XVII. OFF-LINE/ON-LINE PRINTER SUBSYSTEM

GENERAL DESCRIPTION

As its name implies, the off-line/on-line printer subsystem is capable of operating on line, printing information directly from the GE-225 central processor; or operating off-line, reading and printing information from magnetic tape. An advantage of off-line operation is the production of reports more quickly and at a lower cost. Automatic format control is possible in both on-line and off-line modes of operation. Programs written for the high-speed printer (described in Section X) will operate correctly in the on-line mode of this printer.

The subsystem, illustrated in Figure XVII-1, is housed in three cabinets. One contains the printer unit and a second contains the printer controller. The third cabinet contains the buffered tape reader and its controller and power supply. The buffered tape reader is used only in off-line operation.

Printer

The 900 line-per-minute printer is essentially the same unit used in the high-speed printer subsystem. Since the printer unit is described in Section X, the readers of this manual are requested to refer to pages X-5, X-6, and X-7 for the printer description. Two control panels and their associated control boxes have been added to the top of the on-line/off-line printer unit. These permit the operator to control both tape reader and printer operations from one location.

Printer Controller. The on-line/off-line controller contains electronic elements capable of performing all of the functions which the controller for the high-speed printer performs. These functions are described on pages X-1 and X-3 of Section X. In off-line operations, the printer controller receives its data and/or format characters from the 1024-character core buffer of the tape controller. The controller differs from the one described in Section X in that it does not have a control and indicator panel. All of the controls are concentrated on the printer. In addition, the controller for the off-line/on-line printer can, with minor modification, control a re-entry printer which uses print characters which can be read either optically or magnetically.

Printer Paper. Paper used with the printer must be a continuous perforated sheet of 3-1/2 inch minimum width and 19-1/2 inch maximum width. The sprocket holes on the margin of the paper must be spaced at intervals of 1/2 inch from center to center and have no more than 1/4 inch from the center of the hole to the edge of the paper. As many as five copies can be run through the printer at a time. When multiple copies are in the printer, no staples (either metal or plastic) and no glue must be used to hold the paper and/or carbons together.

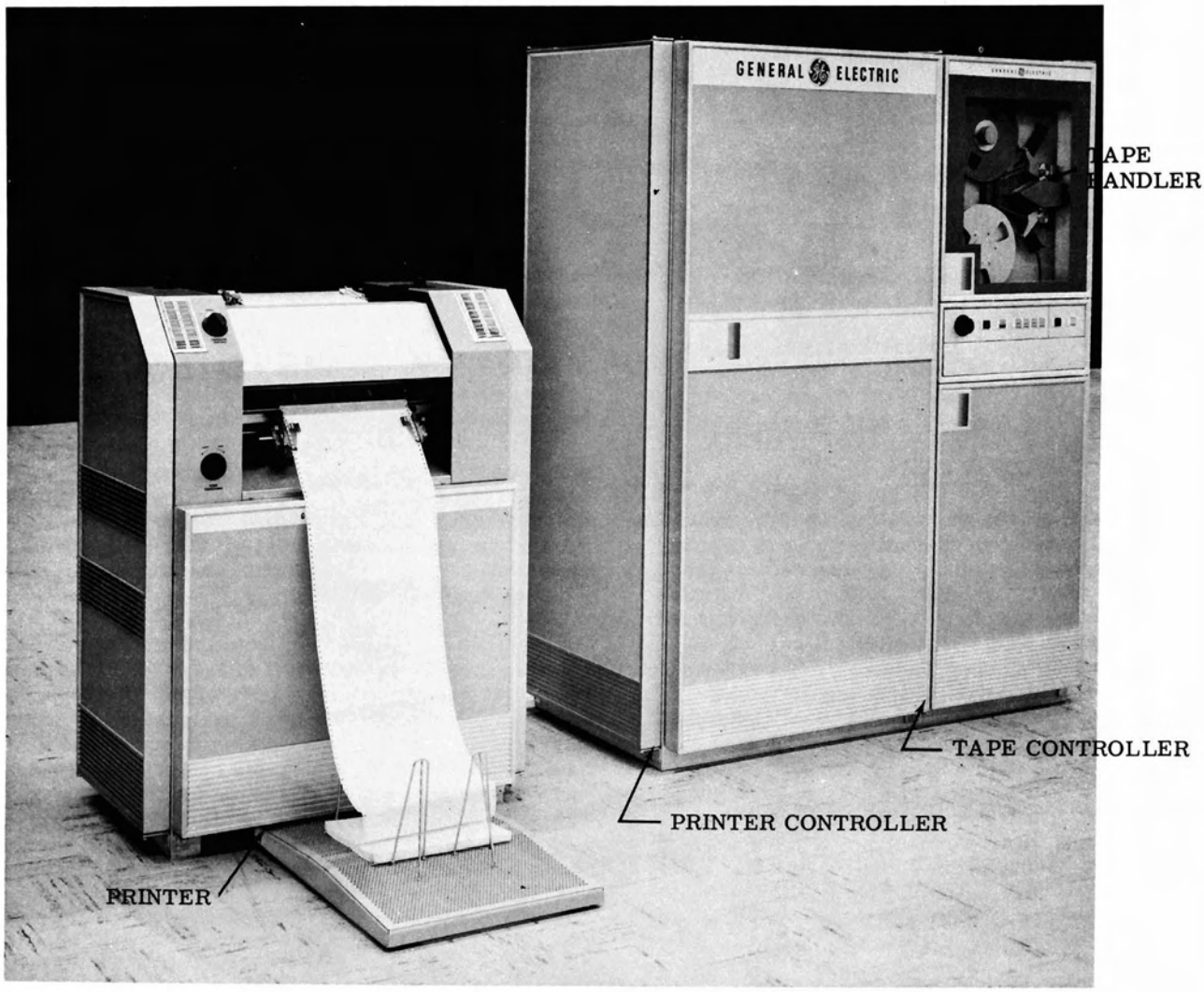
Printer Control Panels

The left panel at the top of the printer contains controls and indicators for operation of the printer. Most of these pushbutton controls and indicators pertain to both off-line and on-line operation as described below. Figure XVII-2 illustrates this panel.

POWER ON. This switch turns on power to the entire printer subsystem. It is illuminated amber when power is on.

POWER OFF. This switch turns off printer power. It is illuminated red when power is off.

HI SPEED/LOW SPEED. This switch sets the speed of the typeline drive motor. The HI SPEED setting permits 900 line/minute printing. The LO SPEED setting permits 600 lines/minute printing. The pushbutton changes from one condition to the other when depressed. It is horizontally divided so that the mode which is set can be indicated by illumination; the HI SPEED half is blue.



Off-Line/On-Line Printer Subsystem

ON LINE/OFF LINE. This switch determines the mode of operation by selecting input from the central processor (ON LINE) or from the magnetic tape reader (OFF LINE). The pushbutton changes from one condition to the other when depressed. It is horizontally divided so that the mode which is set can be indicated by illumination; the ON LINE half is blue.

SPACE PAPER. This switch can be used only when the reader is in the manual mode. When the switch is depressed, it slews printer paper one line. It also performs the same function that MANUAL CLEAR performs, causing all counters, registers, and buffers to be cleared.

POSITION LOOP. This switch slews printer paper to the top of the next page. It can be used to slew from 1 to 132 lines. It operates in conjunction with the vertical format loop.

MANUAL CLEAR. This switch halts print and slew functions and stops tape motion before printing or reading the complete record. It clears the circuitry so that operations can begin again without error. Depressing MANAUL CLEAR clears all buffers, counters, registers, and alert conditions except the paper alert light. The POWER ON and SPACE PAPER switches also clear the circuitry of error conditions.

MEMORY DUMP. This switch initiates a slew to top of page followed by an octal printout (dump). When in the on-line mode, the printout is of the contents of the central processor memory, starting at location zero. When in the

off-line mode, the printout is of the contents of the 1024-character core buffer in the tape unit. In the off-line, automatic mode, zeros will be printed for empty spaces when the buffer is not filled. After a memory dump, MANUAL CLEAR must be depressed before operations can continue. In the on-line mode, MANUAL CLEAR stops the printout which otherwise would repeat the entire dump over and over. In the off-line mode, MANUAL CLEAR corrects the OVERFLOW condition which results after the dump. (See the Special Procedures description of how to take a memory dump.)

PARITY IN. This indicator glows red when the word received from the computer during on-line operations has incorrect parity. It remains lit until manually reset by either the MANUAL CLEAR or SPACE PAPER switch.

OVERFLOW. This indicator glows red when an attempt was made to load more than 120 characters in the typeline buffer in the printer controller. This is normally the result of a program error. In the on-line mode, operations halt before printing the line in the buffer. In the off-line mode, operations halt after printing the line in the buffer. The OVERFLOW indicator remains lit until it is manually reset by depressing the MANAUL CLEAR switch.

SLEW. This indicator glows red when there is a "runaway paper" condition, meaning that paper is slewing beyond the point designated by the program. The operator must depress the MANUAL CLEAR switch to halt the slewing. This pertains to both on-line and off-line operation.

PAPER. This indicator glows red when the printer is either out of paper or there is incorrect paper tension. The operator must check the printer to determine which of these two conditions caused the alert, and must either load paper or adjust paper tension. This pertains to both on-line and off-line operation.

The right panel at the top of the printer contains push-button controls and indicators which pertain to off-line tape reader operation. Figure XVII-3 illustrates this panel.

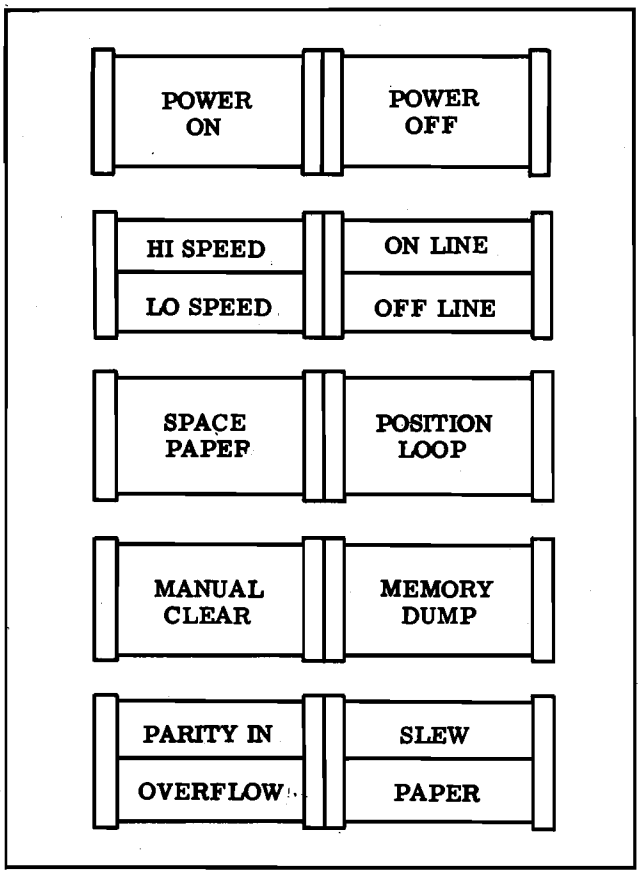


Figure XVII-2. Printer Control and Indicator Panel - Left Side

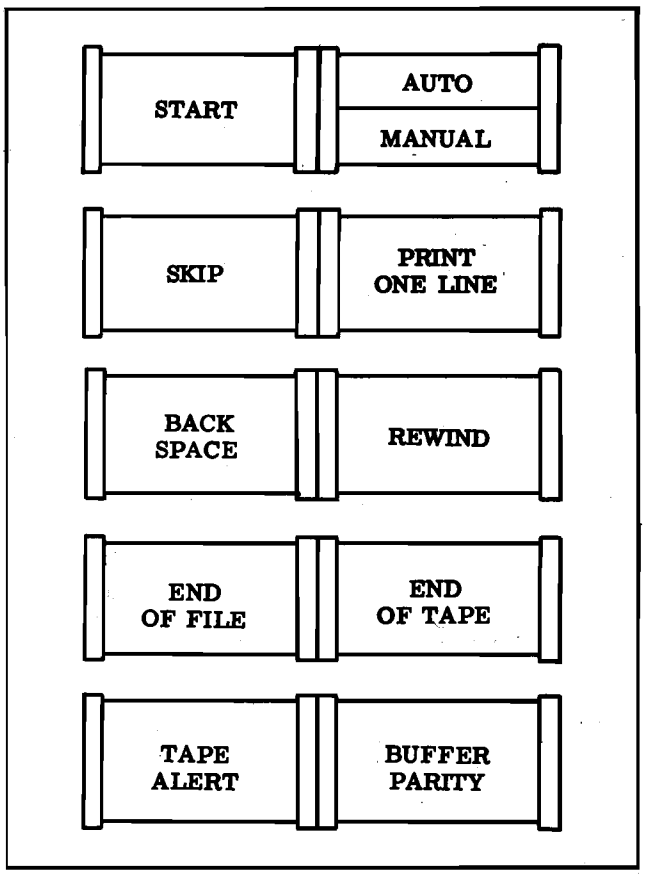


Figure XVII-3. Printer Control and Indicator Panel - Right Side

START. Depressing this switch starts off-line printing (providing the tape reader and the printer are ready for operation). The subsystem must be in the AUTOMATIC and off-line modes. The pushbutton glows yellow when printing is in operation.

AUTO MANUAL. This switch sets the mode of off-line operation to either AUTOMATIC or MANUAL. The pushbutton changes from one condition to the other when depressed, and it is horizontally divided so that the mode which is set is illuminated. The AUTOMATIC mode is used during off-line printing. In MANUAL, tape movement occurs only under operator control. The manual mode must be used when the operator depresses any of the following switches: SKIP, PRINT ONE LINE, REWIND, SPACE, TAPE FORWARD, TAPE REVERSE, and STOP. Switching from AUTO to MANUAL causes all off-line operation to halt as soon as the print line in process is completed.

SKIP. When in the manual mode, depressing this switch causes tape to advance one record and read a selected file into the 1024 character core buffer. If a selected file is not encountered in the first record, tape motion continues until a selected file is encountered. If no FILE SELECT switch was depressed before the SKIP, the entire tape is passed by the read heads as they search for a file code.

PRINT ONE LINE. When in the manual mode, this switch causes one line of data to be printed each time it is depressed. The information printed and the format and slew are determined by the program. Repeated depressing of the pushbutton causes all print lines in the 1024 character core buffer to be printed. No new information is read into the buffer, so the same lines will be printed over and over. Depressing SKIP causes new information to be read into the buffer.

BACK SPACE. This switch causes the tape reader to backspace one tape record. If in the automatic mode, the tape will automatically reread the tape record. If in the manual mode, the tape will halt after backspacing, and the operator must depress MANUAL CLEAR and START to continue.

REWIND. When in the manual mode, this switch causes tape to be rewound at 150 inches per second and positioned at the load point marker. The rewind can be halted by depressing MANUAL CLEAR. When tape is positioned at the load point marker, END OF TAPE is illuminated.

END OF FILE. This indicator glows red when an end-of-file code is encountered during a tape reading operation. It indicates to the operator that no error condition exists. Tape motion halts, and information in the buffer is printed. MANUAL CLEAR must be depressed to turn off the indicator light and permit continuation.

END OF TAPE. This indicator glows blue when an end-of-tape marker is sensed. It indicates to the operator that no further information is on the tape. Tape motion halts and information in the buffer is printed. Tape must be rewound before the tape unit is operable. Rewinding turns off the indicator light, as does depressing MANUAL CLEAR.

TAPE ALERT. This indicator glows red when any of five types of errors occur in the tape unit. The error conditions are: lateral parity, longitudinal parity, mod check, 1024 character core buffer overflow, and tape interlock. An interlock error is caused by the dust cover on the tape handler being left open in which case, tape does not move.

BUFFER PARITY. This indicator glows red when a character read into or out of the 1024 character core buffer had a parity error. It indicates either a bad read-in or read-out. Tape reading halts, and MANUAL CLEAR must be depressed to turn off the BUFFER PARITY indicator light. Operator procedure (whether to restart or continue) will be determined by programmer instructions for the particular run.

In addition to the controls just described, the printer has the following:

Paper tension knob
Paper drive tractors
Form positioning knob
Penetration control knob

These controls are described on pages X-6, and X-7 of Section X; please refer to those pages.

Buffered Tape Reader

The reader has a tape handler of the vacuum feed type. It is like the handler described on pages IX-4 and IX-5, except that the write head is deactivated. Two models of readers are available. Model #4WPA690A has the capability of reading tapes packed at 200 bits per inch. Model #4WPA690B is capable of reading either 200 or 555 bits per inch. On the model which can read either high-density (555 bits/inch) or low density (200 bits/inch) tape, the switch to change from one type of reading to another is on the printer. It is inside the back panel, and must be set by the service engineer to the density of tape used.

1024-Character Core Buffer. The tape unit contains a 1024-character core buffer which is a small random-access memory unit. It holds 1024 addressable 7-bit character locations. Information is read from tape into the buffer before it is transferred to the printer controller. Although the buffer has 1024 character locations, only 1023 of these may be filled with information read from tape. The tape controller generates an octal 17 and stores it in the character position following the last data character stored in the buffer. The octal 17 is necessary to initiate tape read action to again fill the buffer.

Tape Controller. The tape controller controls tape movement, translates signals from the tape read heads to binary format, and makes numerous checks to insure that no error occurs in reading tape and no information is lost in transfer between the tape unit and the printer. The controller loads binary data and format characters into and out of the 1024-character core buffer.

Tape Reader Controls and Indicators

The switches and indicators on the two panels of the tape reader (Figure XVII-4) control all tape operations. Some of these switches and indicators are duplicated on the panel at the right side of the printer. All switches are of the pushbutton type.

FILE 0 - - - FILE 7. These switches select one or more of the eight file codes of information on magnetic tape for reading and printing. FILE 0 has the special function of enabling the entire tape to be written in an octal printout - a memory dump operation. When FILE 0 is depressed, it takes precedence over other file switches. Codes 1 through 7 permit only those print lines with the selected file codes to be stored in core buffer and then printed, with the exception that command words having code zero are always printed, even though the FILE 0 switch is not depressed. Any combination of file select switches 1 through 7 may be set at one time. If the total number of characters in selected files exceeds 1023, it will cause an overflow. Likewise, FILE 0 will cause an overflow when any tape record exceeds 1023 characters. When a FILE switch is selected (depressed), it is illuminated.

STOP. This switch stops all tape motion, and must be used in the manual mode of operation.

FORWARD. In a manual mode of operation, this switch moves tape forward. It should be used with LO SPEED during any reading operation. Tape moves until a record is encountered which is headed by a preselected file code. That record is then read into the 1024-character core buffer. The tape halts when the end of record is reached.

REVERSE. In a manual mode of operation, this switch moves tape backward until either a load point marker is sensed or until tape movement is stopped by the MANUAL CLEAR or the STOP switch. If both HI SPEED and REVERSE are depressed, tape motion is about as fast as that obtained with the REWIND switch - 150 inches per second. When tape is positioned at the load point marker, the END OF TAPE indicator is illuminated.

HI SPEED/LO SPEED. This switch determines the speed of tape movement. Tape moves as a result of pinch rollers pushing against capstan drive wheels. The capstan drive motors turn at rates which cause tapes to move at either 75 inches a second (LO SPEED), or at 150 inches

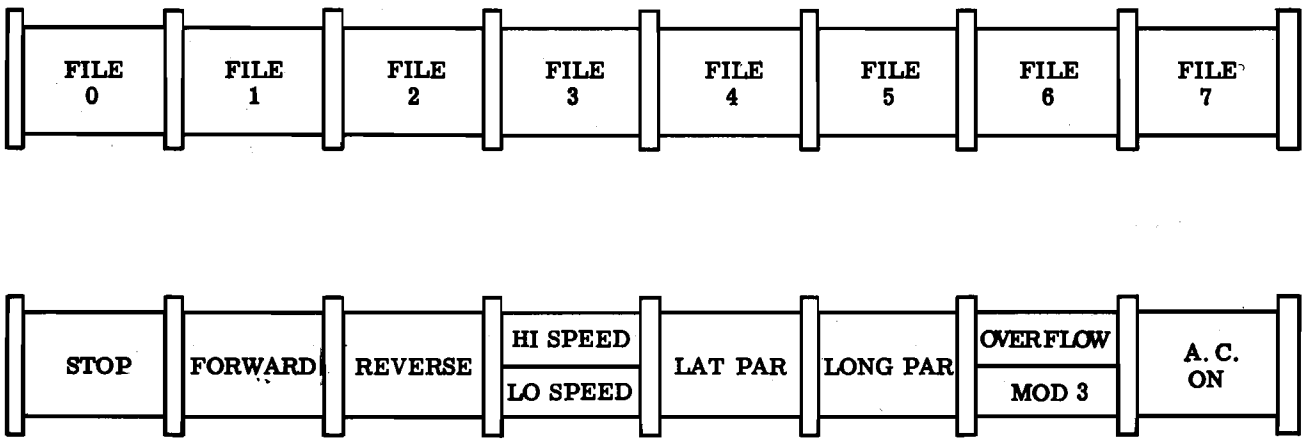


Figure XVII-4. Controls and Indicators on the Tape Unit

a second (HI SPEED). The pushbutton changes from one speed to another when depressed, and is horizontally divided so that the speed which is set is indicated by illumination. The switch must be set at LO SPEED during off-line printing.

LONG PAR. This indicator and the TAPE ALERT indicator glow red when an error is detected during a longitudinal parity check on a record. Tape motion halts at the end-of-record gap immediately following the error. No part of the record will be printed unless the operator is able to backspace and reread the record without an error. MANUAL CLEAR must be depressed.

LAT PAR. This indicator and the TAPE ALERT indicator glow red when a lateral parity error is detected during the checking of tape reading. Tape halts at the end of the record being read, and recovery procedure is the same as for a lateral parity error.

OVERFLOW. This indicator and the TAPE ALERT indicator glow red when an attempt was made to load more than 1023 characters in the core buffer. This is usually caused by a programming error, and no printing can occur until corrective action is taken. The operator may want to backspace and reread the record to be sure that the equipment has functioned properly. If the overflow persists, the information in the buffer which caused the overflow cannot be printed. It must be skipped. To continue, the operator must depress MANUAL CLEAR to turn out the indicator light, depress SKIP to read a new record, then depress AUTO and START.

MOD 3. This indicator and the TAPE ALERT indicator glow red when an incorrect number of characters has been detected on a record. The check is to see that the number of characters in the tape record is a multiple of three. Tape reading halts at the end of the record and the indicator comes on. The manual mode must be set and MANUAL CLEAR depressed to turn off the light. Backspacing and rereading might correct the error if it was caused by the hardware and not the program. Programmer instructions may specify which procedure to follow.

A.C. ON. This switch turns on the alternating current power supply for the handler and controller. It glows amber when power is on.

OFF-LINE OPERATION

Before printing off-line, the program (including format and data words) is stored on reels of magnetic tape. The reels of tape serve a function similar to that which core memory serves in on-line printing. All information on tape is written in the 18-bit special binary mode. Each line of format is preceded by a command word and is followed by an end-of-line (octal 77) word. The format command word contains identification (as format), a file code number, and a starting address for storage in the 1024-character core buffer. Each line of data is preceded by two command words and is followed by an end-of-line word. The command words contain identification (as data), file code number, print or slew specification, and format address. Figure XVII-5 summarizes information in command words for off-line printing. Because the tape reader's core buffer can hold only 1023 characters, the program must be prepared so that no more than 1023 characters are transferred to the core buffer at one time.

When a reel of tape is installed on the tape handler, the START switch initiates a tape read and buffer fill cycle. The file select code determines where reading begins. Characters are decoded and read into the 1024-character core buffer. If the information is a line of format, the command word is decoded to determine the starting address of format storage. If it is a line of data, the command words are stored along with the data for use by the printer controller. Lines of data and their command words and end-of-line codes are stored sequentially in the buffer starting at location zero. A stored buffer word consists of only one 6-bit character plus a parity bit. The tape controller hardware makes numerous checks to assure correct tape reading and character transfer to the buffer. If no errors occur, tape is read until an inter-record gap is encountered. Then, a buffer empty and print cycle follows. In this cycle, the printer controller requests alternately a word of data and a word of format from the 1024-character core buffer, and assembles the print line in the printer controller's 120-character print-line image buffer. When a end-of-line code (octal 77) is encountered, it signals the printer to print the line. The printer controller hardware checks parity and other possible error conditions, to assure correct transfer of characters from the tape unit to the printer controller. After the line is printed, the controller examines the next word in the buffer and continues filling print lines until an end-of-print lines signal (octal 17) is encountered. The signal means that the 1024-character buffer has been emptied and must be filled. So — the tape read and buffer fill cycle is again initiated. These two read and write cycles are performed alternately until an end-of-file code is encountered and operations halt.

ON-LINE OPERATION

Programs written for the on-line (high-speed) printer will operate correctly in the on-line mode of the off-line printer. During on-line operation, the printer controller receives format and data words directly from the memory of the central processor. Since

Bit Position	Format Line	Data Line	
	Command Word	Command Word 1	Command Word 2
0	Not used	Not used	Not used
1	Not used	Not used	Not used
2	Zero	One	VFU-8
3	One	Zero	VFU-7
4	Zero	Zero	VFU-6
5	File Select 2^2_1	File Select 2^2_1	Zero
6	File Select 2^1_0	File Select 2^1_0	Zero
7	File Select 2^0	File Select 2^0	Zero
8	Zero	Print (1) or Slew (0)	VFU-5
9	Zero	Format (1) or Not $_9$(0)	VFU-4
10	Format Address 2^9	Format Address 2^8_9	Zero
11	" " 2^8	" " 2^7_8	Zero
12	" " 2^7	" " 2^6_7	Zero
13	" " 2^6	" " 2^5_6	Zero
14	" " 2^5	" " 2^4_5	VFU-3
15	" " 2^4	" " 2^3_4	VFU-2
16	" " 2^3	" " 2^2_3	VFU-1
17	" " 2^2	" " 2^1_2	Zero
18	" " 2^1	" " 2^0_1	Zero
19	" " 2^0	" " 2^0	Zero

Figure XVII-5. Command Words for Off-Line Printing

this procedure is the same as that described for the high-speed printer in Section X, it will not be repeated here.

SETUP PROCEDURE - OFF LINE

The following are the steps for preparing for off-line operation. Refer to Table XXIV for a summary of controls and indicators. Unless specified otherwise, controls and indicators are on the printer.*

A. Prepare the Tape Unit using these steps:

1. Depress the A.C. ON switch on the tape reader.

2. Depress the POWER ON switch on the panel at the left of the printer.

3. Set the AUTO/MANUAL switch on the panel to MANUAL (MANUAL will be illuminated).

4. Check to make sure that the write-permit ring is removed from the reel of tape. Load the tape onto the handler as illustrated in Figure IX-7, using the following steps:

a. Place the tape reel (grooved side first) onto the upper reel mounting hub. The reel must be fully seated on the mount; hold the reel in place with one hand (be sure to press only on the reel hub) and tighten the knob by turning it clockwise. CAUTION: Never tighten the reel mount knob more than necessary to secure the reel; over-tightening will result in stripping the threads of the knob screw.

b. Pull the dust cover open slowly. This causes the tape takeup arms to be pulled into the open position. There must be an audible click as the mechanism goes into the cocked position. If the click is not heard, close the dust cover and reopen it slowly to cause the click. This procedure also releases brakes holding the mount hubs and allows the reels to turn freely.

c. Thread the tape leader through the guides as shown in Figure IX-7. Wind the end of the tape leader around the hub of the takeup reel and manually turn the reel approximately six revolutions (clockwise) to secure the tape. CAUTION: The tape end must lay straight and flat on the lower reel. If the tape is folded, bunched, or protrudes from the reel, it could cause damage to working portion of the tape.

*It is assumed that the HIGH/LOW Density switch was set correctly by the service engineer. Most computer users read only one density of tape and do not have occasion to change the density switch after its initial setting.

d. Prior to closing the dust cover, pull it back slightly to release the thread switch. Do not let it slam; it could cause damage to the handler assembly.

e. If tape is not drawn into the vacuum pocket by the vacuum, tap the tape lightly over the vacuum pocket opening until the tape is drawn into the opening. (Vacuum pockets are often called "pucker" pockets.)

f. Depress the FORWARD switch on the tape reader.

(1) If the tape is threaded properly, the leader foil has not yet passed the sensing cells, and the tape will stop on or a little beyond the foil.

(2) If the tape happened to be threaded with the leader foil beyond the sensing cells, the tape will keep right on going. In this case, the operator must stop the tape by depressing STOP.

g. Depress the REVERSE switch on the tape reader to bring the tape to the load point marker (leader foil). The END OF TAPE indicator is illuminated when tape is positioned at the load point marker.

5. Depress the FILE pushbutton corresponding to the file codes to be read from tape.

B. Prepare the Printer using these steps:

1. Set the HI SPEED/LO SPEED switch to the desired speed of 600 or 900 lines per minute (the effective HI or LO setting is illuminated).

2. Depress the MANUAL CLEAR switch to clear the circuitry.

3. Install the VFU tape in the VFU mechanism of the printer. Steps for the installation are:

a. Remove the access panel from the left side of the printer.

b. Raise the brush mounting block by rotating the block-raising knob. (See Figure X-4.)

c. Place the tape loop so it is threaded between the format wheel and the tape guide; sprocket holes are on the side of the tape closest to the operator; and the teeth on the format wheel engage the sprocket holes on the tape.

d. Lower the brush mounting block by turning the block-raising knob and replace the access panel.

4. Remove the paper from the tractors and depress the POSITION LOOP switch to synchronize the VFU tape with the tractors and thereby position the VFU tape loop.

5. Check the paper supply and replace the paper in the tractors. If necessary, load paper following the directions in Section X, pages X-8 and X-9.

6. Set the ON LINE/OFF LINE switch to the OFF/LINE position (OFF LINE is illuminated).

7. Depress the MANUAL CLEAR switch.

8. Set the AUTO/MANUAL switch to AUTO.

9. Depress the START pushbutton.

Unloading Tape

After a program has been run, remove tape as follows:

1. Set the AUTO/MANUAL switch to MANUAL.

2. If the END OF TAPE indicator is not lit, indicating that tape is rewound to the leader foil, depress REVERSE to make sure it is on the foil.

3. Open the dust cover slightly so the vacuum dies slowly; otherwise, tape is sucked into the pockets, causing damage.

4. Rewind the upper reel by turning it by hand until all the tape is rewound. The hand winding prevents causing damage to both tape and equipment.

5. Remove the top reel of magnetic tape from the handler as follows:

a. Turn the knob in the center of the top reel mounting hub counterclockwise to release the reel.

b. Remove the reel.

(1) If the information on the reel is not to be saved, place it in a clean container and store it with "non-save" tapes.

(2) If the information on the reel is to be saved, place the reel in a clean container and file it in an area specified for tapes to be saved

6. If it is the end of the day's operation, or normal shutdown for some other reason, release the spring tension on the dust cover to avoid damage to the cover's springs.

TABLE XXIV

SUMMARY OF CONTROLS AND INDICATORS FOR THE OFF-LINE/ON-LINE PRINTER

Location	Control or Indicator	Function
Tape Reader Control and Indicator Panel (Figure XVII-4)	FILE 0 switch and indicator (white)	Permits an octal printout of the entire tape. Glows white when depressed.
	FILE 1 through FILE 7, switch and indicator (white)	Permits a formatted printout of information from selected FILES. Pushbuttons glow white when depressed.
	STOP switch	Must be used only in MANUAL MODE. Stops tape motion.
	FORWARD switch	Use only in the manual mode. Moves tape forward until a selected record is encountered, then reads that record into the 1024-character core buffer. Tape halts after 1 record is read.
	REVERSE switch	Use only in the manual mode. Moves tape backward to the load point marker. Can be used with either HI SPEED or LO SPEED.
	HI SPEED/LO SPEED switch and indicator (blue and white)	Determines tape speed as HI (150 ips) or LO (75 ips). Effective speed is illuminated. (HI SPEED is blue)
	LAT PAR indicator (red)	Glows red when a lateral parity error occurs during tape reading. Tape motion halts.
	LONG PAR indicator (red)	Glows red when a longitudinal parity error occurs during tape reading. Tape motion halts.
	OVERFLOW indicator (red)	Glows red to indicate that the program attempted to load too many characters in the 1024-character core buffer. Printing is halted.

TABLE XXIV (CON'T.)

Location	Control or Indicator	Function
Tape Reader Control and Indicator Panel (Figure XVII-4) (Cont.)	MOD 3 indicator (red)	Glows red to indicate that an incorrect number of characters has been read from a record. Tape reading is halted.
	A.C. ON switch and indicator (amber)	Turns on a-c power supply for the tape handler and controller. Glows amber to indicate when power is on.
Left control and indicator panel of the printer (Figure XVII-2)	POWER ON switch and indicator (amber)	Turns on power to the entire printer subsystem. Glows amber when power is on.
	POWER OFF switch and indicator (red)	Turns off power to the entire printer subsystem. Glows red when power is off.
	HI SPEED/LO SPEED switch and indicator (blue and white)	Sets the speed of printing at either 900 lines per minute (HI SPEED) or 600 lines per minute (LO SPEED). HI SPEED glows blue when set. LO SPEED glows white when set.
	ON LINE/OFF LINE switch and indicator (blue and white)	Selects input from the central processor (ON LINE) or from the magnetic tape reader (OFF LINE). ON LINE glows blue when selected, OFF LINE glows white when selected.
	SPACE PAPER switch	Use only in the manual mode. Slews printer paper one line each time it is depressed. Also clears all counters, registers, and buffers.
	POSITION LOOP switch	Slews printer paper to the top of the next page.
	MANUAL CLEAR switch	Halts print and slew functions and stops tape motion. Also clears all buffers, registers, and alert conditions.

TABLE XXIV (CON'T.)

Location	Control or Indicator	Function
Left control and indicator panel of the printer (Figure XVII-2) (Cont)	MEMORY DUMP switch	In the off-line mode, initiates an octal printout of the contents of the 1024-character core buffer of the tape unit. In the on-line mode, initiates a printout of the contents of the central processor memory, starting at location zero.
	PARITY IN indicator (red)	During on-line operation, glows red to indicate a parity error on a word received from the central processor.
	OVERFLOW indicator (red)	During either on-line or off-line operations, OVERFLOW glows red and the printer subsystem halts because an attempt was made to overload the typeline buffer.
	SLEW indicator (red)	Glows red to indicate a "runaway" paper condition in the printer.
	PAPER indicator (red)	Glows red to indicate that the printer is either out of paper or has insufficient paper tension.
Right control and indicator panel of the printer (Figure XVII-3)	START switch and indicator (amber)	In the automatic mode, starts off-line printing. Glows amber when printing is in operation.
	AUTO/MANUAL switch and indicator (white)	Sets the mode of printing to AUTO or MANUAL. The mode selected is indicated by illumination.
	SKIP switch	In the manual mode, advances tape until a preselected file is encountered and read into the 1024-character core buffer.
	PRINT ONE LINE switch	In the manual mode, causes printing one line of information each time it is depressed.
	BACK SPACE switch	Causes the tape reader to backspace one tape record. In the automatic mode, rereads the tape record.

TABLE XXIV (CON'T.)

Location	Control or Indicator	Function
Right control and indicator panel of the printer (Figure XVII-3) (Cont)	REWIND switch	In the manual mode, rewinds tape at 150 inches per second until the lead point marker is encountered load.
	END OF FILE indicator (red)	Glows red when an end-of-file code is encountered. Tape motion and printing halt.
	END OF TAPE indicator (blue)	Glows blue when an end-of-tape marker is sensed. Tape motion and printing halt.
	TAPE ALERT indicator (red)	Glows red to indicate that any of five types of errors occur: lateral parity, longitudinal parity, mod check, 1024-character buffer overflow, and tape interlock.
	BUFFER PARTY indicator (red)	Glows red to indicate when a parity error occurred, during reading into or out of the 1024-character core buffer.

SPECIAL PROCEDURES

Obtaining Octal Dump

Off-Line Dump of Whole Tape Reel. When an octal tape dump is required for debugging purposes or because of error conditions, the following procedure is used. (It is assumed that tape is loaded properly, power is on, and the desired speed is selected.)

1. Depress FILE 0 on the tape unit control panel.
2. Set the AUTO/MANUAL switch to AUTO at the right of the printer.
3. Depress MANUAL CLEAR at the left of the printer.
4. Depress START at the right of the printer.

This causes a printout of the contents of the 1024-character core buffer. If no record is longer than 1023 characters, a series of tape reads and printouts will automatically follow until the entire tape is dumped. This dump is of command words, end-of-line codes, data words, and format words printed in 16 groups of two octal numbers per line (representing 16 BCD characters). The data is printed as it was written on tape and before it has been acted upon by format characters. If any record is longer than 1023 characters, an overflow occurs, and printing cannot result until after the operator depresses MANUAL CLEAR and START.

Off-Line Dump of the 1024-Character Core Buffer. When only information from one file code is desired, for example, when an error condition occurs during operation, the following procedure is used. (It is assumed that tape is loaded and power is on.)

1. Depress a FILE pushbutton to the desired file code number on the tape unit control panel.
2. Set the AUTO/MANUAL switch to MANUAL at the right of the printer.
3. Depress SKIP at the right of the printer.

4. After tape has been read into the buffer (tape motion halts), depress MEMORY DUMP at the left of the printer.

5. Depress MANUAL CLEAR to eliminate the overflow condition which results after the memory dump.

This results in an octal printout of information in the buffer. The printout includes command words, data words, format words, and end-of-line codes like the printout described for the dump of the whole tape reel. No tape is read into the buffer following the printout, so printer operation halts. If the record in the buffer contains more than 1023 characters, an overflow results and no printing occurs until the operator depresses MANUAL CLEAR, AUTO, and START.

On-Line Memory Dump. To provide information for the programmer during debugging of a program or whenever error conditions interfere with the running of an on-line program, the following procedure should be used to obtain an octal memory dump.

1. Depress the MEMORY DUMP switch at the left of the printer.

2. Depress the MANUAL CLEAR switch at the left of the printer when the printout has reached the place where you want to stop it and set the central processor to the manual mode. The printout will never stop by itself, but will repeat the whole memory dump over and over if not stopped manually.

This provides an octal printout of the information in all of memory. It can be used in connection with a service routine. The format of the octal printout is 8 groups of 7 decimal numbers on each print line. Each group of 7 numbers represents the octal coding of a 20-bit word.

Backspace Print Line Recovery Procedure

If a print error occurs (such as an error indicated by a SLEW or PAPER alarm light), the operator backspaces to correct the error by rereading and reprinting. To do this, he must learn to position the printing correctly on the new page so that a page replaces the complete page which had the error.

Figure XVII-6 shows that the "First Line" of Page III (the new page which is to replace the page with the error) must be the print line which follows immediately after the "Last Line" on page I (the page which precedes the one with the error). The following steps should help the operator learn the technique of doing this. References to pages I, II, and III refer to the figure.

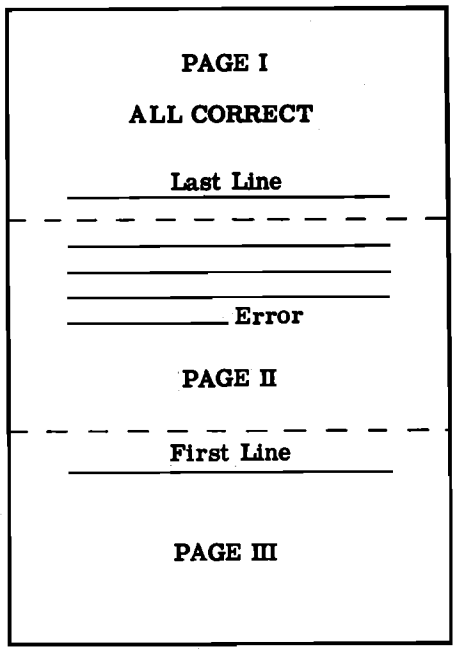


Figure XVII-6. Backspace and Reprint Procedure

1. Set the AUTO/MANUAL switch to MANUAL.

2. Depress BACK SPACE several times - enough to position the tape at the data corresponding to that at the bottom of page I.

3. Depress SKIP to bring information from magnetic tape to the 1024-character core buffer.

4. Depress PRINT ONE LINE several times.

5. Depress SPACE PAPER to bring the printed lines into view.

6. By comparing the lines just printed with those on pages I and II, determine whether you need to move forward or backward to print a line to match the last line on page I.

7. To go forward, continue to depress PRINT ONE LINE until the last printed matches the last line of page I. CAUTION — do not depress SPACE PAPER, for it causes the buffers to be cleared out. To be able to PRINT ONE LINE after buffers are cleared, it is necessary to depress BACKSPACE and SKIP to again fill the buffers and prepare for printing. The location of the line just found is also lost.

8. Depress POSITION LOOP to position the paper at the top of a page.

9. Depress AUTO and START. This should produce a page corresponding to page II which had the error.

10. To go backward, from step 6, return to step 2 and repeat steps 2 through 6 until the lines match as specified, then continue with steps 8 and 9.

Preparation of a Vertical Format Loop

This is prepared in the same manner as the vertical format loop of the high speed printer, described on pages X-12 and X-13.

Changing the Printer Ribbon

The ribbon is changed in the same manner as is that of the high speed printer, described on pages X-13, X-14, and X-15.

Loading Paper in the Printer

Refer to pages X-8 and X-9 for a description of how to load paper into the printer. Steps 5a through 5p on those pages describe paper loading.

Replacing Leader and Trailer Foils

Refer to page IX-15 for a description of how to change leader and trailer foils. The last paragraph of that description is being corrected to specify that the trailer foil should be 20 to 22 feed from the end of tape when used in 8K memory systems and 33 to 35 feet from the end of tape when used in 16K memory systems. (A shorter length was specified in the original printing of the manual.)

Cleaning and Care of Tape Handlers

Refer to page IX-15 for a description of how to care for tape handlers.

Inspection and Replacement and Care of Tape

Refer to pages IX-15, IX-16, and IX-17 for some good advice on inspecting and replacing magnetic tape and on handling and storing tape.

ERRORS AND OPERATOR CORRECTIVE ACTION

The operation of the on-line/off-line printer requires that the operator become familiar with over 40 switches or controls and a dozen indicators. It also requires that he know magnetic tape handling procedures and the special procedures involved in printer care such as preparing a vertical format loop, loading printer paper, and changing printer ribbon. The operator must not only know the special procedures involved in servicing the subsystem, but must become proficient so as to take the necessary steps in a minimum of time.

Operator Errors

The tape handler unit can fail to operate correctly whenever the operator neglects to:

1. Wait the one minute for equipment to warm up after power is on.
2. Load tape correctly.
3. Rewind tape when required.
4. Select correct FILE code switches.

The printer unit can fail to operate properly whenever the operator neglects to:

1. Install the correctly punched VFU tape.
2. Load paper correctly with the supply set squarely in front of the printer.
3. Set paper margin adjustments.
4. Adjust paper tension.
5. Turn up the pressure plate; adjust penetration control if necessary.
6. Adjust character phasing when necessary.
7. Adjust the form positioning knob.
8. Set the proper controls for either on-line or off-line operation.

Under the description of the various error conditions, recovery procedures have been described. Unless instructed otherwise, the operator should try to correct tape errors by backspacing the tape and rereading the portion which caused the error.

Program Errors

The following error conditions may result from program errors. They are listed here so the operator can more easily identify the difficulty in program operation when these errors occur. The programmer will be particularly anxious to know about these error conditions when they occur, so the operator should take an octal tape dump to assist in locating the errors.

1. The program does not include an end-of-record gap at least every 1023 characters. This results in the OVERFLOW indicator on the tape reader control and indicator panel and the TAPE ALERT indicator on the right panel of the printer glowing red. The overflow pertains to the tape unit's 1024-character core buffer. Depressing MANUAL CLEAR and START pemits operation to continue.

2. The program does not have an end-of-line code (octal 77) after 120 print characters. The OVERFLOW indicator at the left of the printer glows red. The overflow pertains to the printer controller's 120 character print line buffer.

Table XIII on pages X-16, X-17, and X-18 describes numerous error conditions, their possible causes, and suggested corrective action. Although these were written for the high speed printer, almost all of them apply equally well to operation of the off-line/on-line printer subsystem and particularly to on-line operation. In using Table XIII, it must be remembered that the printer controller indicators of the high speed subsystem have been moved to the upper right side of the printer on the on-line/off-line subsystem.

Table XXV describes error conditions and suggested corrective action specifically for off-line operation of the on-line/off-line printer subsystem.

TABLE XXV
ON-LINE/OFF-LINE PRINTER ERROR CONDITIONS

Error Condition	Possible Cause	Corrective Action
START on the right side of the printer is depressed but nothing happens	No FILE switches have been depressed	Select the proper FILE switches, depress START.
	Tape has stopped on an end of file code and the END OF FILE indicator glows red	Depress MANUAL CLEAR and START to continue.
	Either the POWER ON switch on the printer or the A.C.ON switch on the tape unit has not been depressed	Depress A.C.ON and then depress POWER ON.
There are repeated SLEW alerts	The program does not have end-of-line (octal 77) codes in the proper places	Depress MANUAL CLEAR to halt the slewing. Take an octal dump of at least that portion of the tape, and notify the programmer of the condition.
The OVERFLOW indicator on the tape unit and the TAPE ALERT on the printer are lit	The tape unit hardware did not function properly or the program did not have and end-of-record gap	Depress MANUAL CLEAR, AUTO, and BACKSPACE. If this does not correct the condition, depress MANUAL CLEAR and START, and take an octal dump of at least that portion of the tape. Notify the programmer of the condition.
The OVERFLOW indicator on the left panel of the printer glows red	The program did not have an end-of-line code after 120 print characters	Depress MANUAL CLEAR and START, take an octal dump of at least that portion of the tape. Notify the programmer of the condition.

TABLE XXV (CON'T.)

Error Condition	Possible Cause	Corrective Action
The LAT PAR indicator on the tape unit and the TAPE ALERT on the printer are lit. The subsystem halts	A lateral parity error was detected during a check on tape reading	1. Set the AUTO/MANUAL switch to MANUAL. 2. Depress MANUAL CLEAR. 3. Depress BACKSPACE. 4. Set the AUTO/MANUAL switch to AUTO. 5. Depress START.
The LONG PAR indicator on the tape unit and the TAPE ALERT on the printer are lit. The subsystem halts	A longitudinal error was detected during a check on a tape record	
The MOD 3 indicator on the tape unit and the TAPE ALERT on the printer are lit. The subsystem halts	An incorrect number of characters has been detected on a record	
The TAPE ALERT indicator on the printer is lit. Magnetic tape does not move.	The dust cover on the tape handler was not closed tightly, causing a tape interlock error	Close the dust cover on the tape handler.