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AND VERIFY PROGRAM

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THE SSS PAPER TAPE PUNCH AND VERIFY PROGRAM

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July 1971

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FOREWORD

This manual describes a Computer Program written to punch and verify paper tapes. These tapes contain SSS Flight Programs which will be telemetered to the processor on-board the SSS Satellite.

THE SSS PAPER TAPE PUNCH AND VERIFY PROGRAM

I. INTRODUCTION

The SSS Paper Tape Punch and Verify Program is the most recent software addition to the Program Writing and Checkout Facility. It punches paper tape for SSS Flight Programs (previously done by the SSS Assembler), and also a bit-for-bit verification of the paper tape punched. This verification was not implemented in the SSS Assembler and was deemed necessary for assurance of good tapes.

This program was designed for a CDC 3200 computer with 16K memory, two tape drives, a card reader, and a paper tape punch and reader. It has been used for several months, and it has proven useful not only in punching and verifying SSS Flight Programs, but also as a Quality Test of the paper tape punch and reader since there is no similar functional program.

II. BLOCK DIAGRAM AND PROGRAM DESCRIPTION

Figure 1 is the Block Diagram for the program in which there are basically three operations.

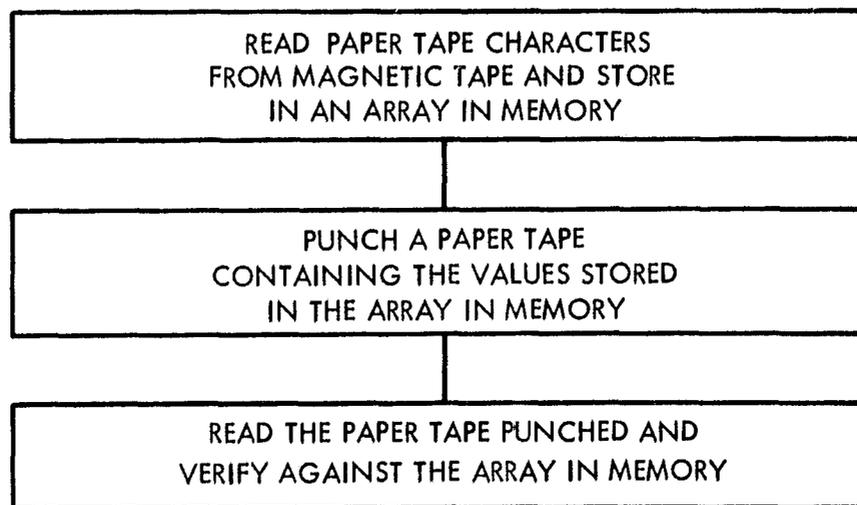


Figure 1. Block Diagram of the SSS Paper Tape Punch and Verify Program

First, the paper tape characters are extracted from a magnetic tape and stored in an array in memory. (The magnetic tape used as input is produced by the SSS Assembler).

Second, the characters stored in the computer array are transferred to the punch and punched one at a time. Extra copies of the tape can be obtained at this point via console typewriter message.

Third, after the punched tape has been loaded into the paper tape reader, the characters are verified one at a time (Bit for Bit) against the memory characters. Any discrepancy detected is output on the printer, and at the end of the tape, the total of all the discrepancies is output on the console typewriter. The program then reinitializes and can either punch the next file on tape or terminate.

III. OPERATING INSTRUCTIONS

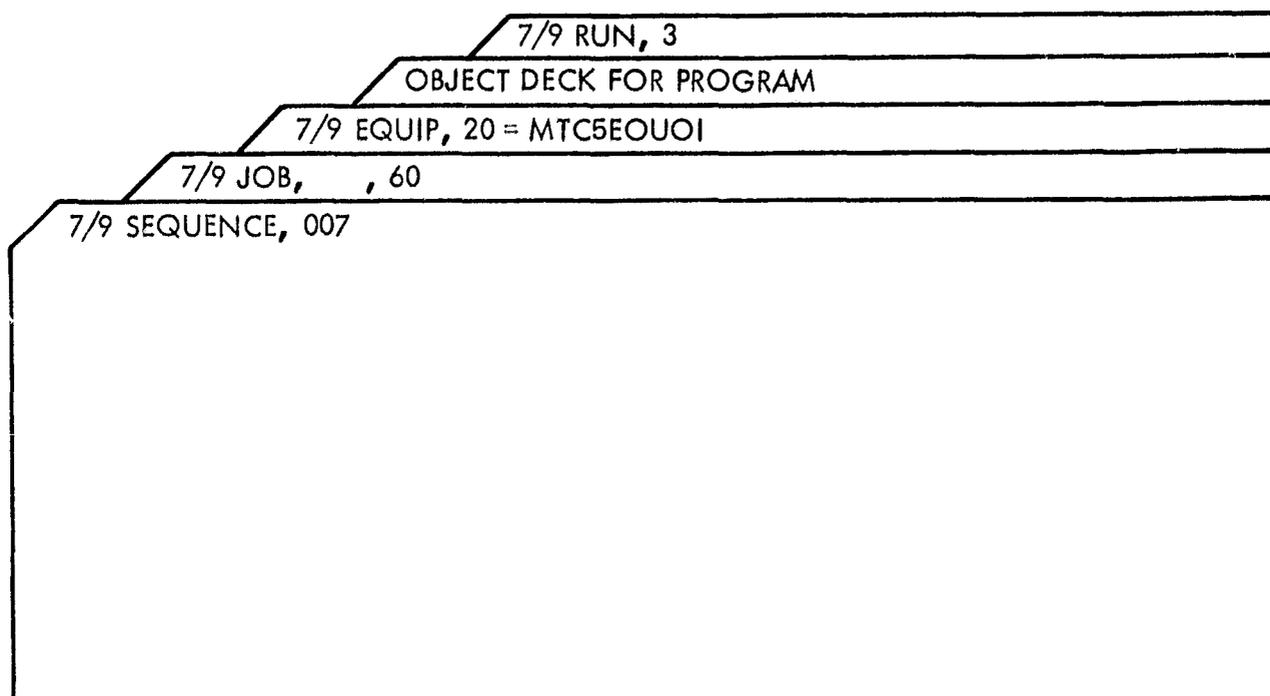


Figure 2. Deck Structure for the SSS Paper Tape Punch and Verify Program

- STEP
1. Load the object deck (in the format shown in Figure 2 in the card reader.
 2. Push STOP on the CDC 3200 console.
 3. Push MASTER CLEAR (MC) on the CDC 3200 console.
 4. Push AUTOLOAD on the CDC 3200 console.
 5. When the typewriter types "Date" type in the date (MMDDYY), then push FINISH.

STEP 6. When the typewriter types "Time", type in the time (TTTT), then push FINISH.

7. The typewriter will then type: SEQUENCE, 007
JOB, JJJ
20 = MT, C5, E0, U01 READY?

Load the tape drive specified by the typewriter with the digital tape containing the paper tape characters and then press FINISH.

8. The program is then loaded into the computer and upon completion of loading, the typewriter types: PAUSE 01 Press MI/MI to continue.

9. At this pause, the operator should check to see if the paper tape punch is loaded and ready as specified in Appendix B. When it is ready, press "MI" on the CDC 3200 Console, then press "/" on the console typewriter, and then press "MI" on the CDC 3200 console.

10. The first file on the tape will then be buffered into memory. Upon completion the typewriter types: No. of tapes. The operator indicates the number of identical paper tapes he wishes by typing the number from 0 to 7 on the console then he presses FINISH. (If an illegal number or character is typed, the message "No. of Tapes" will be repeated on the typewriter.) The tapes are then punched. If the message was answered with 0 the program goes directly to step 11, without punching any tapes. This input was allowed in order that files may be shipped on a multi-file tape.

11. The typewriter now types: Punch next file (Y or N). Type answer and press FINISH. If "Y" is typed go to step 10. If "N" is typed go to step 12. If neither "Y" nor "N" is typed step 11 is repeated.

12. The typewriter now types: Verify last file (Y or N). At this point, if a paper tape is to be verified, it must be loaded into the paper tape reader following the procedure described in Appendix C. Then type "Y" and press FINISH. (Step 13 follows if "Y" was typed. If "N" was typed the program is terminated.

13. Each character is verified one at a time and any errors are printed on the printer in the format shown in Figure 3. At the end of the tape, the total number of errors is output on the

on the typewriter in the following format: "No. of errors = XXXXX" Then the program returns to step 11.

Note: If a parity error occurs during the Buffering-in of the magnetic tape the typewriter will output: "Parity error. Rewind or next file (R or N). The message is self-explanatory. The program then returns to step 10.

IV. PROGRAM RESTRICTION AND MODIFICATION SUGGESTIONS

There are three restrictions which keep this program from being considered general purpose:

1. Limitation in no. of characters
2. Spacing in visileader
3. Parity of input tape

First, the program allows a maximum of 500 characters to be input from tape on one file. This figure was ascertained from the following considerations. The program was written for the SSS On-Board Processor (OBP) which has a program memory of only 256 words. To load the OBP Program Memory it takes 18 paper tape characters per word, and two command words of 20 characters each which precede and follow the OBP Program. Also there is a 230 character visileader in the tape. Hence:

$$\begin{aligned}\text{Max Characters} &= (256) \times (18) + 20 + 20 + 230 \\ &= 4878 \text{ Characters.}\end{aligned}$$

These characters are all stored in memory.

The second limitation is that there is a slight editing in the first 184 characters (Visileader) read in from magtape. After every fourth character, a blank is inserted to make the visileader more readable. Hence, output leader length was computed thusly:

$$\begin{aligned}\text{Visileader Characters} &= 184 + 184/4 \\ &= 230 \text{ Characters}\end{aligned}$$

The third limitation is that the Data on the input magtape was Buffered out of the SSS Assembler and hence is in odd parity. Consequently, this program uses "Buffer In" statements which also accept only odd parity Data.

This program could be modified for other paper tape producing programs. For instance, the Varian 620 i Assembler could well benefit from a paper tape verification. The modification needed would involve correction of the aforementioned three restrictions. The first restriction could be corrected by not storing values into an array in memory. Dumping and verification of characters could be accomplished by going directly from magtape to paper tape and vice versa. The only loss that would occur would be a little execution time. The second restriction, that of inserting spacing in the Visileader, could be corrected by removing the five lines of coding in the program which accomplished this. The third restriction can be corrected by either producing odd parity magnetic tapes, or by replacing the "Buffer In" statements with "Read" statements in the program compatible with the tape. With these modifications the program can be made adaptable to most magtape to paper tape programs.

V. CONCLUSIONS

The SSS paper tape punch and verify program insures the production of good paper tapes containing Flight Programs for telemetering to the SSS on-board processor. It also is a unique preventive maintenance test for the CDC 3200 paper tape punch and reader. With a few modifications, it represents a hopeful future technique in the production of reliable paper tapes.

APPENDIX A

INTRODUCTION

The Control Data 3691-B Paper Tape Reader/Punch is an Input/Output device for the Control Data 3200 Computer system. Housed within a special peripheral cabinet are the Control Data 350 Paper Tape Reader, the National Cash Register model EM-BZ Paper Tape Punch and Controller logic common to both Read and Punch operations. The Controller allows the Data Channel to Select the equipment for either operation and modifies and synchronizes the data flow but, since it is shared by both the Reader and Punch, only one operation can progress at a time.

The 3691-B is capable of operating in one of four possible modes, Read Assembly, Read character, Punch assembly or Punch character. It will punch or read 5, 7 or 8 level tapes. (Figure A-1.)



Figure A-1. 3691-B Paper Tape Reader/Punch

SWITCHES & INDICATORS

The switches and indicators on the controller console are used to prepare the 3691-B for operation and to indicate the present condition of its related equipment. Figure A-2 shows the switches and indicators located on the controller console. Table 1 lists the switches and indicators on the console and their functions.

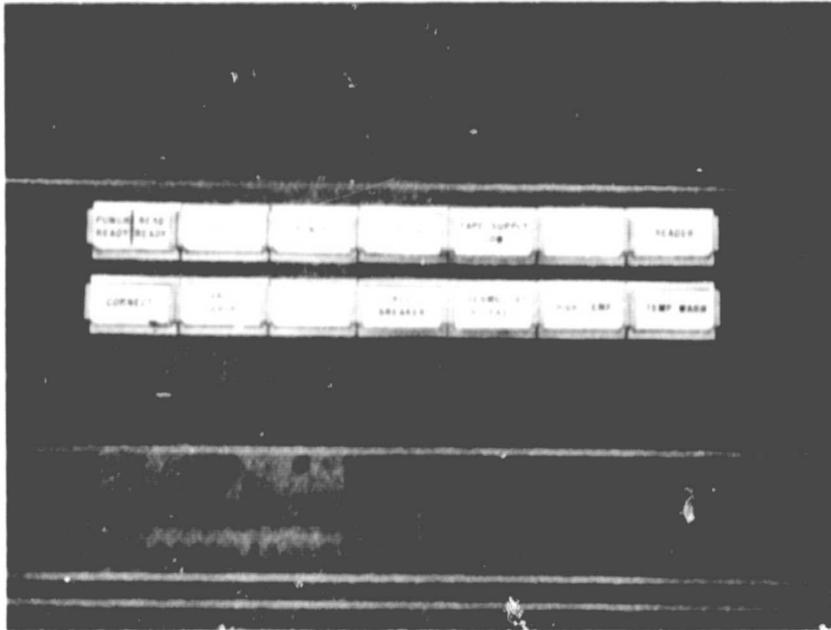


Figure A-2. Console Control Panel

Table 1

Console Switches and Indicators

NAME	S/I*	FUNCTION
Ready	S/I	A momentary switch which signals the controller that the punch, the reader, or both are ready. READY indicator lights when switch is depressed and remains lit as long as one or both units is ready. It does not light if neither is ready.
Stop	S/I	A momentary switch which stops either the reader or punch at the end of the byte being processed. The STOP indicator lights and stays lit until the unit made ready again.

*S=Switch I=Indicator

Table 1. (continued)

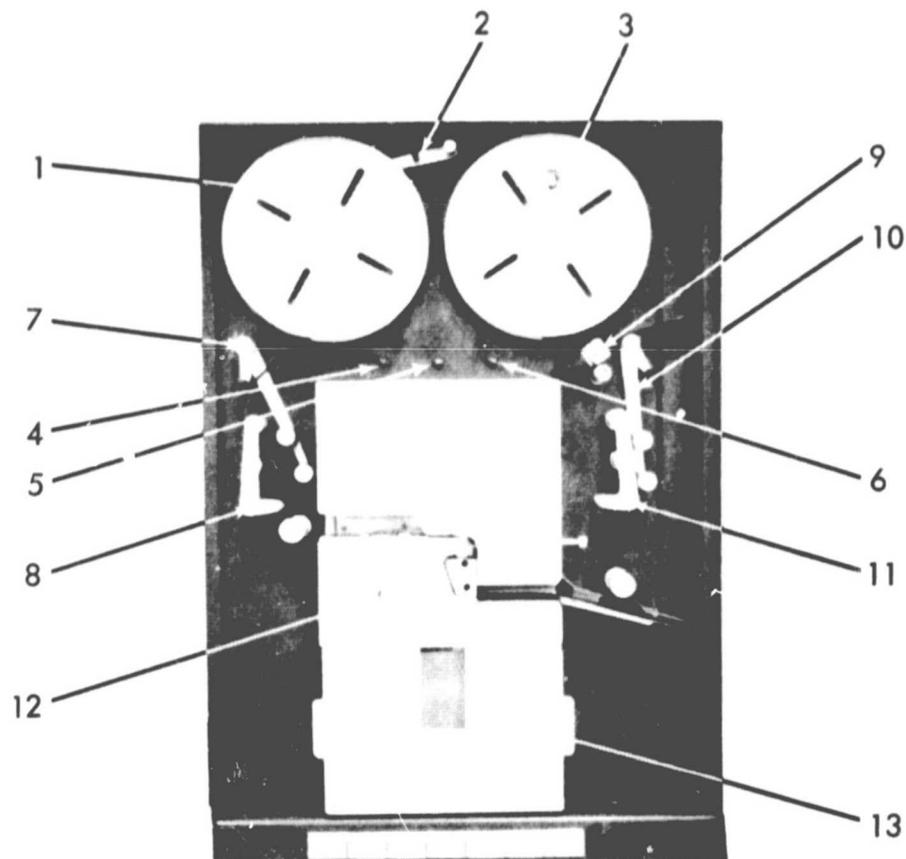
NAME	S/I*	FUNCTION
Punch	S/I	A switch to apply a-c power to the punch. PUNCH indicator lights when power is applied.
Leader	S	A momentary switch used to advance tape through the punch until released. Only feed sprocket holes are punched.
Tape Supply Low	I	Indicator lights when tape supply is low on supply reel of punch.
Reader	S/I	A switch to apply a-c power to the reader. Indicator lights when power is applied.
Connect	I	Indicator lights when the controller is connected to the data channel.
Parity Error	I	Indicator lights when a transmission parity error is detected in Connect code, Function code, or Data bytes. A Master Clear clears the light and error signal.
Circuit Breaker	I	Indicator lights when an overload has occurred in the power supply circuit; the power is disconnected.
Thermostat By-Pass	I	Indicator lights when the THERMOSTAT BY-PASS switch is connected.
High Temp	I	Indicator lights when the internal cabinet temperature exceeds 110°F. The 3691-B is turned off unless the THERMOSTAT BY-PASS switch is connected.
Low Temp	I	Indicator lights when the temperature of the air entering the cabinet is above normal. (80°)

*S=Switch I=Indicator

APPENDIX B

OPERATION OF THE EM-BZ PAPER TAPE PUNCH

The tape transport contains the tape supply and take-up mechanisms. The tape supply mechanism supplies paper tape to the punch from a motor driven tape reel. The supply control arm forms a loop of tape between the supply reel and the punch head that isolates the inertia of the supply reel from the punch head. As punched tape is fed from the punch head, it may be wound on a motor driven take-up reel which is controlled by the take-up arm. If the tape take-up mechanism is not used the take-up control is latched, turning off the take-up motor. The tape is then fed through a slot on the side of the cabinet (Figure B-1).



- | | |
|--|-------------------------|
| 1. SUPPLY REEL | 8. SUPPLY IDLERS |
| 2. TAPE LOW SENSING ARM | 9. TAPE BRAKE |
| 3. TAKE-UP REEL | 10. TAKE-UP CONTROL ARM |
| 4. SUPPLY CONTROL ARM RELEASE BUTTON | 11. TAKE-UP IDLER |
| 5. TAPE LOW SENSING ARM RELEASE BUTTON | 12. PUNCH HEAD COVER |
| 6. TAKE-UP LATCH RELEASE BUTTON | 13. CHAD BOX |
| 7. SUPPLY CONTROL ARM | |

Figure B-1. Tape Transport

To Load Tape on Supply Reel

1. Latch the Tape Low Sensing Arm (Figure B-1)
2. Remove supply reel flange by a firm pull
3. Mount a roll of tape with a standard paper core on the supply reel to unwind clockwise.
4. Replace flange with a firm push
5. Release the Tape Low Sensing Arm by pressing the center release button on the front of the punch (Fig. B-1)

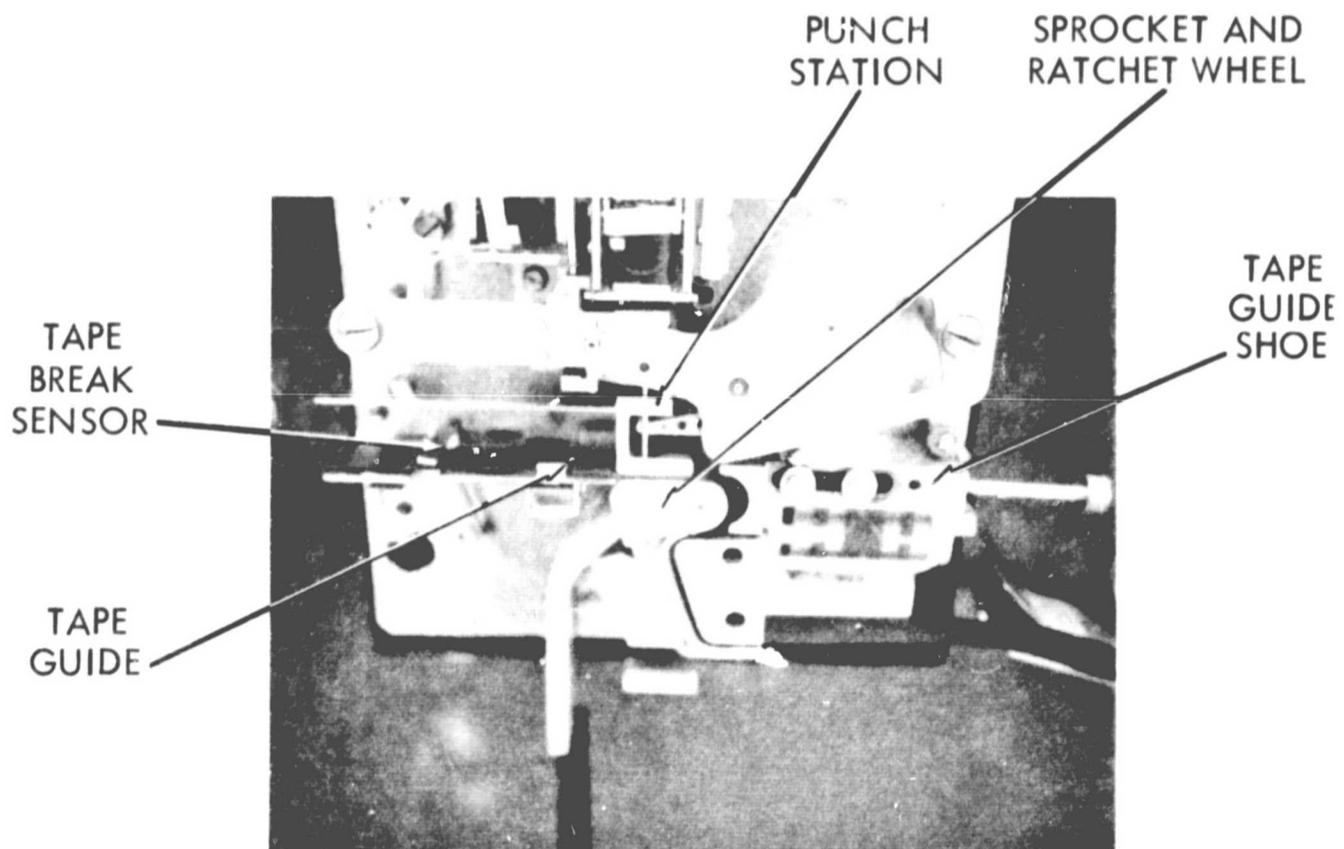


Figure B-2. Punch Head

To Load Tape in Punch Head

1. Move tape guide shoe to the right (Fig. B-2)
2. Adjust tape guide to width of tape being punched.
3. Latch supply control arm by rotating it clockwise (Fig. B-1)

4. Pull tape from supply reel.
5. Pass tape between the supply control arm and the supply idlers.
6. Pass tape under the adjustable idler at left of the punch head and adjust the idler for level of tape being punched. (5, 7, or 8).
7. Thread tape through punch head (Fig B-2).
8. Move tape guide shoe to left in order to engage the sprocket and ratchet as well as activate the tape break switch.
9. Release supply control arm by pressing the left release button on the front of the punch (Fig. B-1).
10. Depress and hold Leader Switch on the Console Control Panel to advance tape through punch area. Only sprocket holes will be punched.

NOTE:

If the take-up reel is not used then after step 10:

- A. Thread tape through side of cabinet.
- B. Depress Punch indicator/switch on Console Control Panel. Light indicates that punch is ready.

TO LOAD TAKE-UP REEL

1. Remove the take-up reel flange
2. Latch the take-up control arm by rotating counter-clockwise (Fig. B-1)
3. Pass tape under the adjustable idler on the right of the punch head.
4. Pass tape between the take-up control arm and the idlers.
5. Pass the tape between the brake shoes. Release brake by moving take-up control arm against its latch stop.
6. Insert tape into slot of the take-up reel and wind excess onto reel.
7. Remount reel flange.
8. Release take-up control arm by pressing the right release button on the front of the punch.
9. Depress the punch switch on console control panel. Light indicates punch is ready.
10. Depress READY switch. Light indicates punch is ready to be programmed.

APPENDIX C

OPERATION OF THE CONTROL DATA 350 PAPER TAPE READER

The Control Data 350 Paper Tape Reader is a photo-electric reader capable of reading 5, 7, or 8 level tape at the rate of up to 350 characters per second. A window over the tape deck allows the operator to view the tape while loading and reading.

LOADING OF PERFORATED PAPER TAPE (Fig C-1)

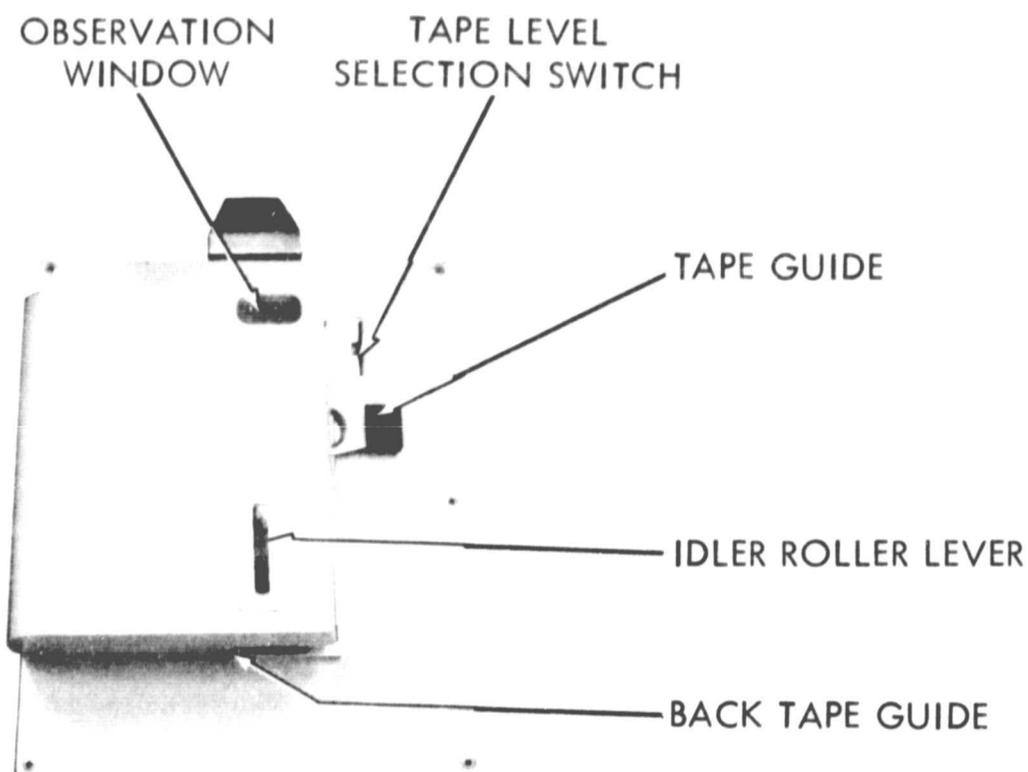


Figure C-1. Reader

1. Set tape level selector switch to position corresponding to the level of tape to be read. (5, 7, or 8).
2. Place Idler Roller Lever in the Up position to permit the tape to be inserted into the tape transport area.
3. Set tape guide by pressing down on guide handle and sliding it in or out to the correct position according to the level of tape being used. (5, 7, or 8)

4. Orient punched tape so that 3 tracks to the left of the sprocket holes are toward the Back Tape Guide.
5. Insert the tape into the tape transport area using the observation window to make sure the tape lies parallel with, and butts against, the Back Tape Guide.
6. Place Idler Roller Lever in the Down position. Reader is now ready for operation.
7. Set Read Ready switch on Control Console.

UNLOADING TAPE FROM READER

1. Place Idler Roller Lever in Up position and draw tape through the transport area or remove from the open side of the cover.