the mouth of the feed gate (from the input hopper) and move the transport belt by hand by turning the turn-around roller clockwise until the card has passed into the stacker. If the cards do not pass the length of the transport area freely, it means torn bits of a card remain, and a service engineer must be called to remove the card fragments.

A summary of error conditions and corrective action to be taken by the operator is given in Figure 25.

Error Condition	Possible Cause	Corrective Action
Reader feeds one card and halts.	Necessary loader card is not in deck or cards are out of order.	Add loader card or put deck in order. Reload cards and restart read operations.
CARD READER ALERT (CARD READER) indicator glows red, CARD READER READY indicator goes off, central processor halts.	There was a phantom feed.	Remove cards from stacker. Return to nearest restart point or to beginning of program.
FEED ERROR indicator on card reader glows red, CARD READER READY indicator on operator's console goes off, cards stop feeding.	There was a feed error.	Check and reposition card at feed gate. Unlatch feed plate if it is latched. Depress the OPERATE switch on card reader to resume card reading. This procedure may be repeated if card feed does not start.
	Card will not load because its leading edge is wrinkled.	Smooth edge of card. If it does not feed on next attempt, replace card with newly reproduced one, depress OPERATE, and continue reading cards.
SYNC ALERT indicator on card reader glows red, cards stop feeding.	Program calls for the system to stop on a sync alert.	Follow directions given by programmer for sync alerts. (There may be a typeout of directions.)
C READER ECHO ALARM (CARD READER and ECHO ALARM) and PRIORITY indicators on operator's console glow red, CARD READER READY indicator goes off.	Program tried to execute a read command while the reader was not ready.	Notify the programmer.
CARD READER READY indicator on operator's console goes off, on card reader BIN EMP and OPERATE indicators glow red (END OF FILE indicator may also glow), cards stop feeding.	Empty input hopper	Add cards to hopper, unlatch feed plate, and depress the OPERATE switch to continue reading cards.
FEED ERROR indicator on card reader glows red, CARD READER READY indicator on operator's console goes off, cards stop feeding, transport mechanism stops.	Card jam.	If possible, remove card causing jam, return program to nearest restart point or to the beginning.
BIN FULL and OPERATE indicators on card reader glow red, CARD READER READY indicator on operator's console goes off, cards stop feeding.	Full output stacker. Feed plate of input hopper was left in latched position.	Remove cards from output stacker to card removal point, unlatch stacker plate, depress OPERATE switch to resume card reading. Unlatch the feed plate and depress the OPERATE switch to continue reading cards.

Figure 25. Summary of 1000 cpm Card Reader Error Conditions

400 cpm Card Reader

CONTROLS AND INDICATORS

The three control switches of the 400 cpm card reader are located on its front panel. (See Figure 26.)

POWER ON/OFF

The POWER ON/OFF rocker switch, when in the ON position, turns on power to the card reader; however, this does not function unless the PWR ON switch on the operator's console is also on. When the OFF half of this switch is depressed, power is turned off.

FEED ON/OFF

The FEED ON/OFF rocker switch, when in the ON position, sets in motion the feed mechanism of the card reader and, if there are cards in the input hopper, causes the CARD READER READY light on the operator's console to glow green. The feed mechanism goes off when the OFF half of this switch is depressed.

MOTOR ON/OFF

The MOTOR ON/OFF rocker switch, when in the ON position, turns on the motor of the card reader. The motor is turned off when the OFF half of this switch is depressed.

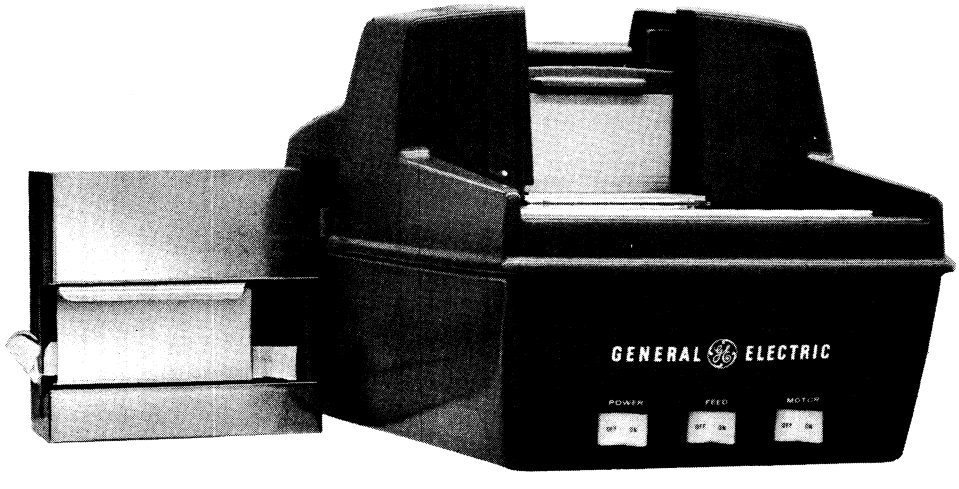


Figure 26. 400 cpm Card Reader

The input and output areas of the 400 cpm card reader contain switches which are normally activated by the movement of the cards.

Hopper Empty Switch

A Hopper Empty switch, located in the input hopper, halts the card reader and the central processor when there are no cards remaining in the hopper. On the operator's console the CARD READER READY indicator goes off and the CARD READER ALERT (CARD READER) indicator glows red.

Stacker Full Switch

A Stacker Full switch, located in the output stacker, halts the card reader and the central processor when the stacker becomes full. On the operator's console the CARD READER READY indicator goes off and the CARD READER ALERT (CARD READER) indicator glows red.

A summary of the functions of these controls is shown in Figure 27.

Location	Control or Indicator	Function
Front of card reader	Power ON/OFF switch	Turns power to card reader on or off (central processor power must be on before this switch is operable).
	Motor ON/OFF switch.	Turns card reader motor on or off.
	Feed ON/OFF switch.	Turns card reader feed mechanism on or off.
Inside input hopper	Input Hopper Empty switch.	Halts card reader and central processor when no cards remain in input hopper.
Inside output stacker	Output Stacker Full switch.	Halts card reader and central processor when stacker has reached its capacity.

Figure 27. Summary of 400 cpm Reader Controls

SETUP PROCEDURES

Reading Cards

Reading of cards with the 400 cpm card reader is initiated as follows:

1. Set the AUTO/MAN switch on the operator's console to the MAN position.
2. Place the reader's power switch in the ON position to turn on power.
3. Place the reader's motor switch in the ON position.
4. Place the reader's feed switch in the ON position.
5. Load cards into the input hopper as follows:

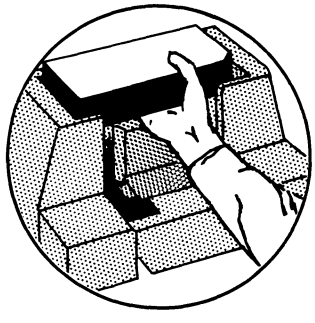
   a. Remove the weight from the card input hopper.

   b. Jog the cards to be sure that the edges are aligned.

   c. Hold the card deck tightly with one hand and riffle the cards with the other, both forward and backward, to remove static electricity which could cause the cards to stick and create a card jam.

   d. Again jog the cards to align them.

   e. Lower the card deck into the input hopper face down and with the top edge facing toward the operator, as shown below.



   f. Withdraw the hand quickly, allowing the cards to fall to the bottom of the hopper.

   g. Place the weight gently on top of the cards.

When loading a program deck, be sure that the first card of the deck is a loader card punched in binary format. There must be two blank cards at the end of the deck. The procedure at the operator's console is as shown on the following page.

1. Depress the LOAD CARD switch to move the first card.

2. Depress the RESET MODES switch (GE-235 only).

3. Depress the RESET ALARM switch.

4. Again depress the LOAD CARD switch. This loads the first card image into memory (in binary) beginning with location 0000.

5. Depress the RESET P switch.

6. Return the AUTO/MAN switch to the AUTO position.

7. Depress the START switch to begin automatic feed of the cards under program control.

Adding Cards

When a large number of cards must be fed for a single program, it may be necessary to add cards to a hopper partially full. This is done as follows:

1. Leave the weight off the cards after loading the initial deck into the input hopper. Use of this weight is not mandatory except when only a few cards remain in the hopper.

2. When the input hopper is partially empty, add more cards.

3. Add two blank cards to the final batch of cards loaded and replace the weight.

Removing Cards

For a large card deck, it may be necessary to remove cards while they are still being fed. If the output stacker becomes too full, the reader halts and the CARD READER ALERT (CARD READER) indicator on the operator's console glows red. Cards are removed from the output stacker by opening the swing-out card tray and lifting the card deck. (See Figure 28.)

ERROR CONDITIONS AND OPERATOR CORRECTIVE ACTION

The various error conditions which may occur in the operation of the 400 cpm card reader are:

1. Feed errors - A feed error occurs when there are cards in the input hopper and an instruction is given to feed, but the cards do not move.

2. Read errors - A read error is indicated when there is incorrect timing and synchronization of a card.

3. Empty input hopper - There are no cards remaining in the input hopper.

4. Card jams - A card is blocked in its normal passage through the reader.

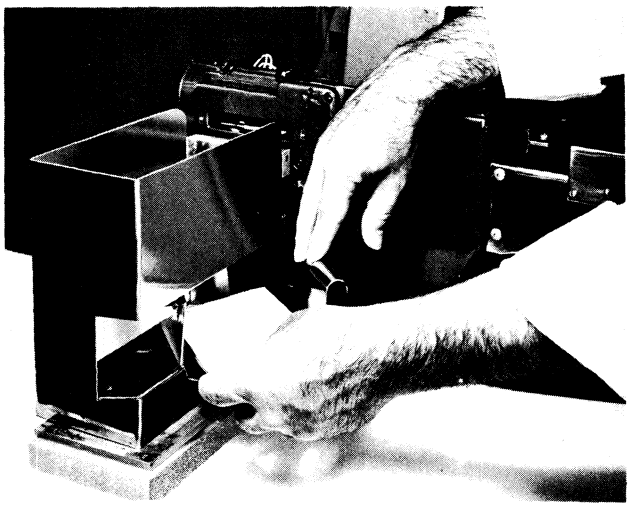


Figure 28. Removing Cards from 400 cpm Card Reader Output Stacker

The card reader will not operate properly and may cause a system halt under any of the following conditions:

1. Failure to turn on card reader power.
2. Failure to set up deck correctly (superfluous cards, incorrect loader and transfer cards, no blank cards at end of deck, deck not riffled).
3. Failure to align edges of cards.
4. Failure to insert weight in the input hopper when only a few cards remain.
5. Failure to clear the CARD READER ALERT (CARD READER) indicator on the operator's console by depressing the RESET ALARM switch.

In addition, the operator is usually responsible for correcting card jams. (Serious card jams are handled by the service engineer.) Jams can result either from cards in poor condition or from malfunctioning equipment and cause the CARD READER ALERT (CARD READER) light on the operator's console to glow red. The CARD READER READY light goes off. By using fingers only and working from outside the equipment, the operator may remove the jammed cards; at no time may sharp tools be used. Card jams in the 400 cpm card reader may occur at the feed throat, on the sensing platform, or in the read station.

1. Feed throat jams - The feed throat gap is adjusted such that one, and only one, card can be passed through the gap into the feed rollers. If the adjustment is not made properly or the leading edge of the card has been warped by humidity or frayed through improper handling, the card will not pass through the gap and a misfeed will result. Since a card was not fed onto the reading station, the next command to read a card results in a card feed error. The damaged card must be removed from the input hopper and reconditioned.

2. Sensing platform jams - If the feed rollers are out of adjustment, a card could be driven up into the support bracket and result in an accordion-folded card. Although two more cards may be jammed into the first one before the reader halts, the cards are usually still in a readable condition.

3. Read station jams - An obstruction blocking the path of the cards can cause jams between the read station and the output stacker. The operator's fingers can cause a jam if he reaches into the stacker while the reader is in operation. Jams at this point result in the necessity of forcibly removing the cards from the eject rollers. Caution must be exercised when removing cards from this area because leaving particles of card in the eject rollers or under the diodes can misalign the read mechanism. Partial disassembly by the service engineer may be required to clear this area.

A summary of error conditions and corrective action to be taken by the operator is given in Figure 29.

Error Condition	Possible Cause	Corrective Action
Reader feeds one card and halts.	Necessary loader card not in deck or cards out of order.	Put deck in order, reload cards, and restart read operation.
C READER ECHO ALARM (CARD READER and ECHO ALARM) and PRIORITY indicators on operator's console glow red, card reader stops, central processor halts.	Program tried to execute a read instruction when the reader was busy.	Notify programmer.
CARD READER ALERT (CARD READER) indicator on operator's console glows red, card reader stops.	Empty input hopper.	Load input hopper, press RESET ALARM switch, restart program.
	Full output stacker.	Empty output stacker. Press RESET ALARM and restart program.
	Card will not load because leading card edge is wrinkled, no card on sensing platform.	Smooth card and feed in manually or reproduce card, place new card in deck, press RESET ALARM, and restart reading operation.
	Insufficient weight on cards.	Add cards or put weight on deck, press RESET ALARM, and restart program.
	A misfeed has caused reader to miss a cycle (a card did not go through read station).	Check condition of card on sensing platform and replace if necessary, press RESET ALARM, and restart program.
	Card jam caused by mutilated card.	Pull out cards if possible, replace damaged cards, press RESET ALARM, recover or restart program.
	Operating switches on reader are off.	Turn on switches, press RESET ALARM, and start reading operation.

Figure 29. Summary of 400 cpm Card Reader Error Conditions

300 cpm Card Reader

The control and indicator panel for the 300 cpm card reader is located in the upper right corner of the unit. (See Figure 30.)

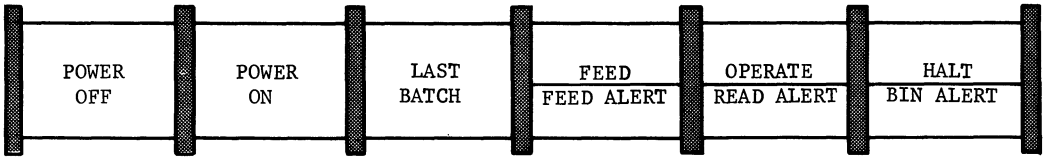


Figure 30. 300 cpm Card Reader Control and Indicator Panel

POWER OFF Switch and Indicator

Depressing this control turns off all a-c and d-c power to the card reader except the power to the control and electronics. This indicator is illuminated white when the control is pressed.

POWER ON Switch and Indicator

Pressing this switch starts all belts, pulleys, rollers, etc., moving, turns on the read lamp and the white POWER ON and red BIN ALERT indicators.

LAST BATCH Switch and Indicator

Depressing this switch signals the processing system that the next deck is the last of a series. The white indicator remains lit until the OPERATE switch is pressed.

FEED/FEED ALERT Switch and Indicator

Depressing the FEED switch allows the operator to control card feeding. Feeding continues only so long as the switch is depressed.

The red FEED ALERT indicator comes on when a card fails to feed on demand or a card jams in the feed, read, or transport areas.

OPERATE/READ ALERT Switch and Indicator

Depressing the OPERATE switch signals the processing system that the card reader is ready to accept a command. The white indicator comes on unless the input hopper is empty or the output stacker is full.

The red READ ALERT indicator comes on when the clock belt fails to move with a card, the read lamp is burned out, or no light reaches the photocell after a card has been processed.

HALT/BIN ALERT Switch and Indicator

Depressing the HALT switch stops operation of the reader and turns on the white HALT indicator.

The BIN ALERT indicator comes on if either the input hopper is empty or the output stacker is full.

The input and output areas of the 300 cpm card reader contain two switches which normally are activated by the movement of the cards and one safety switch.

Interlock Switch

This switch turns off all power to the reader when the top panel is raised.

Hopper Empty Switch

When the absence of cards in the hopper relieves pressure on this switch, the card reader halts and the red BIN ALERT indicator comes on.

Stacker Full Switch

When the height of cards in the stacker depresses the switch, the red BIN ALERT indicator comes on and card reading halts.

Control or Indicator	Function
POWER OFF switch and indicator	Turns off power to card reader.
POWER ON switch and indicator	Turns on power to card reader.
LAST BATCH switch and indicator	Indicates that the forthcoming deck is the last of a series.
FEED/FEED ALERT switch and indicator	FEED allows operator control of card feeding. FEED ALERT indicates feed failure or card jam.
OPERATE/READ ALERT switch and indicator	OPERATE readies circuitry for on-line operation. READ ALERT indicates belt, read lamp, or photocell failure.
HALT/BIN ALERT switch and indicator	HALT stops operation of the reader. BIN ALERT indicates hopper empty or stacker full.
Interlock Switch	Turns off power when top panel is raised.
Hopper Empty switch	Turns on BIN ALERT and halts reader.
Stacker Full switch	Turns on BIN ALERT and halts reader.

Figure 31. Summary of 300 cpm Card Reader Controls and Indicators

SETUP PROCEDURES

The card input and output areas of the 300 cpm card reader are on the top surface of the equipment as shown in Figure 32.

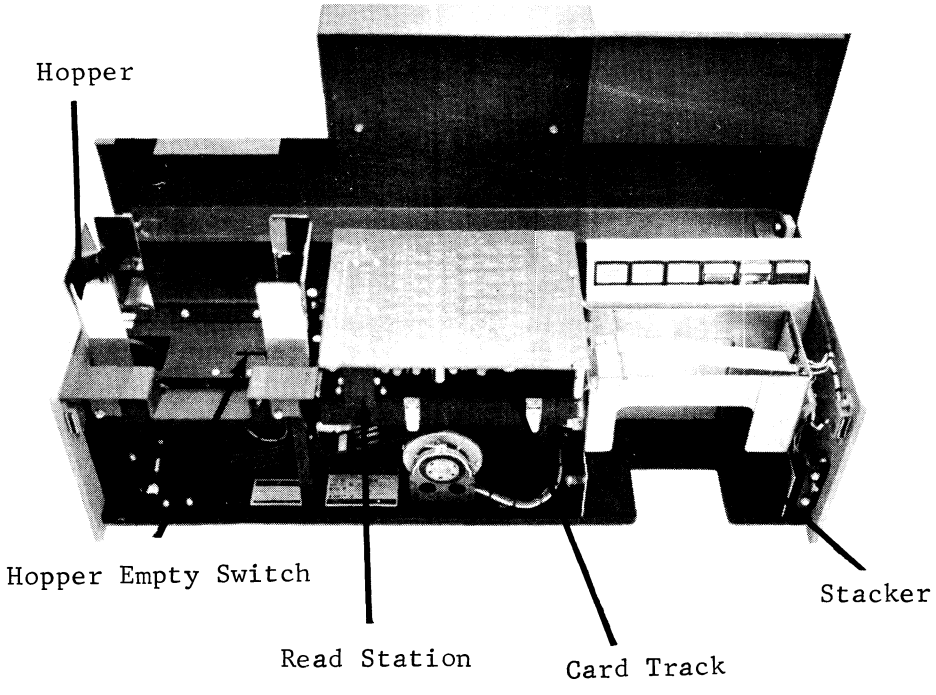


Figure 32. 300 cpm Card Reader Input-Output Areas

Reading Cards

To set up the card reader for operation, the operator follows the sequence below:

Press the POWER ON switch. The indicator comes on and the BIN ALERT portion of the HALT/BIN ALERT indicator lights red.

Load cards into the input hopper on the top left of the card reader as follows:

1. Take the card weight from the hopper and lay it aside.
2. Joggle cards on plate provided on top of the machine until all edges of the deck are even.
3. Load the deck into the hopper face down with column 1 to the operator's right. BIN ALERT indicator will go out.

4. Replace the card weight.

5. Be sure that the LAST BATCH switch is set correctly. This indicator should not be on unless the programmer has specified that it be on after the cards are loaded.

6. Press the OPERATE switch so that the OPERATE indicator comes on. If OPERATE does not come on, a condition exists in the card reader or processing system which must be corrected before reading can begin.

Adding Cards

If it becomes necessary to add cards while the machine is in operation, the procedure below should be followed:

1. Make certain that at least two inches of cards still remain in the input hopper before adding new cards. If less than two inches remain, go to step 3; otherwise, step 2.

2. Remove card weight and place additional cards, with edges aligned, in the input hopper in the same manner as the original cards. Care should be taken not to drop the new cards on the deck in process as an undue shock on the card being processed could cause a feed or read error.

3. When less than two inches of cards remain in the hopper, the card reader should be halted before more cards are added. This can be done by depressing the HALT switch. When the new cards have been added and the card weight returned to the hopper, resume operation by depressing the OPERATE switch.

Removing Cards

The stacker may be unloaded while the machine is running. Since the incoming cards settle at an intermediate level prior to dropping to the base area, the cards located on the base level may be removed at any time. When the cards are stacked higher than the wide opening at the bottom of the stacker pocket, it is necessary to pull the bottom cards outward, splitting the deck below the bottom of the two upper legs located in the pocket opening. The cards then remaining will drop to the lower stacker level. When unloading the machine after it has shut down, no cards should be left suspended at the upper intermediate level.

ERROR CONDITIONS AND OPERATOR CORRECTIVE ACTION

The various error conditions which may occur in the operation of the 300 cpm card reader are:

1. Feed errors - A feed error occurs when there are cards in the input hopper and an instruction is given to feed, but the cards do not move.

2. Read errors - A read error is indicated when there is incorrect timing and synchronization of a card, failure of a photocell, or failure of a read lamp.

3. Empty input hopper - There are no cards remaining in the input hopper.

4. Full output stacker - The output stacker has reached its capacity of 750 cards.

5. Card jams - A card is blocked in its normal passage through the reader.

The card reader will not operate properly and may cause a system halt under any one of the following conditions:

1. Failure to turn on card reader power.
2. Failure to depress the OPERATE switch.
3. Failure to set up deck correctly (superfluous cards, incorrect loader and transfer cards).
4. Failure to align edges of cards.
5. Failure to clear the CARD READER ALERT (CARD READER) indicator on the operator's console by depressing the RESET ALARM switch.

In addition, the operator is usually responsible for correcting card jams. Jams can result from either malfunctioning equipment or from cards in poor condition. The operator may clear most card jams in the 300 cpm card reader in the following manner:

1. Raise the cover to the transport area.
2. Locate the area of the jam.
3. Remove the cards or any pieces of cards.

A summary of error conditions and corrective action to be taken by the operator is given in Figure 33.

Error Condition	Possible Cause	Corrective Action
Reader feeds one card and halts.	Necessary loader card is not in deck or cards are out of order.	Add loader card or put deck in order. Reload cards and restart read operations.
FEED ALERT indicator on card reader glows red, CARD READER READY indicator on operator's console goes off, cards stop feeding.	There was a feed error.	Check and reposition cards. Depress the OPERATE switch on card reader to resume card reading. This procedure may be repeated if card feed does not start.
	Card will not load because its leading edge is wrinkled.	Smooth edge of card. If it does not feed on next attempt, replace card with newly reproduced one, depress OPERATE, and continue reading cards.
C READER ECHO ALARM (CARD READER and ECHO ALARM) and PRIORITY indicators on operator's console glow red, CARD READER READY indicator goes off.	Program tried to execute a read command while the reader was not ready.	Notify the programmer.
CARD READER READY indicator on operator's console goes off, on card reader BIN ALERT indicator glows red, cards stop feeding.	Empty input hopper.	Add cards to hopper and depress the OPERATE switch to continue reading cards.
FEED ALERT indicator on card reader glows red, CARD READER READY indicator on operator's console goes off, cards stop feeding, transport mechanism stops.	Card jam.	If possible, remove card causing jam, return program to nearest restart point or to the beginning.
BIN ALERT indicator on card reader glows red, CARD READER READY indicator on operator's console goes off, cards stop feeding.	Full output stacker.	Remove cards from output stacker to card removal point; depress OPERATE switch to resume card reading.

Figure 33. Summary of 300 cpm Card Reader Error Conditions

MAINTENANCE

Routine maintenance by the operator consists primarily of removing accumulated card dust by cleaning out the read station, transport mechanism, input hopper, and output stacker. The operator will also be called upon to replace the read lamp, clock belt, and large O-ring transport belt when required. All other maintenance procedures require the special skills and techniques of the service engineer.

Read Lamp Replacement

To remove the lamp, the operator should first wait until the lamp is sufficiently cool to allow handling. The lamp is then pressed into the socket and twisted counterclockwise to release it. Insert the new bulb by pressing on the bulb and twisting clockwise to lock it in place. (When the bulb is locked in place, the window should be facing upward.)

Clock Belt Replacement

The clock belt should be handled with care at all times, and new belts should be kept in a container that will prevent kinks or damage to webs or tabs.

To remove a worn belt, the transport cover is unlatched and lifted up to expose the belt. The tension device is relieved, and the belt is removed from the machine.

To install the new belt, thread it over the belt guide area on the frame with the tabs sticking out and the single row of punches in the belt nearest the operator. The lower left portion of the belt is slipped over the tension guide shaft, and the guide is slid to the far left.

The tabs in the transport area should fold to the left when the transport cover is closed. The tabs should be pressed down, if necessary, to assure following to the left. The cover is then closed and latched down. The belt is pulled through the transport to make sure it is not binding and to position the first tab presented to the card in a position just under the edge of the transport cover.

For a final check, the machine is turned on and the feed switch is used to feed a card through the machine. A single card should be cycled through the machine to check clock belt positioning each time that the clock belt is disturbed, such as when the transport cover has been opened.

O-Ring Transport Belt Replacement

To replace a transport belt, the transport cover is opened, and the belt is removed from the three pulleys on the frame. The belt is replaced in the reverse order.

CARD PUNCH OPERATIONS

Operation of both the 100 cpm card punch and the 300 cpm card punch, including a detailed discussion of controls and indicators, setup procedures, error conditions and operator corrective action, and special procedures, is given below.

100 cpm Card Punch

CONTROLS AND INDICATORS

The control and indicator panel for the 100 cpm card punch is on the right side of the front panel. (See Figure 34.)

POWER OFF Switch and Indicator

When depressed, the POWER OFF indicator glows red and turns off power to the card punch.

POWER ON Switch and Indicator

When depressed, the POWER ON indicator glows green and indicates that power to the card punch has been turned on. Before this switch is operable, both the plugboard and the chad box must be in place and properly adjusted.

MANUAL CYCLE Switch

When depressed, the MANUAL CYCLE switch causes cards to move forward one position without allowing the punching mechanism to operate. It is used chiefly to position cards in the punch prior to commencing the punching operation and to clear the last cards from the equipment after punching stops.

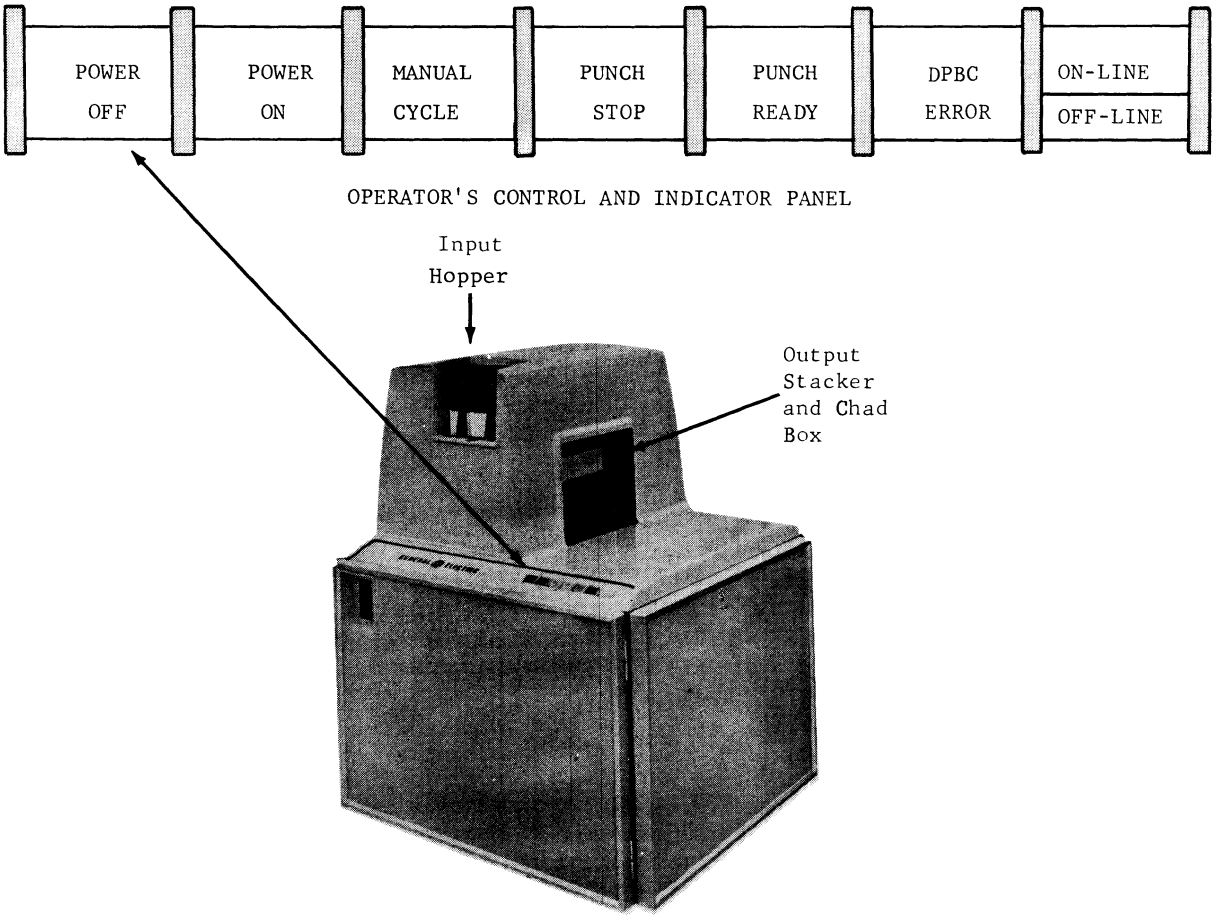


Figure 34. 100 cpm Card Punch Control and Indicator Panel

PUNCH STOP Switch

The PUNCH STOP switch, when held down, causes the punching mechanism to stop at the end of the current punching cycle. When punching stops, both the CARD PUNCH READY indicator on the operator's console and the PUNCH READY indicator on the card punch go off.

PUNCH READY Switch and Indicator

When depressed, the PUNCH READY indicator glows amber and indicates that the punch will continue to run as instructed by the program until one of the following conditions occurs.

1. Card punch input hopper is empty.
2. There is no card in the pre-read station.
3. There is no card in the punch station.
4. There is no card in the post-read station.
5. Card punch output stacker is full.
6. PUNCH STOP switch has been depressed.
7. There is a double punch or blank column (DPBC) error.

When the PUNCH READY indicator is lighted, the CARD PUNCH READY indicator on the operator's console glows green.

DPBC ERROR Indicator

The DPBC ERROR indicator, when it glows red, indicates the detection of an unauthorized blank column or double punch in an area of the card as defined by the plugboard. When this light comes on, the CARD PUNCH READY indicator on the operator's console and the PUNCH READY indicator on the card punch go off and card punching stops. The card containing the detected error is the top card in the output stacker.

ON-LINE/OFF-LINE Switch and Indicator

The ON-LINE/OFF-LINE divided switch sets and indicates the mode of operation as either on-line or off-line.

The input and output areas of the 100 cpm card punch contain switches which are normally activated by the movement of the card.

Hopper Empty Switch

A Hopper Empty switch, located in the input hopper, halts the card punch and the central processor when there are no cards remaining in the hopper. The CARD PUNCH READY light on the operator's console and the PUNCH READY indicator on the card punch both go off.

Stacker Full Switch

A Stacker Full switch is located in the output stacker of the card punch. When activated, it indicates that the stacker has reached its capacity of cards. The punch and the central processor halt and both the CARD PUNCH READY light on the operator's console and the PUNCH READY indicator on the card punch go off.

The plugboard is behind the swing-out front panel of the punch. (See "Special Procedures" for a detailed discussion of the plugboard.)

The functions of the controls and indicators of the 100 cpm card punch are summarized in Figure 35.

Location	Control or Indicator	Function
Front of card punch	POWER OFF switch and indicator (red)	Turns off power to the card punch.
	POWER ON switch and indicator (green)	Turns on power to the card punch.
	MANUAL CYCLE switch	Moves cards through the punch without allowing any punches to be made.
	PUNCH STOP switch	Holding this switch down stops the punch mechanism at the end of the current cycle.
	PUNCH READY switch and indicator (yellow)	Indicates a punch ready condition, and when depressed, causes the punch to run until an error condition occurs.
	DPBC ERROR indicator (red)	Registers absence of a punch or presence of an extra punch.
	ON LINE/OFF LINE switch and indicator (white)	Sets punch to either on-line or off-line mode of operation.
Inside input hopper	Hopper Empty switch	Halts card punch and central processor when hopper is out of cards.
Inside output stacker	Stacker Full switch	Halts card punch and central processor when stacker is full.
Beneath front panel	Plugboard	Provides a choice of card punching formats.

Figure 35. Summary of 100 cpm Card Punch Controls and Indicators

SETUP PROCEDURES

In the setup procedures given below for card punching, it is assumed that the central processor has been previously turned on. All controls and indicators mentioned are on the card punch control and indicator panel unless otherwise specifically stated.

On-Line Operation

On-line punching of cards with the 100 cpm card punch is initiated as follows:

1. Set the AUTO/MAN switch on the operator's console to the MAN position.

2. See that the chad box is correctly in place and install the correct plugboard. Most computer sites have several prewired plugboards for use with the most frequently used programs. The operator must know the stock of plugboards and the applications of each. If a prewired plugboard is not available for the program to be run, the operator must wire one. (See "Special Procedures.")

3. Depress the POWER ON switch.

4. Jog a deck of 50 to 100 cards so that they are all in line. If necessary, tap them with the palm of the hand until the top and bottom edges are smooth.

5. Firmly grasp the cards and, without letting them slip, lower them into the input hopper, face down and with the top edge of the card facing toward the punch.

6. After loading the number of cards desired into the feed hopper, replace the weight.

7. Depress the ON-LINE/OFF-LINE switch so the ON-LINE half of the indicator glows.

8. Depress the MANUAL CYCLE switch four times. This causes cards to be fed completely through the system so that the punch is ready to begin.

9. Depress the PUNCH READY switch. When it glows amber, control is returned to the central processor. Set the AUTO/MAN switch on the operator's console to the AUTO position. After the START switch is depressed, the punch is ready to operate as soon as it receives the first punching instruction from the program.

Off-Line Operation

The card punch may be used off-line to duplicate information on one card, usually called a header card, on a series of succeeding cards. The number of cards which may be punched with information from the header card is unlimited. This procedure is known as gang punching. Off-line punching is initiated as follows:

1. See that the chad box is properly in place and install the correct plugboard. If the proper plugboard is not available, it is necessary to wire one. (See "Special Procedures.")

2. Depress the POWER ON switch.

3. Place the header card to be duplicated in the input hopper, face down and with its top edge toward the punch.

4. Jog a deck of 50 to 100 cards so that they are all in line. If necessary, tap them with the palm of the hand until the top and bottom edges look smooth.

5. Firmly grasp the cards and without letting them slip, lower them into the input hopper face down and with the top edge of the card toward the punch.

6. After loading approximately 800 cards, check that the master card is as far back from the card throat as possible; that is, the bottom edge should be against the feed hopper posts.

7. Replace the card weight.

8. Depress the ON/LINE-OFF/LINE switch so the ON-LINE half of the indicator glows.

9. Depress the MANUAL CYCLE switch twice.

10. Depress the PUNCH READY switch. When it glows amber, the card punching operation starts.

Adding Cards

Although card punching is completely automatic, the operator should not allow the input hopper to become empty. To add cards lift the weight from the input hopper, place additional cards on top of those remaining in the hopper, and replace the weight.

If the operator neglects to add cards when necessary, the Hopper Empty switch automatically halts the punching operation. The operator must then add additional cards as necessary and depress the PUNCH READY switch to resume punching.

Removing Cards

The operator must also watch the output stacker of the card punch to prevent it from becoming too full. To remove cards the operator must depress the PUNCH STOP switch to halt punching operations, remove cards from the output stacker, and then depress the PUNCH READY switch to resume punching.

If the operator neglects to remove cards when necessary, a stacker full switch automatically halts the punching operation. The operator must then remove cards as necessary and depress the PUNCH READY switch to resume punching.

When card feed has been completed for any particular program, the last three cards must be removed from the punch manually. This is true of both on-line and off-line operations. The procedure for this is as follows.

1. If in the on-line mode of operation, set the AUTO/MAN switch on the operator's console to the MAN position.

2. Remove cards from the input hopper.

3. Depress the MANUAL CYCLE switch four times to clear the last card from the punch. CAUTION: Do not hold the MANUAL CYCLE switch down for continuous feed, but hit it quickly four times. Holding this switch down may cause a card jam.

4. Remove cards from the stacker.

ERROR CONDITIONS AND OPERATOR CORRECTIVE ACTION

The various error conditions which may occur in the operation of the 100 cpm card punch are:

1. Feed errors - A feed error occurs when there are cards in the input hopper and an instruction is given to feed, but the cards do not move.

2. Read errors - When operating in the decimal mode, unauthorized double punches and blank columns are detected.

3. Empty input hopper - There are no cards remaining in the input hopper.

This card punch will not operate properly and may cause a system halt under any of the following conditions:

1. Failure to depress the POWER ON switch on the card punch.

2. Failure to load a sufficient number of cards into the input hopper.

3. Failure to clear the C PUNCH ECHO ALARM (CARD PUNCH) indicator when it glows red.

4. Failure to insert correct plugboard.

5. Failure to empty chad box when full, or to insert it properly into the punch.

6. In off-line operation, failure to remove all cards from the punch prior to initiating action.

7. In off-line operation, failure to place the card to be reproduced in front of the deck.

It is also possible that a program error may halt card punching operations. This occurs when a card punch instruction is given while the punch is already busy punching another card and the C PUNCH ECHO ALARM (CARD PUNCH) indicator comes on. At such times the operator should consult his run book or other instructions and notify the programmer.

In addition, the operator is usually responsible for correcting card jams in the input hopper or the output stacker. If the operator can see the card causing the jam, he should try to remove it. He should also try to be sure that all pieces of torn cards are removed. At no time should implements or sharp tools be used to clear a jam. When the jam is apparently corrected and cards still do not feed through the punch, the service engineer must be called.

The operator should also frequently observe the output stacker of the card punch to see that cards are proceeding satisfactorily through the equipment and are not caught in an internal jam. The only indication of an internal jam may be the fact that cards go in but do not come out. The service engineer must be called to clear all internal jams.

A summary of error conditions and corrective action to be taken by the operator is given in Figure 36.

SPECIAL PROCEDURES

Plugboard Wiring

The 100 cpm card punch uses a plugboard for its information-checking and gang punching functions. The plugboard is designed to give a wide choice of format in the location of punched information on cards. Through use of the plugboard it is possible to:

1. Route information from the central processor to any selected field on the card.

2. Check up to 30 preselected card columns for unauthorized double punching (a single card column of data is punched twice).

3. Check up to 30 preselected card columns for unauthorized blank columns.

4. Repeat any field of information on each succeeding card.

The plugboard is divided into eight areas, seven of which have a unique function in controlling overall punch operation.

1. COMPUTER EXIT - These top four rows of the plugboard contain hubs that carry the information output of the central processor. Each of these 80 computer-exit hubs corresponds to a card column output line from the computer.

2. PUNCH MAGNET ENTRY - The next four rows of hubs connect directly into the punch magnets in on-line or off-line operations. The hubs correspond to the 80 columns of a card.

3. READ BRUSH EXIT - This third group of four rows contains the output of the punch reading station brushes. These hubs serve as the input source for the off-line and card information checking functions.

Error Condition	Possible Cause	Correction Action
POWER ON switch on card reader glows green only as long as it is depressed.	Plugboard not in holder.	Insert proper plugboard.
	INTERLOCK hubs of plugboard are not wired together.	Wire INTERLOCK hubs 1 and 2 together.
	Chad box is not properly positioned in card punch.	Reposition chad box.
PUNCH READY indicator on card punch goes off and on operator's console CARD PUNCH READY indicator goes off.	Empty input hopper or full output stacker.	Add or remove cards and depress the PUNCH READY switch on the card punch.
	Misfeed.	1. Remove cards from hopper. 2. Examine bottom cards of deck. If one or more cards have deformed top edges, remove them from the deck. 3. Reload input hopper and empty output stacker. 4. Depress MANUAL CYCLE switch on card punch twice. 5. If operating on-line, set AUTO/MAN switch on operator's console to MAN position. 6. Depress the PUNCH READY switch on the card punch. 7. If operating on-line, return AUTO/MAN switch to AUTO position. 8. Return to nearest restart position.
	Programming error.	1. Consult operating instructions and/or notify programmer. 2. Set AUTO/MAN switch on operator's console to MAN position. 3. Depress RESET ALARM switch on operator's console. 4. Make necessary correction. 5. Return AUTO/MAN switch to AUTO position. 6. Return to nearest restart position.
On operator's console CARD PUNCH READY indicator goes off. On card punch the PUNCH READY indicator remains lit.	Card jam.	Notify service personnel.

Figure 36. Summary of 100 cpm Card Punch Error Conditions

Error Condition	Possible Cause	Corrective Action
DPBC ERROR indicator on card punch glows red and CARD PUNCH READY indicator on operator's console goes off.	The card punch has failed to punch or has double punched in one or more columns where this should not have occurred.	1. If on-line, consult operating instructions for specific details. If off-line, begin with step 4 below. 2. Set the AUTO/MAN switch on the operator's console to the MAN position. 3. Press the MANUAL CYCLE switch on the punch once. 4. Depress the RESET ALARM switch on the operator's console. 5. Examine card on top of card punch output stack for a double punch or a blank in column where neither should be. 6. Depress the MANUAL CYCLE switch on the card punch once. 7. If the PUNCH READY indicator on the card punch goes off again, repeat steps 3, 4, and 5 for on-line operation and steps 4 and 5 for off-line operation. 8. Depress the PUNCH READY switch on the card punch. Normal operation is restored at this point in off-line operation. If operation is on-line continue with steps 9 and 10. 9. Set the AUTO/MAN switch on the operator's console to the AUTO position. 10. Depress the START switch on the operator's console.
	Cause other than above.	Notify service personnel.
CARD PUNCH READY indicator on operator's console goes off, I-register contains 2514007 or 2516007 (program is in loop).	DPBC error.	Follow procedure described above for DPBC error indication.
	Empty input hopper or full output stacker.	Add or remove cards and depress the PUNCH READY switch on the card punch.
Cards enter card punch but do not come out.	Internal Jam.	Notify service personnel. This condition can exist without an error being otherwise indicated.
MEM PARITY (PARITY) indicator on operator's console glows red. If STOP ON PARITY ALARM switch is also on, the central processor halts and card punching stops.	Information coming from memory contains a parity error.	Take no action unless central processor halts, in which case follow programmer's instructions.

Figure 36. (Cont.)

4. DPBC ENTRY - Hubs in this area control the double-punch and blank-column checking functions. There is no sequence to the hubs; all of the hubs in the area have exactly the same function. They select a card column that is to be checked for either a double punch or for no punches. A corresponding pair of DPBC ENABLE hubs must be plugged together.

5. BC ENTRY - If only blank-column checking is required, this is done by plugging the desired column of READ BRUSH EXIT hubs to any BC ENTRY hub. In this case, no DPBC ENABLE hubs need also be wired.

6. DPBC ENABLE - A pair of these hubs, corresponding to the plugs used in the DPBC ENTRY area, must be plugged together to activate the logic selected by the DPBC ENTRY hubs.

7. EMITTER - Only two hubs in this area are used by the operator. They are the hubs numbered 1 and 2 in the upper right corner of the area, and are designated INTERLOCK hubs. These two hubs serve as a power interlock, and they must be plugged together to complete the circuit path necessary to apply power to the card punch. The remaining numbered hubs in this area are used only by service personnel for test purposes.

8. The bottom section of the plugboard is not used.

When wiring plubboards, the following fundamental principles should be observed.

1. Always wire together the two INTERLOCK hubs for both on-line and off-line operation.

2. For on-line operation, always wire from the COMPUTER EXIT hubs to PUNCH MAGNET ENTRY hubs. For exact reproduction of information received from the computer, wire COMPUTER EXIT hubs labeled 1 through 80 to the corresponding 1 through 80 numbers of the PUNCH MAGNET ENTRY hubs. (See Figure 37.)

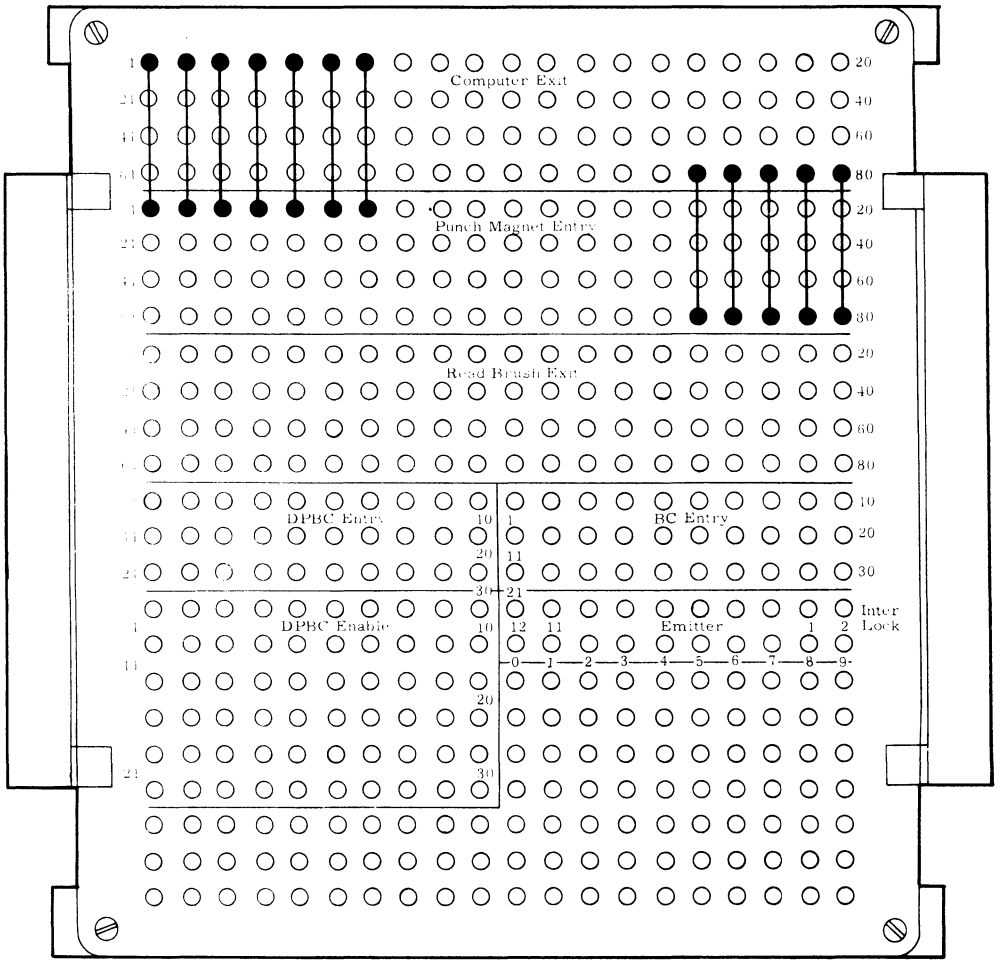


Figure 37. Plugboard Wiring for Exact Reproduction of Central Processor Information

To change the format of data on the cards, select the entry hubs in the format desired, and connect these to the exit hubs. PUNCH MAGNETIC ENTRY hub numbers correspond to the cards' columns. (See Figure 38.)

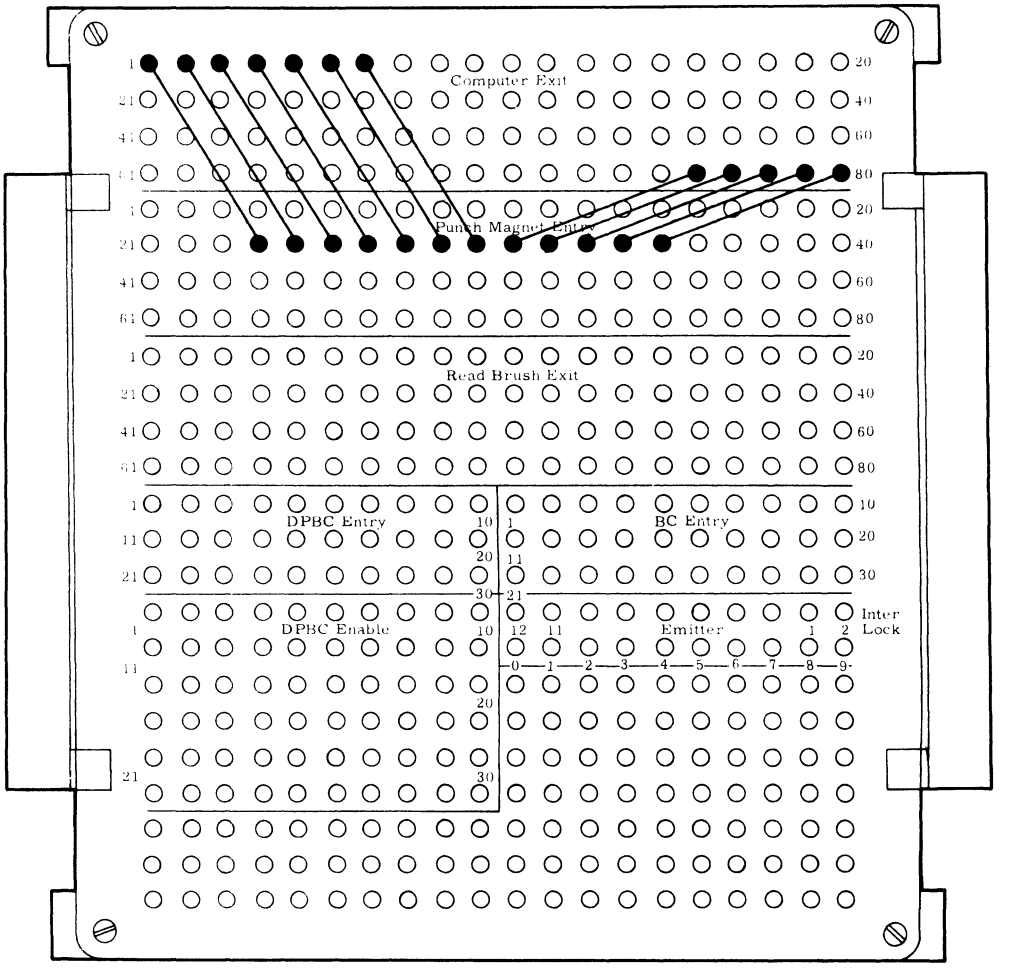


Figure 38. Plugboard Wiring for Relocation of Central Processor Information

3. For off-line operation, always wire from the READ BRUSH EXIT hubs to the PUNCH MAGNETIC ENTRY hubs. (COMPUTER EXIT hubs are not used during an off-line operation.) Figure 39 illustrates the plugboard wiring for duplication of card information from the first eight columns of the header card onto the succeeding card. To duplicate the information from all 80 columns of the header card, all 80 hubs must be wired.

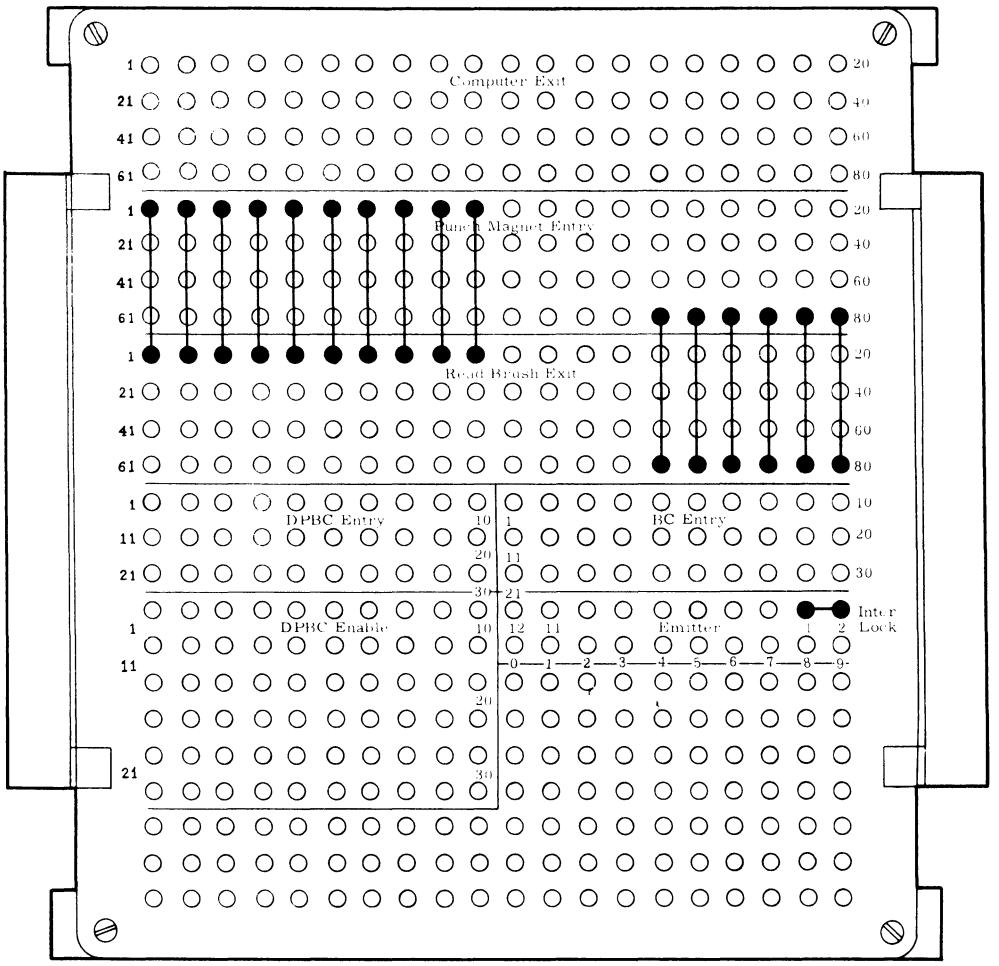


Figure 39. Plugboard Wiring for Gang Punching

4. In either mode of operation, to have the internal logic test a particular card column for a blank condition, plug from the READ BRUSH EXIT hub corresponding to the desired column number to any of the BC ENTRY hubs. (See Figure 40.)

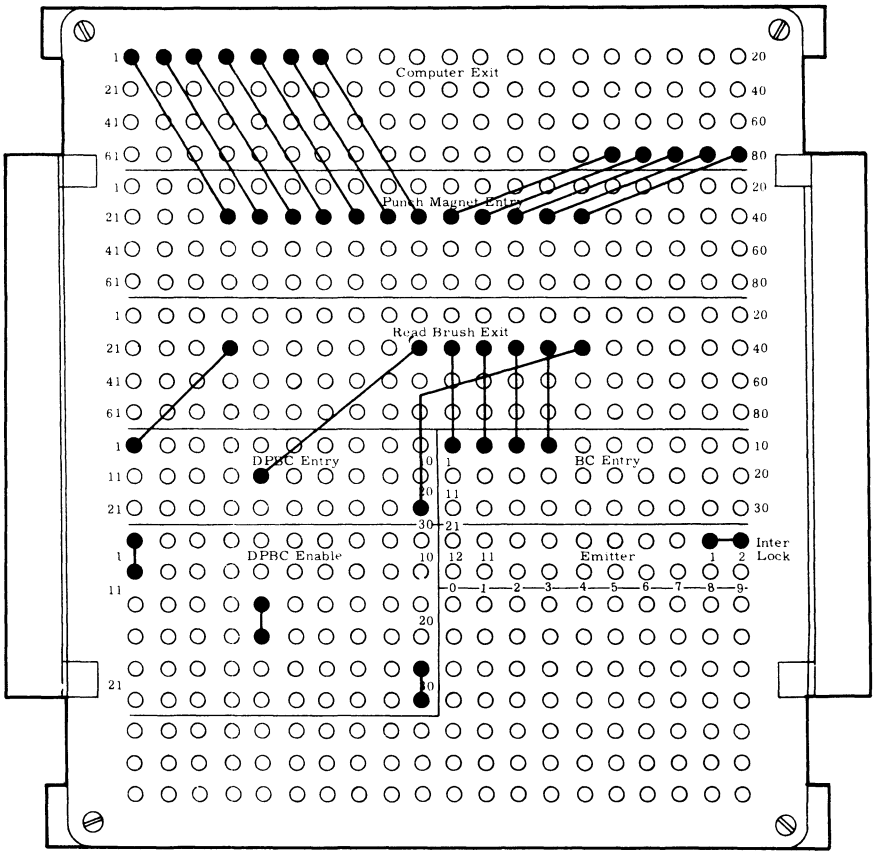


Figure 40. Plugboard Wiring for Blank Columns

5. In either mode of operation, wire from the READ BRUSH EXIT hub, whose number corresponds to the card column selected for a DPBC test, to any of DPBC ENTRY hubs and also wire together the corresponding pair of DPBC ENABLE hubs. Figure 41 illustrates the wiring to check card columns 24, 30, and 35 for double punches.

6. To simplify wiring and checking of the plugboard, always maintain an ascending numerical sequence in connecting hubs.

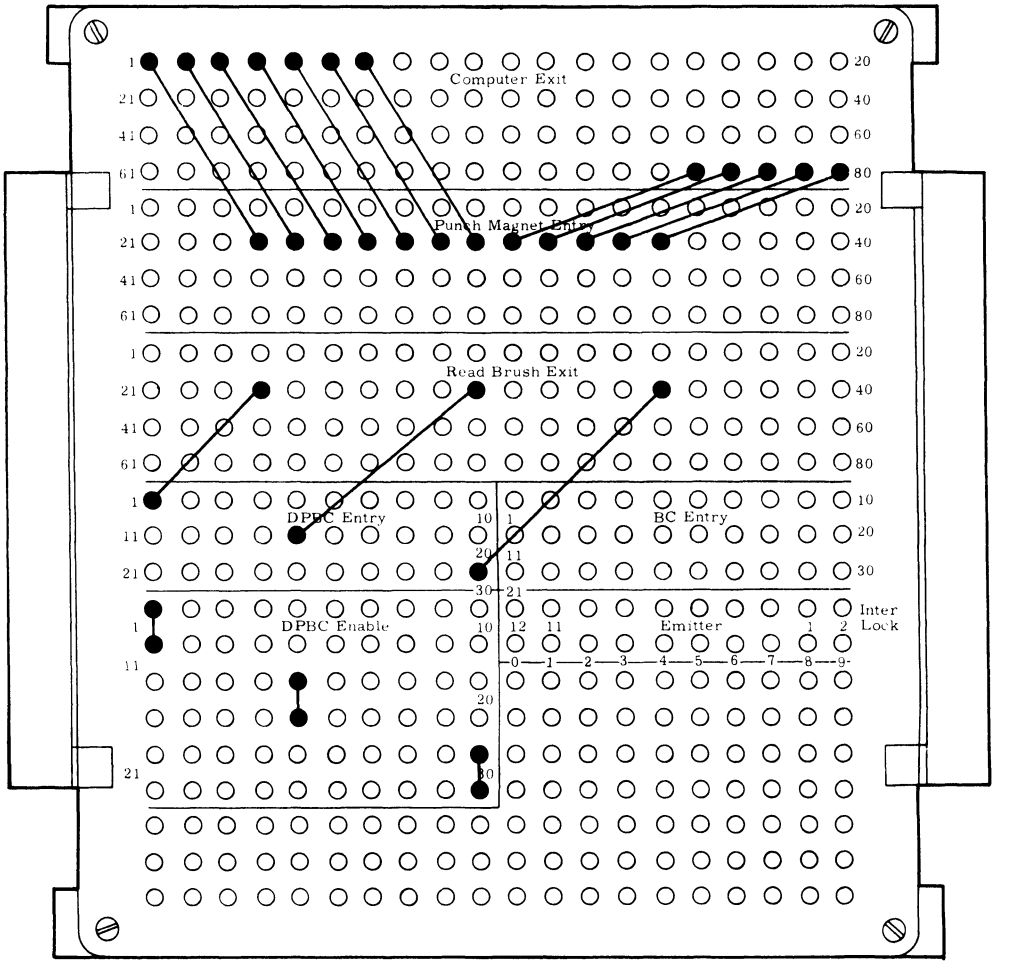


Figure 41. Plugboard Wiring for Double Punches

Emptying the Chad Box

The chad box of the 100 cpm card punch is in the area adjacent to the output stacker. If the card punch is operating continuously, it is necessary to empty the chad box every hour. This is done in the following manner.

1. Set the AUTO/MAN switch on the operator's console to the MAN position if operating on-line; if operating off-line, ignore this step.
2. Depress the PUNCH STOP switch on the card punch until card movement stops.
3. Depress the POWER OFF switch on the card punch.
4. Remove and empty the chad box and return it to its original position. If the chad box is not replaced properly, power cannot be applied to the card punch and it will not operate.
5. Depress the POWER ON switch on the card punch.
6. Depress the PUNCH READY switch on the card punch.
7. Return the AUTO/MAN switch on the operator's console to the AUTO position if operating on-line; if operating off-line, ignore this step.

Changing Card Punch Brush and Die Units

Changing the punch brush and die units is a function which requires the special skills of the service engineer. The operator should not attempt to do this himself.

300 cpm Card Punch

CONTROLS AND INDICATORS

Controls and indicators for the 300 cpm card punch are located on the right side of the top panel. (See Figure 42.)

POWER ON Switch and Indicator

When depressed, the POWER ON indicator glows amber and turns on power to the card punch.

POWER OFF Switch

When depressed, the POWER OFF switch turns off power to the card punch.

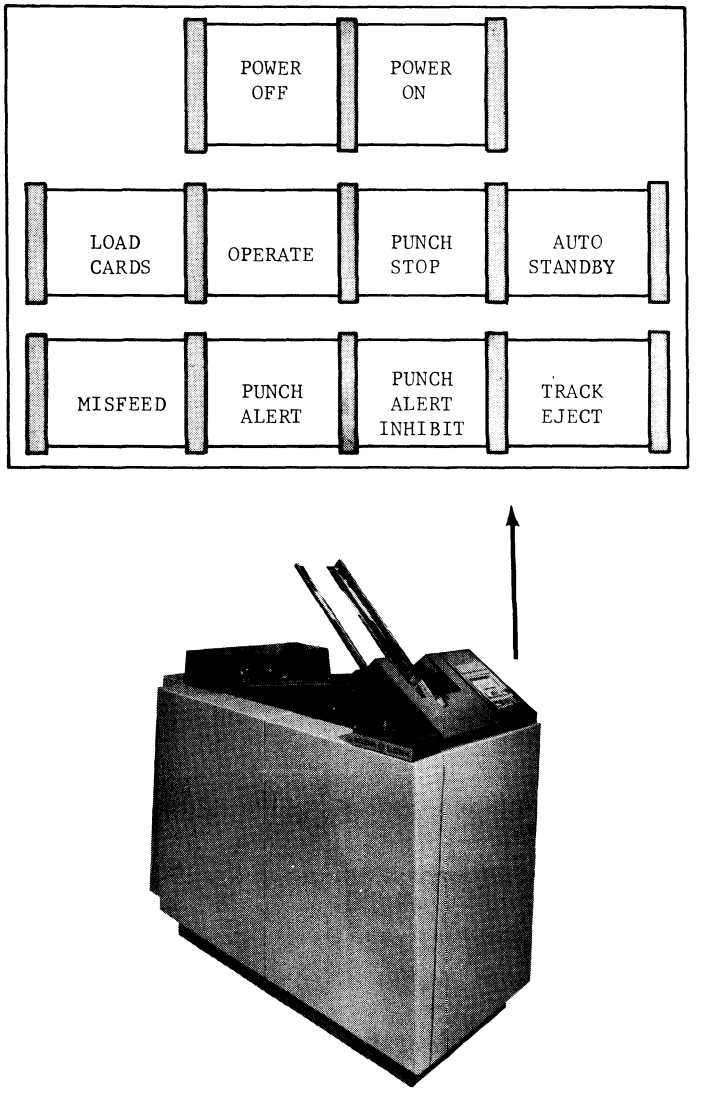


Figure 42. 300 cpm Card Punch Control and Indicator Panel

LOAD CARDS Switch and Indicator

The LOAD CARDS indicator glows blue to indicate that the punching mechanism is ready for cards. Depressing this switch causes cards to move in so that all prepunching stations are filled. Holding this switch down causes cards to feed right through the mechanism without being punched.

OPERATE Switch and Indicator

When depressed, the OPERATE indicator glows green and readies the punch circuitry for on-line operation. This light will not come on if a malfunction exists in the card punching equipment.

PUNCH STOP Switch

When depressed, the PUNCH STOP switch halts the card punch after the card currently in the punching station has been completed. The OPERATE indicator goes off.

AUTO STANDBY Indicator

The AUTO STANDBY indicator glows amber when the motors stop as the card punch goes automatically into the standby status. The POWER ON indicator goes off when this indicator comes on. As soon as the punch receives an operating instruction, this light goes off and the punch reverts to the operate status.

MISFEED Switch and Indicator

The MISFEED indicator glows red to indicate a failure in the feeding of cards into the punching mechanism. Card feeding stops. On the operator's console the CARD PUNCH READY indicator goes off. After correcting the error conditions, the operator depresses this switch to clear the alarm circuitry. This also causes the first card in the input hopper to move forward into the punch so that it is not necessary to depress LOAD CARDS before depressing OPERATE.

PUNCH ALERT Switch and Indicator

When the PUNCH ALERT indicator glows red to indicate the detection of a punching error, the card punch halts and the OPERATE indicator goes off. On the operator's console the CARD PUNCH READY indicator goes off. Depressing this switch clears the alarm circuitry. Operation is resumed by depressing OPERATE.

PUNCH ALERT INHIBIT Switch and Indicator

When depressed, the PUNCH ALERT INHIBIT indicator glows amber and inhibits the alarm circuitry of the punch so that it will not stop when a punching error is detected.

TRACK EJECT Switch

Depressing the TRACK EJECT switch causes all cards within the punch to be cleared through the mechanism into the output stacker.

The input and output areas of the 300 cpm card punch contain switches which are normally activated by the movement of the cards.

Hopper Empty Switch

A Hopper Empty Switch, located in the input hopper, halts the card punch when there are no cards remaining in the hopper. The card punch and the central processor halt. Both the OPERATE indicator on the punch and the CARD PUNCH READY indicator on the operator's console go off.

Stacker Full Switch

A Stacker Full switch, located in the output stacker, halts the punch. When activated, it indicates that the stacker has reached its capacity of cards. The card punch and the central processor halt. Both the OPERATE indicator on the punch and the CARD PUNCH READY indicator on the operator's console go off.

A summary of the functions of the 300 cpm card punch controls and indicators is shown in Figure 43.

SETUP PROCEDURES

In the setup procedures listed below for card punching, it is assumed that the central processor has been previously turned on. All controls and indicators mentioned are on the card punch control and indicator panel unless otherwise specifically stated. On-line punching of cards is initiated as follows:

1. Set the AUTO/MAN switch on the operator's console to the MAN position.

2. Depress the POWER ON switch. It takes approximately 20 seconds for the transport motor to synchronize with the motor for the punching mechanism. When the two motors have synchronized, the POWER ON switch glows amber. If the POWER ON switch does not light within the normal time, check to see whether the punch is connected to its power supply or there is a card jam.

3. Load cards into the hopper, face down with the top edge toward the punch.

4. Depress the LOAD CARDS switch once. This turns off the indicator and feeds the first four cards into the punch. If the card does not feed, check to see if the MISFEED indicator glows red; if so, correct this condition and depress LOAD CARDS once again.

5. After a short interval the AUTO STANDBY indicator glows amber and the POWER ON indicator goes off. If this does not occur, it may be because the AUTO STANDBY OVERRIDE switch on the maintenance panel is in the incorrect position. Call the service engineer to correct this condition.

6. Depress the OPERATE switch. It will glow green and on the operator's console the CARD PUNCH READY indicator also will glow green. Card punching begins when the first punch instruction is received from the program. If punching does not start, check to see that the PUNCH STOP switch has not inadvertently been depressed. If this is not the cause, call the service engineer.

7. Return the AUTO/MAN switch on the operator's console to the AUTO position.

8. Depress the START switch on the operator's console.

Location	Control or Indicator	Function
Right front side of card punch.	POWER OFF switch	Turns off card punch power.
	POWER ON switch and indicator (amber)	Turns on card punch power.
	LOAD CARDS switch and indicator (blue)	Causes cars to feed into punch.
	OPERATE switch and indicator (green)	Readies punch circuitry for operation.
	PUNCH STOP switch	Halts card punching.
	AUTO STANDBY indicator (amber)	Indicates that card punch has halted and is on standby status.
	MISFEED switch and indicator (red)	Clears alarm circuitry after misfeed occurs and moves first card into punch.
	PUNCH ALERT switch and indicator (red)	Clears alarm circuitry after detection of punching error.
	PUNCH ALERT INHIBIT switch and indicator (amber)	Inhibits PUNCH ALERT control function.
	TRACK EJECT switch	Clears cards out of punch into stacker.
Inside input hopper	Hopper Empty switch	Halts card punch and central processor when hopper is out of cards.
Inside output	Stacker Full switch	Halts card punch and central processor when stacker is full.

Figure 43. Summary of 300 cpm Card Punch Controls and Indicators

ERROR CONDITIONS AND OPERATOR CORRECTIVE ACTION

The various error conditions which may occur in the operation of the 300 cpm punch are:

1. Feed errors - A feed error occurs when there are cards in the input hopper and an instruction is given to feed, but the cards do not move.

2. Read errors - The read-after-punch hole count check detects a punching error.

3. Empty input hopper - There are no cards remaining in the input hopper.

4. Full output stacker - The output stacker has reached its capacity.

This card punch will not operate properly and may cause a system halt under any of the following conditions:

1. Failure to depress the POWER ON switch on the card punch.

2. Failure to load sufficient cards into the input hopper.

3. Failure to empty the output stacker before it becomes full.

4. Failure to clear the C PUNCH ECHO ALARM when it glows red on the GE-235 operator's console.

It is also possible that a program error may halt card punching operations. This occurs when a card punch command is given while the punch is already busy punching another card. At such times the operator should consult his run book or other instructions and notify the programmer.

In addition, the operator is usually responsible for correcting card jams in the input hopper or the output stacker. If the operator can see the card causing the jam, he should try to remove it. He should also try to be sure that all pieces of torn cards are removed. At no time should sharp tools be used to clear a jam. When the jam is apparently corrected and cards still do not feed through the punch, the service engineer must be called.

A summary of error conditions and corrective action to be taken by the operator is given in Figure 44.

Error Conditions	Possible Cause	Corrective Action
POWER ON indicator does not light when depressed.	Punch is not connected to power supply.	Connect punch to power supply and depress POWER ON switch again.
POWER ON indicator glows at same time as AUTO STANDBY indicator.	Operating mode malfunction.	Call service engineer.
AUTO STANDBY indicator fails to glow after LOAD CARDS switch has been depressed.	Punch fails to go into standby status.	If AUTO STANDBY OVERRIDE switch on maintenance panel is in wrong position, call the service engineer.
OPERATE indicator goes off and punch halts; on the operator's console the CARD PUNCH READY indicator goes off.	Empty input hopper or full output stacker.	Add or remove cards and depress the OPERATE switch.
OPERATE indicator goes off and punch halts; on the operator's console the CARD PUNCH READY indicator goes off and the C PUNCH ECHO ALARM (CARD PUNCH) indicator glows red.	Programming error.	Consult operating instructions and/or notify programmer.
MISFEED indicator glows red, the OPERATE indicator goes off and the punch halts; on the operator's console the CARD PUNCH READY indicator goes off and the C PUNCH ECHO ALARM (CARD PUNCH) glows red.	Misfeed	1. Lift cards from hopper and remove cards with deformed edges. 2. Replace cards in the hopper. 3. Depress the MISFEED switch. 4. Depress the OPERATE switch.
	Card Jam.	If possible, remove card causing jam and go through setup procedure to restart. Call service engineer if jam cannot be cleared.
OPERATE indicator fails to glow when depressed.	Operator error	If PUNCH STOP switch has been depressed, set it to proper position. If OPERATE switch does not light when depressed again, call service engineer.
PUNCH ALERT indicator glows red, OPERATE indicator goes off, card punch halts; on operator's console CARD PUNCH READY indicator goes off.	Hole count punch alert.	1. Examine last card in output stacker for erroneous punch. 2. Depress PUNCH ALERT switch to clear alarm circuitry. 3. To restart, depress the OPERATE switch. 4. If PUNCH ALERT indicator remains on, the next card also has a punch alert. 5. Again depress OPERATE to resume operation.
MEM PARITY (PARITY) indicator on operator's console glows red. If STOP ON PARITY ALARM switch is also on, central processor halts and card punching stops.	Information coming from memory contains a parity error.	Take no action unless central processor halts, in which case follow programmer's instructions.

Figure 44. Summary of 300 cpm Card Punch Error Conditions

SPECIAL PROCEDURES

Emptying the Chad Box

On the 300 cpm card punch the chad box is reached through the double swing-out doors on the left side. This box is large enough to meet the requirements of any normal run. However, it is recommended that the box be emptied only when the run has been completed since these two doors are equipped with a logic interlock which causes operation to halt when they are opened. This can result in a possible loss of information if the doors are opened when data is being transferred from the central processor.

Changing Card Punch Brush and Die Units

Changing the punch brush and die units is a function that requires the special skills of the service engineer. The operator should not attempt to do this himself.

APPENDIX

INSTRUCTION LIST

The abbreviations used in the mnemonics of the Operand and Symbol X Field of the General Assembly Program are as follows:

Card Readers

Opr	Operand*	X**	Octal	Microseconds for GE-200	GE-215	GE-225	GE-235
HCR			2500004	36	54	36	12
RCB	Y	X	250YY01	36	54	36	12
RCD	Y	X	250YY00	36	54	36	12
RCF	Y	X	250YY10	36	54	36	12
RCM	Y	X	250YY12	36	54	36	12
BCN			2516006	36	54	36	12
BCR			2514006	36	54	36	12

* = Y is memory location
**= Instruction may be modified (Index Word)

Card Punches

Opr	Operand*	X**	Octal	Microseconds for GE-200	GE-215	GE-225	GE-235
WCD	Y		250YY02	36	54	36	12
WCB	Y		250YY03	36	54	36	12
WCF	Y		250YY17	36	54	36	12
BPN			2516007	36	54	36	12
BPR			2514007	36	54	36	12

* = Y is memory location
**= Instruction modification not used with card punch commands.

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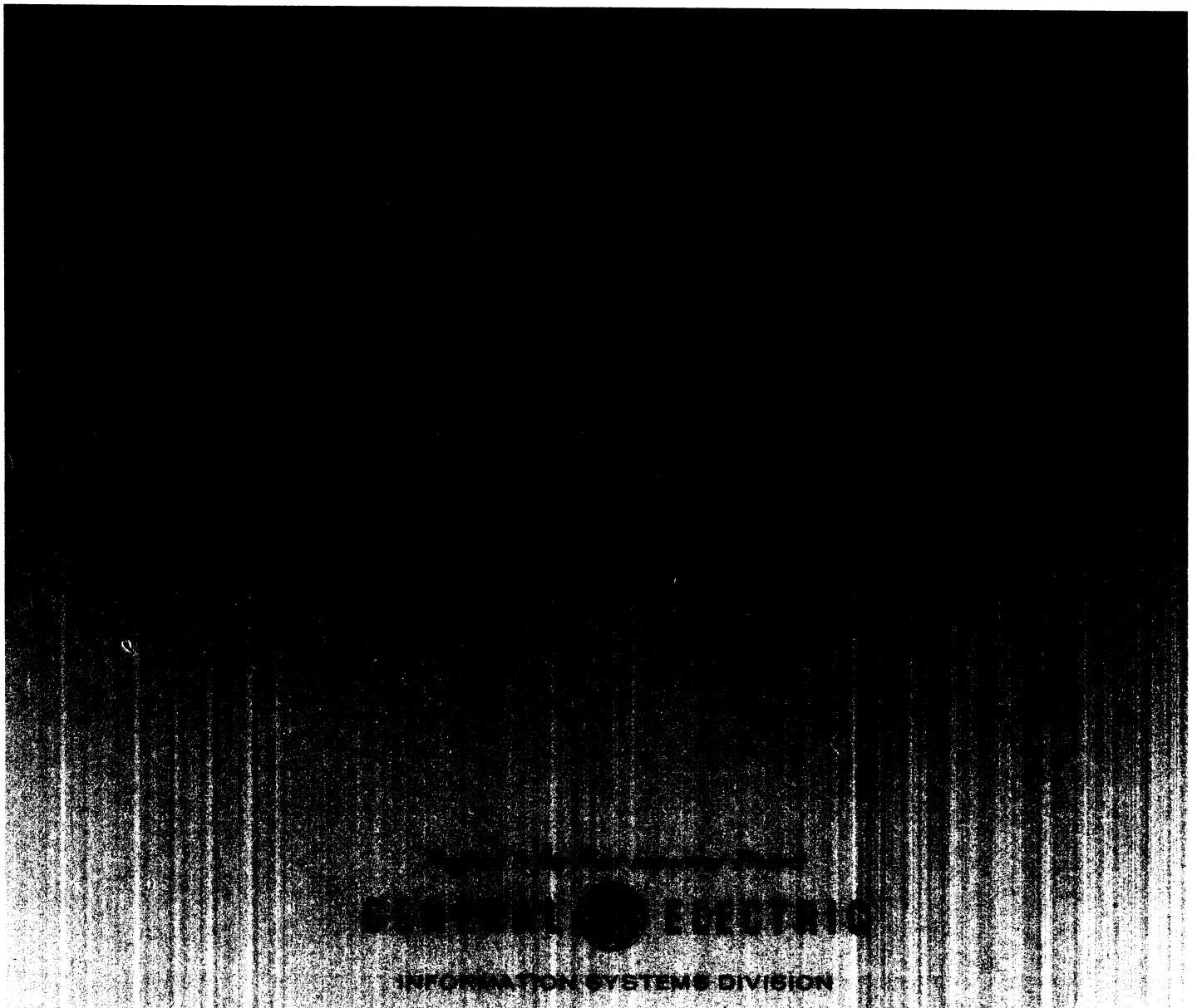

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