

CARD PUNCH

GENERAL DESCRIPTION

The card punch (Figure VIII-1) is an output device which punches standard 80-column cards at the rate of 100 cards per minute, and has checking features which permit it to check as many as 30 columns (depending on the model) of double-punched or blank columns. Cards are punched in either decimal or binary mode, depending on whether the instruction from memory was a Write Card Decimal (WCD), Write Card Binary (WCB), or Write Cards Full (WCF) for 12-row binary.

The card punch receives most of its basic control signals from the central processor and does most of its operating on-line. However, it does one type of operation, called gang punching, off-line. Gang punching is a process whereby any number of cards may be reproduced from one 'master' card.

Major Parts of the Card Punch

Punch Control Circuits. These maintain direct control over all of the punch operations and contain the relay circuitry which controls the timing of card feed.

Drive Mechanism. The drive motor transmits power to a gear housing at the machine through a vee-belt and pulley. Two gears are pinned to the pulley shaft: the eccentric shaft drive gear and the geneva drive gear. The up and down motion of the punching mechanism is derived from the eccentric shaft.

Feed Clutch. The feed clutch is electrically controlled by an electromagnet which receives impulses from the commands of the central processor. When the feed clutch is engaged, it causes card feed to begin.

Geneva Mechanism. This mechanism controls the card's halting for punching and movement to new positions. There are 14 card halts and 14 card movements during each card cycle.

Feed Hopper. This holds the supply of blank card stock, and from this hopper, cards are fed one at a time upon command from the punch control. The feed hopper contains a switch to halt the punch when it is out of cards.

Feed Knives. A pair of feed knives are fitted in slides in the bed of the feed hopper. These knives push a card forward from the hopper into the first feed rollers. Knife action originates when the feed

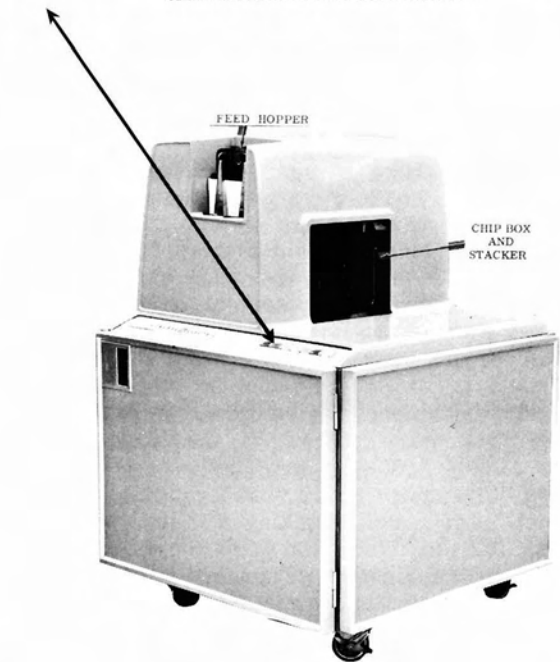
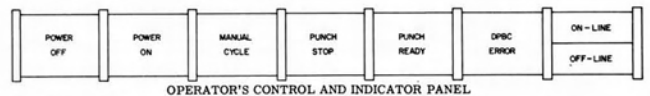


Figure VIII-1. Card Punch and its Control and Indicator Panel

clutch is engaged.

Feed Rollers. There are three pair of feed rollers. The punching station is located between the first and second pair of rollers and the reading station is between the second and third pair.

Feed Roller Opening Device. The first feed rollers are opened and then closed after a card is approximately a fourth of an inch past the center of the rollers. This action originates when the feed clutch is engaged.

Punching Mechanism. The punching station receives cards and punches them, one row at a time. Eighty punches are arranged in a row, and all 80 columns of a row can be punched at one time. When operating on-line, the command from the central processor, acting through the punch magnet, determines what is to be punched. It uses signals from the emitter section of the card punch's plugboard to determine which card row is in the punch die.

Punch Brush Station (Reading Station). This station senses, one row at a time, information that was just punched into the card. The brush station is between the second and third feed rollers. It contains 80 wire brushes, insulated from each other, assembled in a row in a brush holder. Each sensing brush is aligned with one of the 80 card columns. As the card passes the brush station, it travels between the brushes and a contact roller. The brushes make contact through the holes and complete the electrical circuit between sensing and common brushes. This information is sent to the plugboard where it is used for error checking or, in off-line applications, used as input to the following card.

Stacker. There is a stacker shaft through which cards pass prior to their entry into the stacker pocket. The shaft contains two rubber rollers which guide cards emerging from the third feed rollers, and pass them on to a spring-loaded stacker plate. The plate descends progressively in the stacker pocket as the weight of cards increases. As it nears the bottom of the pocket, it operates a switch which can be used to cause the punch to stop card feed. Cards arrive in the pocket face down, the same order in which they were placed in the input hopper.

Plugboard. The card punch uses a plugboard for its card punch information checking and its gang punch functions. The plugboard also gives the user a choice of formats in the location of punched information on the card. The plugboard permits the operator a choice of any, and in many cases, a combination, of the following operations:

1. Routing of computer information to any selected field on the card.
2. Checking for other than a single punch in

any one of thirty pre-selected card columns (number of columns may vary, depending on the model).

3. Verifying the absence of any punch in any one of thirty preselected card columns (number may vary).
4. Repeating any field of information on each succeeding card. This read-and-punch function is known as gang punching.

The description of plugboard organization and method of wiring are covered under the Special Procedures section of this card punch writeup.

Card Movement through the Punch

Cards are fed in parallel from the 800-card capacity input hopper past a punching station where they are punched row-by-row. They are then moved past a punch-brush (reading) station where they are checked. From there, cards are moved into the 800-card capacity stacker. Card feed may be either continuous or card-by-card. As cards pass through the punch, there is an interval of one quarter of an inch between them.

Feed Cycles. The punch operates in four feed cycles. The feed clutch is engaged for each cycle.

1st cycle - Card is fed from hopper to punching station. The card is fed from the hopper, gripped by the first feed rollers, and carried up to the punch die.

2nd cycle - Card passes from punching station to punch brush (reading) station. During this cycle, card is punched during intermittent stops under the punch die, then is gripped by the second feed rollers (before leaving the first roller) and carried to the punch brush (read) station.

3rd cycle - Card moves from punch brush station to the stacker. It passes the punch brush station where data is sensed by the brushes, then into the third feed rollers.

4th cycle - Card enters the stacker pocket. The first card is fed forward by the third feed rollers and guided by the stacker rollers into the stacker pocket.

This sequence continues as long as the feed clutch is allowed to re-engage in each successive card cycle and as long as there are cards in the hopper. This is what is known as continuous card feed.

Control and Indicator Panel. From the punch's control and indicator panel, the operator can perform

off-line operations. From it, the operator can also ready the punch for on-line operations and observe certain phases of the operation. The individual controls and indicators are described in Table VIII.

SETUP PROCEDURES

The following is the procedure for readying the card punch for on-line operation with the GE-225 central processor. It is assumed that the central processor has been turned on. All controls and indicators mentioned are on the card punch's control and indicator panel. (Off-line operation is described under Special Procedures.)

1. Install the correct plugboard. Most computer sites have several pre-wired plugboards for use with the most frequently used programs. The operator must know the stock of plugboards and the applications of each. If a pre-wired plugboard is not available for the program to be run, the operator must wire one. Instructions for this are given in the Special Procedures section of this card punch writeup.
2. Depress the POWER ON pushbutton. Its indicator should light.
3. Joggle 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.
4. Firmly grasp the cards, and without letting them slip, lower them into the feed hopper, face down and 12-edge first.
5. After loading the number of cards desired in the feed hopper, replace the card weight.
6. Set the ON LINE/OFF LINE switch in the ON LINE position.
7. Depress the MANUAL CYCLE pushbutton four times. This causes cards to be completely fed through the system.
8. Depress the PUNCH READY pushbutton. At this time control is returned to the central processor. When the START button on the control console is depressed, the card punch operation commences.

Although card punching is completely automatic, operator attention is necessary whenever the feed hopper needs to be refilled or the stacker needs to be emptied. The operator should be aware of the number of cards in both input and output hoppers so that he can add or remove cards before the switch in either hopper halts the operation.

To add cards: Lift up the card weight, place cards on top of those already in the hopper, and replace the weight.

To remove cards: Stop punch operations by depressing PUNCH STOP, remove cards from the stacker, and start operations again by depressing PUNCH READY.

If the operator neglects to add or remove cards when necessary, the switch in either input or output hopper will halt the punch operation. The procedure in this case is:

1. Add or remove cards as necessary.
2. Depress the PUNCH READY pushbutton.

When card feed has been completed for a particular program, the last three cards must be removed from the punch by manual operation. This is true of both on-line and off-line operation. The steps for this are:

1. If in on-line operation, set the MANUAL/AUTOMATIC switch to MANUAL.
2. Remove cards from input hopper.
3. Depress the MANUAL CYCLE pushbutton three times until the last card is cleared out of the machine. Since four machine cycles are required to move a card from the feed hopper to the card stacker, it is necessary to depress the MANUAL CYCLE button three times to complete the passage of cards to the stacker. CAUTION: Do not hold the MANUAL CYCLE pushbutton down for continuous feed, but hit it quickly three different times. Holding it down can cause a jam in some models of the card punch.
4. Remove blank cards from the stacker to complete the operation.

Return the punched cards to the user, or, if they are to be stored, store them according to storage instructions. CAUTION: Whenever the card punch is operating, the operator should frequently monitor the output stacker to insure that the card reader is operating properly as there is no particular indication if a card jam occurs at the output stacker.

SPECIAL PROCEDURES

Clearing Card Jams

There are two kinds of card jams which the operator may try to clear. All other card jams must be turned over to the service engineer for clearing.

TABLE VIII.
SUMMARY OF CONTROLS AND INDICATORS
FOR THE CARD PUNCH

Location	Control or Indicator	Function
Front of card punch	POWER OFF switch and indicator	Turns off power to the card punch and indicates when it is off.
	POWER ON switch and indicator	Turns on power to the card punch and indicates when it is on.
	MANUAL CYCLE switch	Causes the punch mechanism to perform one card cycle without allowing any punches to be made in a card.
	PUNCH STOP switch	Stops the punch mechanism at the end of the punch cycle during which it was depressed. This switch must be held down until punch stops.
	PUNCH READY switch and indicator	Indicates a punch ready condition, and when depressed, causes the punch to run continuously until one of the following conditions occurs: <ol style="list-style-type: none"> 1. Feed hopper is empty 2. A card is not in the pre-read station 3. A card is not in the punch station 4. A card is not in the post-read station 5. The output stacker is full 6. PUNCH STOP switch is depressed 7. DPBC error 8. Chip box not in properly
	DPBC ERROR indicator	Registers absence of a punch or presence of an extra punch in area of the card where it should not be, and stops punching operation with the card in error on top of the output stacker.
	ON LINE/OFF LINE switch and indicator	Sets and indicates mode of operation as either ON LINE or OFF LINE.

GE-225

TABLE VIII. (CONT.)

Location	Control or Indicator	Function
Control Console	CARD PUNCH alarm indicator	Indicates when a punched card instruction is issued and the card punch is not in a ready state.
	CARD PUNCH READY indicator	Lights whenever the card punch is in a ready state.
	RESET ALARM switch	Clears a card punch alarm condition; turns out the ALARM indicator.

GE-225

When there is an internal jam, the only indication may be the fact that cards go in but do not come out.

Card Jams in the Input Hopper. If the operator can see that the card which caused the jam is in the input hopper, he should try to remove it. This should be done by hand (not with any implements), and the operator should try to make sure all pieces of torn cards are also removed. If cards do not feed after this effort, the service engineer must be called.

Card Jams in the Output Hopper. If the operator can see that the card which caused the jam is in the output hopper, he should try to remove it by the method just described for input hopper jams. If cards do not feed after this effort, the service engineer must be called.

Plugboard Layout and Wiring

A. PLUGBOARD LAYOUT.

The plugboard is divided into eight definite areas. Each of these, except the last, has a unique function in controlling the overall punch operation. The locations of these areas are shown in Figure VIII-2.

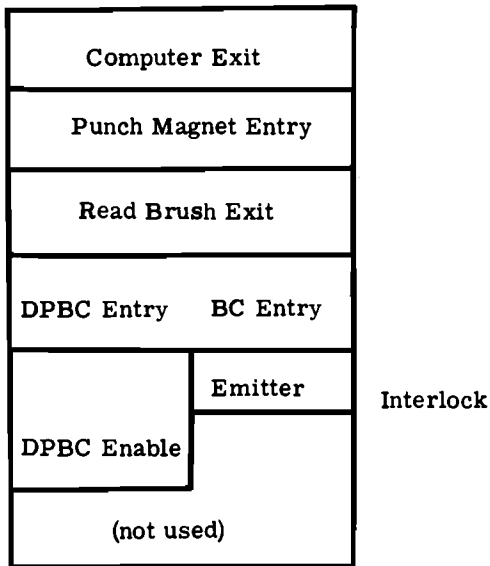


Figure VIII-2. Card Punch Plugboard Layout

An understanding of the functions performed by the various areas of the plugboard will give the

operator a better understanding of its use. These functions are:

Computer Exit. These top four rows contain hubs that carry the information output of the computer. Each of these 80 computer-exit hubs corresponds to a card column output line from the computer.

Punch Magnet Entry. These next four rows of hubs connect directly into the punch magnets in computer input or gang-punch operations. The hubs correspond to the 80 columns of a card.

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 gang punching and card information checking functions.

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.

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 Enable hubs are necessary.

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.

Emitter. Only two hubs in this area are used by the operator. They are the hubs numbered 1 and 2 in the upper right hand 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.

B. PLUGBOARD WIRING.

Only the fundamental principles of plugboard wiring will be discussed. The various complex ways the plugboard may be wired are covered more completely in the General Electric Product Service Manual PER-202-050. Figure VIII-3 illustrates the plugboard wiring for

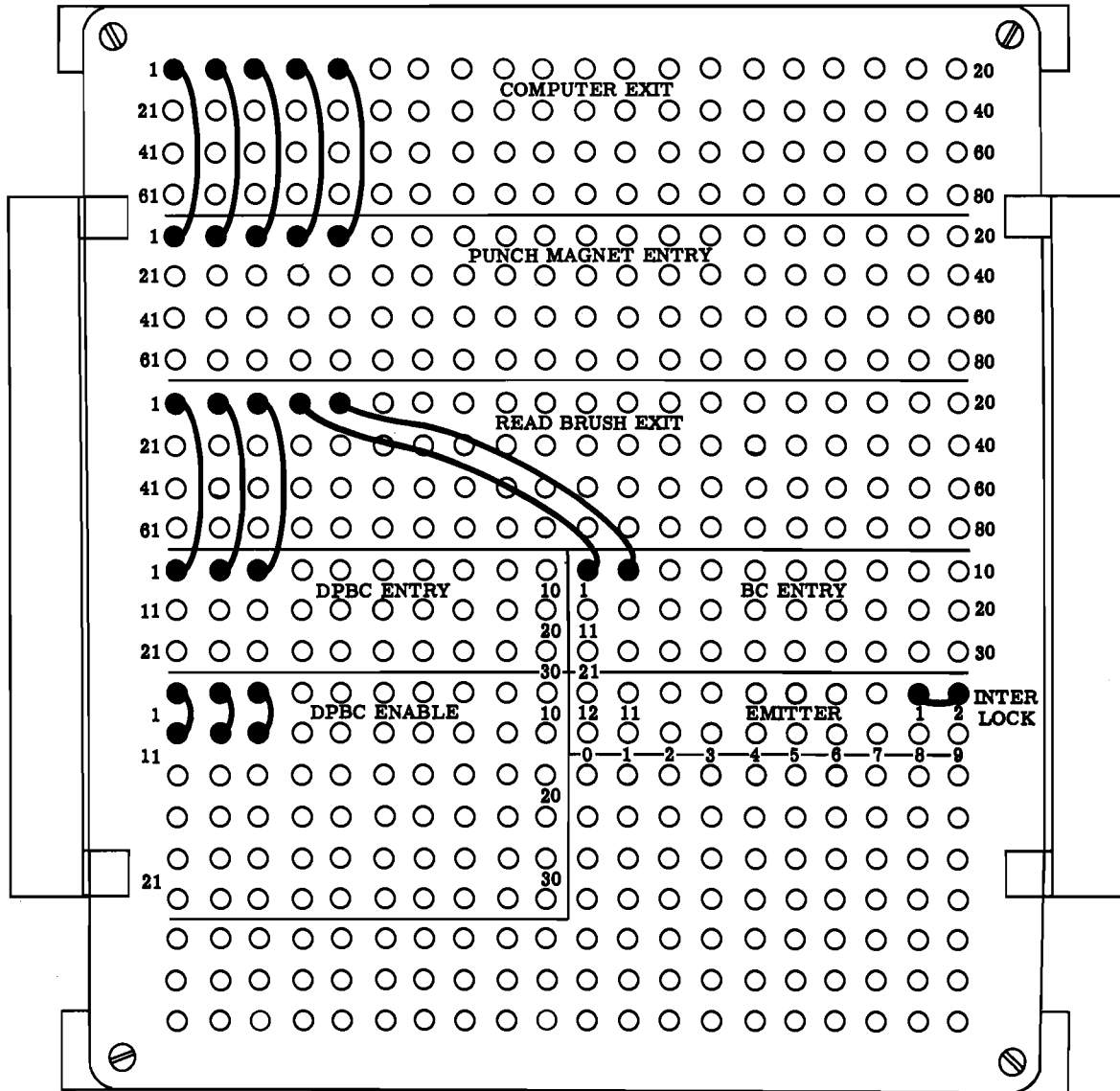


Figure VIII-3. Example of Plugboard Wiring for On-Line Operation

on-line punch operation to detect either a double punch or blank condition in the first three columns of a card.

The following rules for plugboard wiring should be learned and applied. Although it is not mandatory that some of the rules be followed, their use leads to a more orderly wiring of the plugboard and will thus permit less chance for errors to be made.

1. Always wire the two INTER LOCK hubs together.

2. For an 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. 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.

3. For an 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).
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
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 wire together the corresponding pair of DPBC ENABLE hubs at the same time.
6. To simplify wiring and checking of the plugboard, always maintain an orderly ascending numerical sequence in connecting hubs.
4. Place the header card to be duplicated in feed hopper face down, 12-edge first.
5. Joggle 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.
6. Firmly grasp the cards and without letting them slip, lower them into the feed hopper face down and 12-edge first.
7. After loading approximately 800 cards, check that the master card is as far back from the card throat as possible; i.e., the 9 edge should be against the feed hopper posts.
8. Replace the card weight.
9. Depress mode select button until OFF-LINE indicator portion of button lights.
10. Depress MANUAL CYCLE button twice.
11. Depress PUNCH READY button. Indicator portion of switch should light and card punching operation should commence.

Gang Punching Off-Line Computer Operation

The card punch may be used off-line (not connected to the central processor) for the particular function of gang punching which means duplicating the information on one card usually called a 'header' card in each succeeding card. The number of cards which may be made similar to the master card is almost unlimited.

Plugboard wiring for gang punching requires that the Read Brush Exit hubs be wired to the corresponding Punch Magnetic Entry hubs. Figure VIII-4 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.

The following is the procedure for readying the card punch for off-line operation. All controls and indicators mentioned are on the card punch's control and indicator panel.

1. Install the correct plugboard. If the proper plugboard is already available, use it. If not, wire a plugboard for the particular program.
2. Depress the POWER ON button. Indicator portion of switch should light.
3. Remove the card weight from the feed hopper.

Emptying the Chip Box

The chip box is located in the area adjacent to the stacker pocket. If the card punch is operating continuously it is necessary to hourly empty the chip box. This is done as follows: (Unless stated otherwise, controls and indicators mentioned are on the punch's control and indicator panel.)

1. Set the MANUAL/AUTO switch on the console to MANUAL if operating on-line; otherwise, ignore this step.
2. Depress PUNCH STOP until card movement halts.
3. Depress POWER OFF.
4. Remove and empty chip box. Return chip box to original position. (If chip box is not in properly, power cannot be applied to the card punch.)
5. Depress POWER ON.
6. Depress PUNCH READY.
7. Return MANUAL/AUTO switch on the console to AUTO position, if operating on-line, otherwise ignore this step.

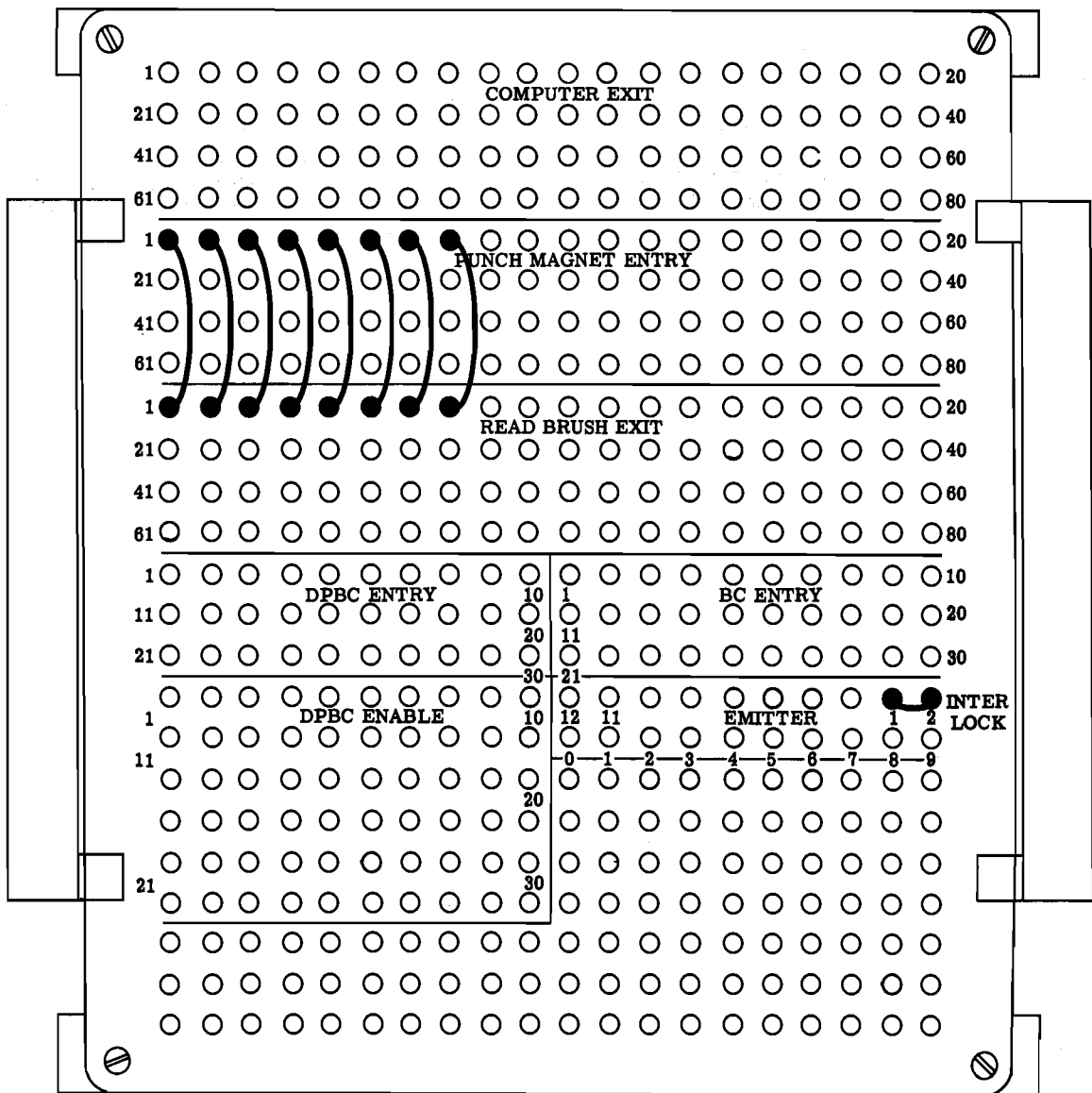


Figure VIII-4. Example of Plugboard Wiring for Off-Line Operation

ERRORS AND OPERATOR CORRECTIVE ACTION

Operator Errors

Failure of the card punch occurs when the operator neglects to:

1. Depress POWER ON pushbutton on the card punch.
2. Load sufficient cards in input hopper.
3. Empty stacker before pocket becomes full.
4. Remove all cards from card punch prior to an off-line operation.
5. Place card to be reproduced in front of deck for an off-line operation.
6. Clear card punch alarm on console.

7. Empty chip box when full or insert chip box properly.

8. Insert correctly-wired plugboard.

These failures, their indication, and methods of correcting them and other common failures are described in Table IX.

Program Errors

A program error occurs whenever a card punch command is executed while the card punch is punching. At such times the operator should consult his run book (or other operator instructions) or notify the programmer. This type of error is also described in Table IX.

TABLE IX.
CARD PUNCH ERROR CONDITIONS

Error Indication	Cause	Operator Action
<p>DPBC ERROR Indicator on the card punch lights and PUNCH READY indicator on the control console is off.</p>	<p>Either the card punch has failed to punch once or has double punched in one or more columns where it should not have.</p>	<ol style="list-style-type: none"> 1. Consult operating instructions for specific details if this is an on-line operation. If errors occur during off-line operation, skip steps 2 and 3. 2. Set AUTO/MANUAL switch on control console to MANUAL. 3. Press MANUAL CYCLE on the punch once. 4. Depress RESET ALARM on control console as designated by run book if ALARM indicator is lit. 5. Examine card on top of output stack of the card punch for a double punch or blank in column where neither should be. 6. Depress MANUAL CYCLE button once. 7. If the PUNCH READY indicator goes off again, repeat steps 3, 4, and 5 for an on-line operation and steps 4 and 5 for an off-line operation. 8. Depress PUNCH READY. Normal operation is restored at this point in an off-line operation. If operation is on-line, continue with steps 9 and 10. 10. Depress START button.
	<p>Cause other than above</p>	<p>Notify service personnel.</p>
<p>Cards enter card punch but do not exit.</p>	<p>An internal jam.</p>	<p>Notify service personnel. Note this condition can exist without an error being otherwise detected.</p>
<p>CARD PUNCH indicator on console lights or CARD PUNCH READY indicator on punch goes out.</p>	<p>The feed hopper is empty or the card stacker is full</p>	<ol style="list-style-type: none"> 1. Rectify supply condition. 2. Depress PUNCH READY.
	<p>Misfeed</p>	<ol style="list-style-type: none"> 1. Remove cards from hopper. 2. Examine bottom cards of deck. If one or more cards have deformed 12 edges, remove them from the deck.

GE-225

TABLE IX. (CONT.)

Error Indication	Cause	Operator Action
<p>CARD PUNCH indicator on console lights or CARD PUNCH READY indicator on punch goes out. (Cont.)</p>		<ol style="list-style-type: none"> 3. Reload feed hopper and empty card stacker. 4. Depress Manual Feed twice. 5. If operating on-line, set AUTO/MANUAL switch to MANUAL, otherwise ignore the step. 6. Depress PUNCH READY. 7. If operating on-line, return AUTO/MANUAL switch to AUTOMATIC. 8. Return to nearest restart position.
	<p>Programming ERROR</p>	<ol style="list-style-type: none"> 1. Consult operating instructions and/or notify programmer. 2. Set AUTO/MANUAL switch in MANUAL. 3. Depress RESET. 4. Make necessary correction. 5. Return AUTO/MANUAL switch to AUTOMATIC. 6. Return to nearest restart position.
<p>CARD PUNCH READY indicator light on console goes out and CARD PUNCH alarm indicator comes on.</p>	<p>Card jam or some other cause.</p>	<p>Notify service personnel.</p>
<p>POWER ON pushbutton lights only as long as it is depressed, and goes out when pushbutton is released.</p>	<p>Plugboard not in holder.</p>	<p>Insert proper plugboard.</p>
	<p>INTER-LOCK hubs are not wired together.</p>	<p>Wire INTER-LOCK hubs 1 and 2 together.</p>
	<p>Chip box is not properly seated in card punch.</p>	<p>Reposition chip box.</p>
<p>Program in loop (I Register contains 2514007 or 2516007) and PUNCH READY is off.</p>	<p>DPBC ERROR</p>	<p>Follow procedure already described under DPBC type error.</p>
	<p>Input hopper is empty or card stacker is full.</p>	<ol style="list-style-type: none"> 1. Rectify card or supply condition. 2. Depress PUNCH READY.