PRELIMINARY INFORMATION

for

COMPUTER
VOLUME THREE

INTERFACE KIT 12532A
HIGH-SPEED PUNCHED TAPE INPUT

02116-9038

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SECTION 1

INTRODUCTION AND DESCRIPTION

1-1. INTRODUCTION

1-2. Interface Kit 12532A provides the interface between the HP 2116A Computer and the HP 2737A Punched Tape Reader or the HP 2737B Punched Tape Reader-Spooler (Figure 1-1). The kit consists of the following:

a. Punched Tape Reader Interface Card (HP Part No. 02116-6002).

b. Interconnecting Cable (HP Part No. 02116-6112).

c. BCS Tape Reader Driver Tape (HP Accessory No. 20005A).

d. SIO 4K Tape Reader Driver Tape (HP Accessory No. 20303A) or SIO 8K Tape Reader Driver Tape (HP Accessory No. 20306A).

e. Tape Reader Test - Binary Tape (HP Accessory No. 20408B).

1-3. Sections II through IV provide installation, operation, programming, theory of operation, and replaceable parts information for the Punched Tape Reader Interface Card. Section V contains a description of the diagnostic program contained on the Tape Reader Test - Binary Tape, a listing of the tape contents, and flow charts illustrating each step of the diagnostic test. Maintenance information for the interface card will be provided at a later date.

1-4. DESCRIPTION

1-5. INTERFACE CARD AND INTERCONNECTING CABLE

1-6. The Punched Tape Reader Interface Card contains control and interrupt logic, and flip-flops (FFs) for temporary storage of the eight possible data bits from the punched tape reader. On receipt of a computer instruction, the stored data bits are placed in the eight least-significant bit positions (0 through 7) of the A- or B-register of the computer. Movement and reading of the punched tape is controlled by the interface card on receipt of computer commands. The card plugs into any of the Input/Output slots of the computer and assumes the lower Select Code of the slot it is plugged into. The interconnecting cable connects the tape reader to the interface card.

1-7. TAPE READER DRIVER TAPES

1-8. BCS TAPE READER DRIVER TAPE. The BCS (Basic Control System) Tape Reader Driver Tape is a flexible Input/Output routine which permits transfer of data between the Computer and the tape reader. The driver is accessed through the BCS I/O Control subroutine (.IOC.) by a 5-word calling sequence. The driver is made part of the Basic Control System through the use of the Prepare Control System routine which is furnished with each Computer. Refer to Chapter 1 of the HP 2116A Computer Basic Control System manual for information on Input/Output programming and to Chapter 4 for information on the processing of the BCS Tape Reader Driver Tape.

1-9. SIO TAPE READER DRIVER. The SIO (System Input/Output) Tape Reader Driver (4K or 8K, depending on Computer memory size) is a simple, unbuffered Input/Output routine used by standard software systems (Fortran, Assembler, etc.) to permit transfer of data between the Computer and the tape reader. The driver is incorporated into the system through the use of the SIO Dump Routine furnished with each Computer. The driver may also be accessed directly by a 3-word calling sequence in the user's program. Refer to Appendix F of the HP 2116A Computer Assembler manual for detailed programming and use information for the SIO Tape Reader Driver Tape.

1-10. PUNCHED TAPE READER

1-11. The HP 2737A Punched Tape Reader is an HP-modified Remex Model RTO302RA/S44 Tape Transport. The HP 2737B Punched Tape Reader-Spooler is an HP-modified Remex Model RTS0302RC/S43 Reader-Spooler Transport. The reader-spooler contains supply and take-up reels with a capacity of 200 feet of 4-mil tape (4,000 16-bit words can be contained in about 70 feet of packed binary tape). The 2737A Reader does not have supply and take-up reels but includes an accessory tape container. The following specifications apply to the punched tape reader and punched tape reader-spooler:

a. Reading Speed: 300 characters per second with 60-Hz input;
250 characters per second with 50-Hz input.

b. Starting Time:

HP 2737A Reader: Six milliseconds.

HP 2737B Reader-Spooler: Eight milliseconds.

c. Stopping Time: One millisecond.

d. Power Requirements:

HP 2737A Reader: 115 vac ± 10 percent, 0.3 amperes (nominal), single phase, 50 to 60 Hz

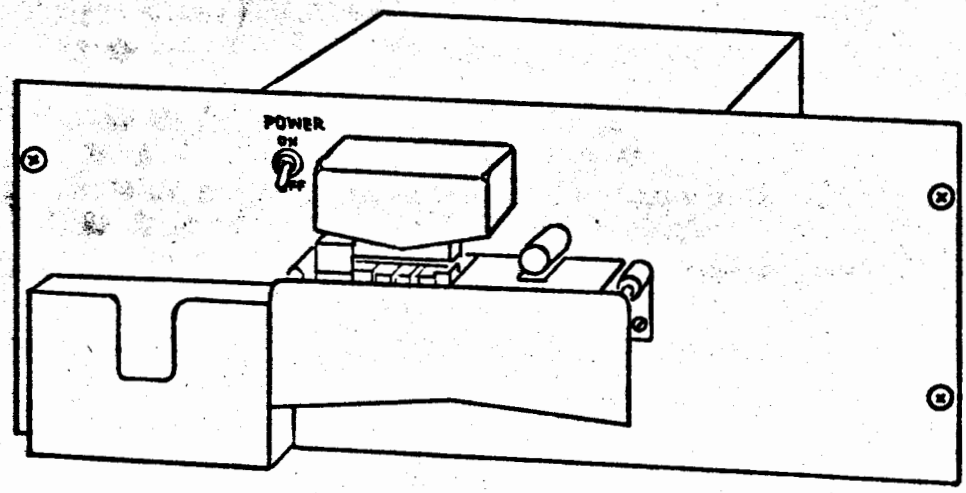
HP 2737B Reader-Spooler: 115 vac ± 10 percent, 0.8 amperes (nominal), single phase, 50 to 60 Hz

e. Tape Handling Capabilities: Photocell block adjustable to 5-channel (11/16 inch), 7-channel (7/8 inch), or 8-channel (1 inch) tape.

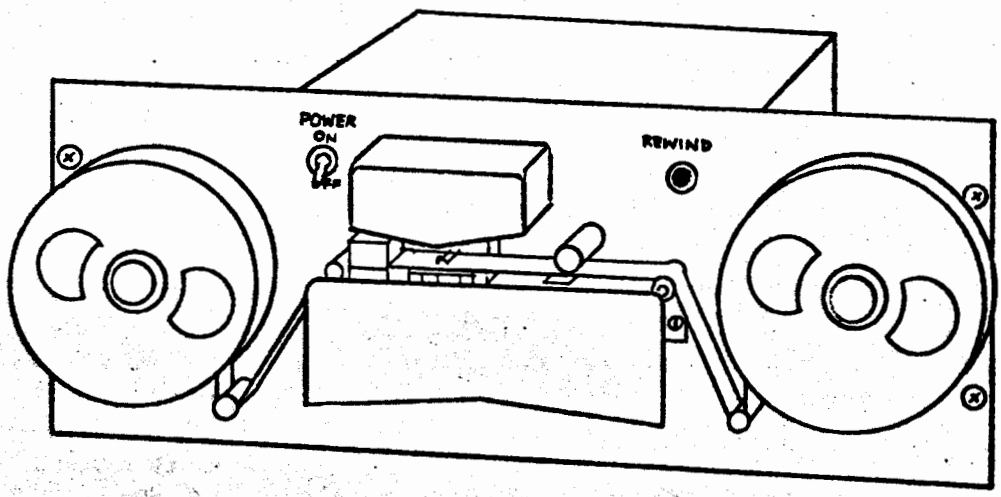
f. HP 2737B Reader-Spooler Rewind Speed: 40 inches per second.

g. Front Panel Height: 7 inches

h. Depth of Unit: 9-3/8 inches



HP 2737A TAPE READER



HP 2737B TAPE READER – SPOOLER

Figure 1-1. HP 2737A/B Tape Reader

SECTION II

INSTALLATION AND PROGRAMMING

2-1. INSTALLATION

2-2. Refer to the Handbook for Model HP-2737A/B Punched Tape Reader for unpacking, installation, and checkout procedures for the tape reader units. Connect the punched tape reader to the tape reader interface card using the interconnecting cable of the interface kit as follows:

a. Facing the back of the tape reader, plug the cable connector marked "02116-6112 2737-J1", into connector J1 located on the right-rear of the electronics chassis of the tape reader.

b. Connect the power cable to connector J101 of the tape reader, adjacent to connector J1, and to 115-volt power.

c. Pull open the front panel of the computer.

d. Plug the interface card into the Input/Output slot assigned for the particular computer system. (The upper extractor handle on the card is marked "TAPE READER".)

e. Pass the other cable connector, marked "TAPE READER 02116-6112", through the slot at the bottom-rear of the computer and up to the front. Slide the connector onto the tape reader interface card.

f. Gently close the front panel of the computer.

2-3. After the punched tape reader has been connected to the computer, run the punched tape reader diagnostic program as described in Section V. If the diagnostic program is completed without error, the computer and punched tape reader operate properly.

2-4. PROGRAMMING

2-5. The user may program a subroutine to perform all of the necessary operations in reading data from the Punched Tape Reader or may utilize the HP standard software facilities. Refer to Paragraphs 1-7, 1-8, and 1-9 for information on the tape-reader driver tapes which are a part of the interface kit and for information on programming of the tape reader.

SECTION III

THEORY OF OPERATION

3-1. GENERAL THEORY OF OPERATION

3-2. The read operation may begin when the punched tape to be read is in the punched tape reader and the POWER ON/OFF switch on the front panel of the tape reader is at ON. If the interrupt system is to be used to signal that one character of data is available in the interface-card Data Register for transfer to the computer, an STF instruction with a Select Code of 00 (octal) must be programmed.

3-3. The read operation is initiated by an STC, CLF instruction to the interface card. (Refer to Figure 3-1.) This initiates the reading of a single character. The CLF portion of the instruction resets the Flag Buffer and Flag FFs to prevent an interrupt signal from being sent to the computer before the tape reader has transferred data to the interface card. The STC instruction sets the Drive FF which applies a true input to each of the Data Register FFs (two true inputs are required to set each FF; see the 1820-0968 diagram in Figure A-1 of Appendix A). The set Drive FF also causes a Drive signal to be sent to the tape reader to move the punched tape until a feed (sprocket) hole is directly over the photo-diode assembly of the tape reader. Any holes in the eight data tracks of the tape cause the tape reader to apply a negative voltage to the eight Data Register circuits which correspond to the tracks containing the punched holes, setting the FF in this circuit. Thus, the Data Register contains a set FF for each hole read and temporarily holds this information.

3-4. When the tape reader detects the feed hole in the tape it applies a negative voltage as a Flag signal to the interface card. The Flag signal resets the Drive FF, removing the Drive signal to the tape reader and preventing further movement of the tape. Resetting the Drive FF also causes the interrupt logic on the interface card to signal the computer that data is available (either by an interrupt signal or by the SKF signal, depending on the method selected). An LIA or LIB instruction then generates an IOI signal to enable parallel transfer of the eight possible data bits representing the character read to the eight least-significant bit positions (bits 0-7) of the A- or B-register. (To pack two characters in the A- or B-register (and then into a Memory location), rotate instructions (ALF or BLF) are used to rotate the first eight bits into the most-significant bit positions (bits 8 through 15) of the register. An MIA or MIB instruction is then used to transfer the second eight bits from the interface card to

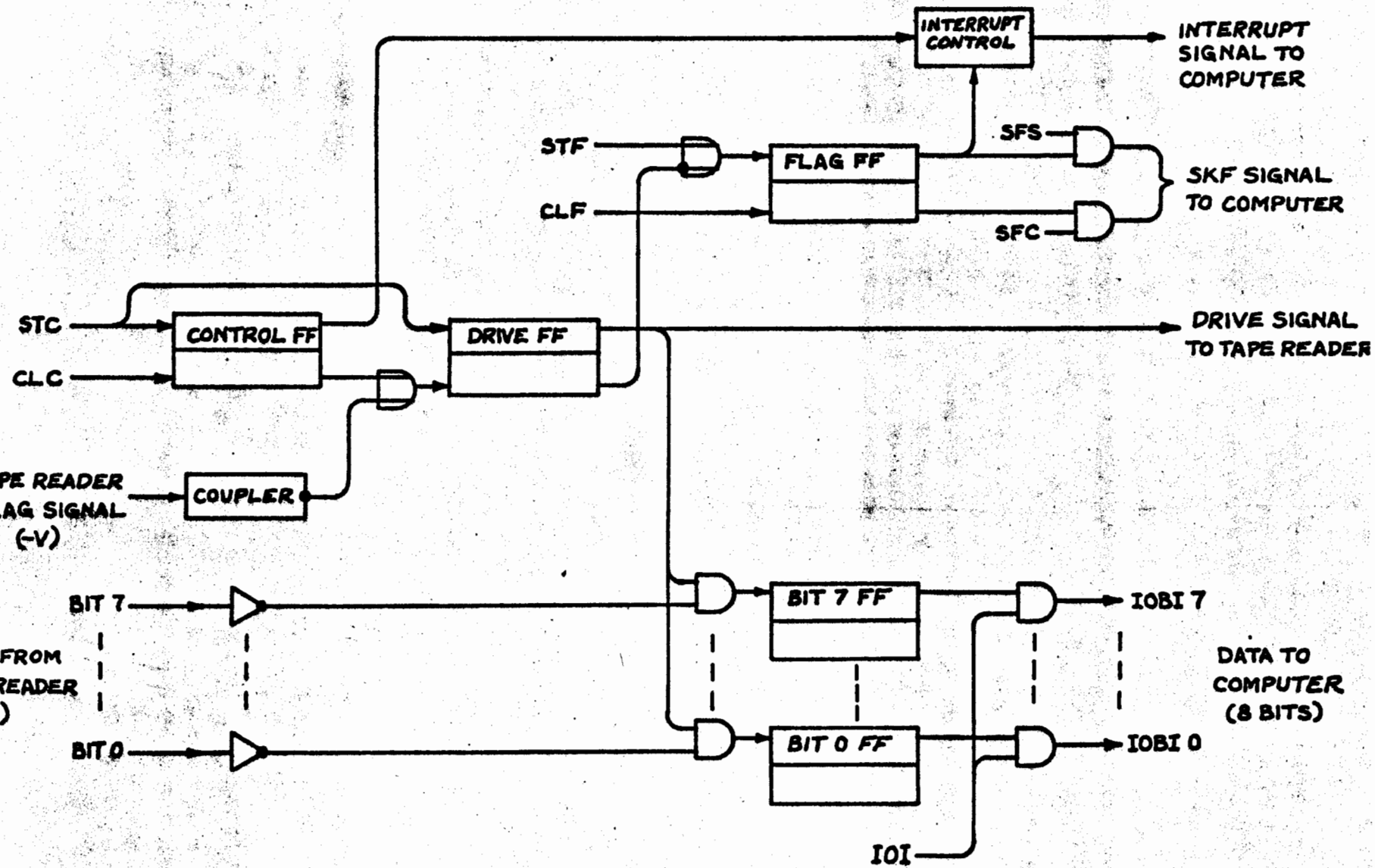


Figure 3-1. Simplified Logic Diagram for Punched Tape Reader Interface Card.

the A- or B-register. (An LIA or LIB instruction cannot be used for second-character transfer since these instructions destroy the contents of the register prior to entering data.)

NOTE

A feed hole in the leader end of the punched tape also causes the tape to stop moving and the interrupt logic to signal the computer. Program instructions must repeatedly cause the tape to move to the next feed hole until the first row of data holes is detected.

3-5. To cause the tape reader to read the next character from the punched tape, another STC, CLF instruction must be programmed to the interface card. The read operation is then repeated. When operation of the tape reader is completed, a CLC instruction must be programmed to reset the Control FF and remove the tape reader from the Input/Output system. The following paragraphs explain the operation of the interface card in detail.

3-6. DETAILED THEORY OF OPERATION

3-7. COMPUTER POWER-ON

3-8. (Refer to Figure 3-2.) When power is initially applied by pressing the POWER push switch on the front panel of the computer, the POPIO(B) and CRS signals are received by the interface card from the I/O Control Card. The POPIO(B) signal sets the Flag Buffer FF through "and" gate MC44C. At time T2, the ENF signal from the I/O Control card resets the IRQ FF and with the output of the Flag Buffer FF, enables "and" gate MC44A to set the Flag FF. The CRS signal resets the Control FF and the reset-side output of the Control FF resets the Drive FF. Initial conditions have now been established for proper operation of the interface card logic.

NOTE

Table 3-2 lists the part numbers of the Microcircuit Packages identified in Figure 3-2 by reference designations preceded by MC. Figure A-1 in Appendix A contains logic diagrams of the Microcircuit Packages according to part number.

3-9. READ CONTROL USING THE INTERRUPT SYSTEM

3-10. GENERAL. The interrupt system can be used to signal that one character of data is available in the interface-card Data Register for transfer to the computer. In this case, the Interrupt System Enable FF on the I/O Control card must be set by an STF instruction with a Select Code of 00 (octal).

3-11. MOVING THE TAPE. Moving the punched tape to a row of data holes requires an STC instruction with a Select Code of the Punched Tape Reader Interface Card. This provides STC, LSCM, LSCL, and IOG(B) signals to the interface card. Refer to Figure 3-2. The STC signal is applied as one true input to "and" gate MC104A. The LSCM, LSCL, and IOG(B) signals are applied to "and" gate MC34C which provides the second true input to gate MC104A. The true output of gate MC104A then sets Control FF MC123 and Drive FF MC103.

3-12. The true output of the Drive FF is applied as one true input to each of the FFs in the Data Register, preparing them to receive new data from the tape reader. The Drive FF also applies a positive voltage through diode CR1 to the base of normally-conducting transistor Q23. This turns off the transistor, sending a negative Drive voltage to the tape reader through pin 21 of the interface card. This negative voltage causes the tape reader to drive the tape to the next feed hole. Refer to Table 3-1 for a list of all leadwire connections between the interface card and the tape reader.

3-13. STOPPING THE TAPE AND INITIATING AN INTERRUPT. When the next feed hole in the tape is directly over the feed-hole sensing photo-diode in the tape reader, a negative Flag signal is applied to the interface card through pin 23. (Simultaneously, the tape reader is reading the data holes in the tape and causing the appropriate FFs in the Data Register to set as explained in Paragraphs 3-16 through 3-18.) Resistor R47 and capacitor C9 filter the incoming signal which turns off the normally-conducting transistor Q22. This places a positive voltage on the base of transistor Q21, causing it to conduct. The positive voltage normally on the collector of transistor Q21, making transistor Q20 conduct, is removed and turns off transistor Q20. This applies a positive voltage through resistor R39 to the base of transistor Q19. Emitter Follower transistor Q19 then conducts, causing transistor Q18 to conduct and turn off transistor Q17. When transistor Q17 is normally conducting, about 4 volts is applied to pins 7 and 8 of Drive FF MC103 and to pins 1 and 14 of Flag Buffer FF MC113. This

Table 3-1. Leadwire Connections for Interconnecting Cable

INTERFACE CARD CONNECTOR PIN	PUNCHED TAPE READER CONNECTOR PIN	SIGNAL
A	B	Data Bit 0
1	L	Data Bit 1
B	V	Data Bit 2
2	d	Data Bit 3
C	p	Data Bit 4
3	y	Data Bit 5
D	D	Data Bit 6
4	N	Data Bit 7
21	w	Tape Drive
23	X	Device Flag
24	K	GND
BB	HH	GND

NOTE:

PINS 24 AND BB ARE CONNECTED ON INTERFACE-CARD CONNECTOR.

does not reset the Drive FF or set the Flag Buffer FF since pins 8 and 14 are inverting inputs and will perform their respective function only on receipt of a negative-going signal. When transistor Q17 is turned off, its emitter voltage drops and the negative-going voltage to pins 8 and 14 causes the Drive FF to be reset and the Flag Buffer FF to set.

3-14. When the Drive FF resets, the positive voltage is removed from the base of transistor Q23 and is replaced by a negative voltage through resistor R48 from the -2-volt supply. This permits the transistor to conduct, removing the negative Drive voltage to the tape reader. The tape reader cannot now advance the tape.

3-15. When the Flag Buffer FF sets, the interrupt request to the computer is initiated. Refer to Paragraphs 2-28 through 2-41 in Section II of Volume Three, Input/Output System Operation, for a detailed description of the interface card interrupt logic and interrupt processing.

3-16. LOADING AND TRANSFERRING DATA. When the feed hole in the punched tape is directly over the feed-hole sensing photo-diode in the tape reader, the data holes will also be directly over their sensing photo-diodes. The data holes in the tape are arranged in Tracks numbered 1 through 8. Data bits sent to the interface card are from the following tracks:

Track 1	Bit 0
Track 2	Bit 1
Track 3	Bit 2
.	.
.	.
Track 8	Bit 7

3-17. When a data hole is sensed, a negative voltage of about -12 volts is applied to the appropriate Data Register circuit on the interface card. EXAMPLE: If a hole is sensed in Track 3 of the tape, a negative voltage is applied to pin B of the interface card (see Figure 3-2). In this example, resistor R9 and capacitor C3 filters the incoming voltage which is applied to the base of transistor Q5. This turns off the transistor, applying a positive voltage to the base of transistor Q6. With 4.5 volts applied directly to the collector of transistor Q6, the transistor conducts and sets Bit 2 FF MC43A (with the Drive FF set). In the same manner, a data hole in in any other track sets the corresponding FF in the Data Register.

3-18. The true set-side output of each of the FFs in the Data Register are applied to an "and" gate. The other input to the "and" gate is from "and" gate MC54B. For gate MC54B to output a true signal, enabling the contents of the Data Register to the computer, an LIA, LIB, MIA, or MIB instruction to the interface card must be programmed. Any of these instructions will provide true LSCM, LSCL, and IOG(B) signals for a true output from "and" gate MC34C to gate MC54B, and a true IOI signal to gate MC54B. One character has now been read from punched tape and transferred to the computer A- or B-register. Another character will be read when an STC, CLF instruction is programmed to the interface card. If operation of the tape reader is completed, a CLC instruction must be programmed to the interface card to remove the tape reader from the Input/Output system.

3-19. READ CONTROL USING THE WAIT-FOR-FLAG METHOD

3-20. The set or reset condition of the Flag FF on the interface card can also be used to signal that one data character is available in the interface-card Data Register for transfer to the computer. With the use of this method, the interrupt system must be disabled by resetting the Interrupt System Enable FF on the I/O Control card with a CLF instruction and a Select Code of 00 (octal).

3-21. Moving and stopping the tape is identical to that for the read control using the interrupt system explained in Paragraphs 3-11 through 3-14, except that an SFS instruction must be programmed after the STC instruction in Paragraph 3-11. Paragraph 3-15 does not apply.

3-22. When the Flag Buffer FF sets (Paragraph 3-13), its output is applied to "and" gate MC44A (Figure 3-2). At time T2, the true ENF signal provides a true output from "and" gate MC54C to gate MC44A. Gate MC44A then sets Flag FF MC94. The set-side output of the Flag FF is applied to "and" gate MC64A. (The output of the Flag FF has no effect on "and" gate MC74A since the IEN signal will be false with the interrupt system disabled.) The other inputs to gate MC64A are true since the SFS instruction to the interface card provides a true SFS signal and the LSCM, LSCL, and IOG(B) signals for a true output from "and" gate MC34C. The true output of gate MC64A is applied to "and" gate MC24A for a true SKF signal output to the computer through pin 12 of the interface card.

3-23. On receipt of the SKF signal, indicating that the next instruction is to be skipped, an LIA or LIB instruction may transfer the contents of the Data Register to the computer as in the read control using the interrupt system. An SFC instruction, being the complement of the SFS instruction,

can also use the set or reset condition of the Flag FF in programming the punched tape reader. With this instruction, "and" gate MC64B provides the true inputs to "and" gate MC24A which applies the SKF signal to the computer.

3-24. Refer to Paragraphs 3-16 through 3-18 for information on loading and transferring data.

3-25. SERVICE REQUEST

3-26. The interface card issues the SRQ (Service Request) signal to the Direct Memory Access (DMA) option, when it is installed, after the Flag FF sets. This signal informs the DMA option that the interface card contains character data in its Data Register. The signal is received by DMA regardless of the set or reset condition of the Control FF on the interface card or the true or false condition of the PRH signal to the interface card.

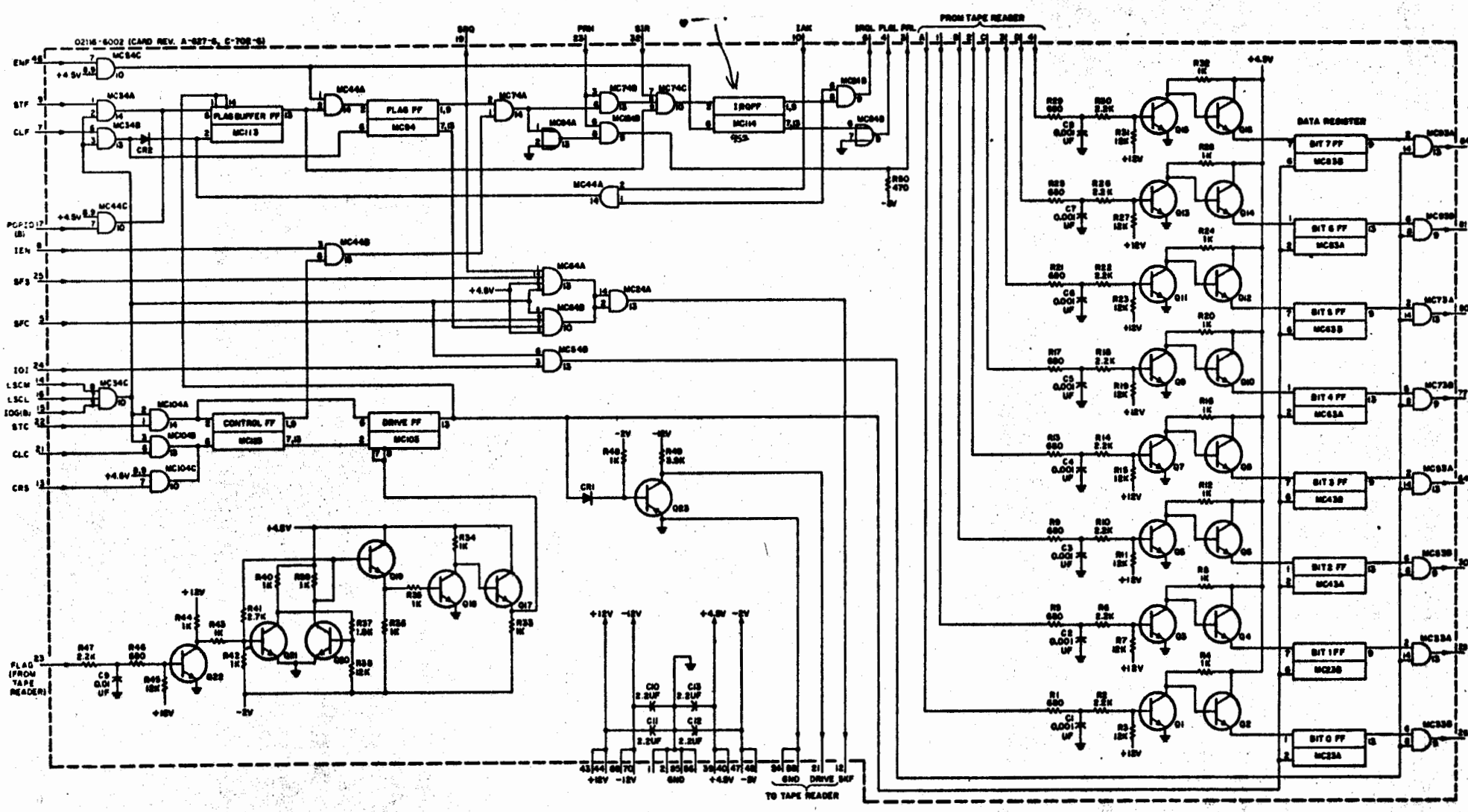


Figure 3-2. Pur[illegible]d Tape Reader Interf[illegible]
Ca[illegible]gic Diagram

SECTION IV

REPLACEABLE PARTS

4-1. INTRODUCTION

4-2. This section contains information for ordering replacement parts for the punched tape reader interface card. Refer to Table 4-1 for a list of replaceable parts in alpha-numerical order of their reference designations, with a description and HP part number for each part.

4-3. ORDERING INFORMATION

4-4. To order a replacement part, address the order or inquiry to your local Hewlett-Packard field office. See the list at the rear of this manual for field-office addresses.

4-5. Specify the following information for each part when ordering:

a. Hewlett-Packard part number.

b. Circuit reference designation.

c. Description.

4-6. To order a part not listed in Table 4-1, give a complete description of the part and include its function and location.

Table 4-1. Replaceable Parts for Punched Tape Reader Interface Card

REFERENCE DESIGNATION	DESCRIPTION	HP PART NO.
C1 thru C8	Capacitor, fixed, Ceramic, 0.001 μf	0160-2097
C9	Capacitor, fixed, Ceramic, 0.01 μf	0150-0093
C10 thru C13	Capacitor, fixed, Tant., 2.2 μf	0180-0155
CR1, CR2	Diode, Silicon	1901-0040
CR3	Diode, Germanium	1910-0022
MC23, MC43, MC63, MC83	Microcircuit Package	1820-0968
MC24, MC33, MC53, MC73, MC93, MC124	Microcircuit Package	1820-0956
MC34, MC44 MC54, MC74, MC104	Microcircuit Package	1820-0953
MC64	Microcircuit Package	1820-0954
MC84, MC94, MC114, MC123	Microcircuit Package	1820-0952
MC103, MC113	Microcircuit Package	1820-0957
Q1 thru Q22	Transistor, Silicon, NPN (2N3646)	2854-0094
Q23	Transistor, Silicon, PNP (2N3640)	1853-0015
R1, R5, R9, R13, R17, R21, R25, R29, R46	Resistor, fixed, 680 ohms ± 5%, 1/4 w	0683-6815
R2, R6, R10, R14, R18, R22, R26, R30, R47	Resistor, fixed, 2.2k ± 5%, 1/4 w	0683-2225
R3, R7, R11, R15, R19, R23, R27, R31, R38, R45	Resistor, fixed, 12k ± 5%, 1/4 w	0683-1235
R4, R8, R12 R16, R20, R24, R28, R32, R33 thru R36, R39, R40, R42, R43, R44, R48	Resistor, fixed, 1k ± 5%, 1/4 w	0683-1025
R37	Resistor, fixed, 1.8k ± 5%, 1/4 w	0683-1825
R41	Resistor, fixed, 2.7k ± 5%, 1/4 w	0683-2725
R49	Resistor, fixed, 3.9k ± 5%, 1/4 w	0683-3925
R50	Resistor, fixed, 470 ohms ± 5%, 1/4 w	0683-4715

SECTION V

DIAGNOSTIC PROGRAM

5-1. INTRODUCTION

5-2. The diagnostic program performs complete functional tests on the punched tape reader interface card and operational tests on the HP 2737A Punched Tape Reader or the HP 2737B Punched Tape Reader-Spooler. The diagnostic program is contained in the Tape Reader Test - Binary Tape (HP Accessory No. 20408B), and is used in conjunction with the HP 2116A Computer and the HP 2752A Teleprinter. The Computer controls the tests performed and the Teleprinter punches test tapes used in the operational tests and types test results. The diagnostic program can be used 1) to verify proper operation of the interface card and either tape reader, or 2) as an aid in the diagnosis of suspected malfunctions. This section describes the tests performed and the test results obtained.

5-3. DESCRIPTION

5-5. GENERAL

5-7. The diagnostic program on the Tape Reader Test - Binary Tape is loaded into computer memory. When started, the program automatically performs a functional test on the punched tape reader interface card. The HP 2752A Teleprinter must be connected to the computer to type test results. When the functional test is completed, the computer halts. The switches of the Switch Register on the front panel of the computer must then be positioned to select certain options required for generation of another test tape or for control in the performance of the operational test on the tape reader. The operational test is performed with a punched tape which, initially, is prepared using the teleprinter tape punch and then is placed in the tape reader. Subsequent testing can reuse the prepared tape. This punched tape can be either a standard test tape or a special test tape. The standard test tape is used for the overall operational test of the tape reader. It is prepared from data placed in Computer memory by the Tape Reader Test - Binary Tape. The special test tape contains a continuous repetition of one character as determined by the positions of Switches 8 through 15 of the Computer Switch Register. The special test tape is used only when the continuous reading of a single character or track in the

punched tape is required to diagnose a malfunction. Switches 1 through 7 of the Switch Register are used in the preparation of both the standard and the special test tapes. The switch positions are analyzed by the diagnostic program to determine the operations to be performed during the operational test of the punched tape reader.

5-8. FUNCTIONAL TEST

5-9. The functional test provides a detailed analysis of the control capabilities and the interrupt logic of the punched tape reader interface card by performing the following:

a. Test the ability of the computer PRESET switch to initialize the interface card properly.

b. Test for proper command responses by the interface card and the I/O Control and I/O Address cards.

c. Test the interface card dynamically by initiating a read operation under interrupt control. If no interrupt occurs within 30 milliseconds, an error message is typed by the teleprinter. (The data transfer capability of the interface card is tested in the operational test of the tape reader.)

5-10. When the functional test is completed, a completion message is typed by the teleprinter and the program halts. This halt allows the operator to analyze any error messages typed by the teleprinter before re-running the functional test or continuing with the operational test.

5-11. OPERATIONAL TEST

5-12. GENERAL. The operational test of the punched tape reader is performed upon completion of the functional test on the interface card. The computer program halts to permit the insertion of the standard or the special test tape in the punched tape reader and to permit the positioning of switches on the front panel of the computer. If a standard or a special tape has not been previously prepared, it is prepared at this time and inserted in the punched tape reader. When the program is started, the switch positions are analyzed by the computer to determine the test options selected and the operational test is performed.

5-13. SWITCH POSITION ANALYSIS. Refer to Table 5-1 for a list of the Computer Switch Register switches and the options resulting from their selection. Switch positions 8 through 15, not shown in Table 5-1, specify the 8-bit character to be punched in or read from the special test tape as determined by the position of switches 0 and 2 of the Switch Register. The following steps describe each of the options listed in Table 5-1.

Table 5-1. Switch Register Selections

SWITCHES 7 6 5 4 3 2 1 0	OPTION SELECTED
0 0 0 0 0 0 0 0	Read
0 0 0 0 0 0 0 1	Punch
0 0 0 0 0 0 1 0	No-Stop Read
0 0 0 0 0 1 X X	Special Test Tape
0 0 0 0 1 X X X	Pause
0 0 0 1 - - - -	Terminate
0 0 1 - - - - 0	Resync Pause
0 1 - - - 1 - 0	Error Type-Out Bypass
1 - - - - - - 0	Interrupt Control

NOTES:

0 = Switch in down (off) position.

1 = Switch in up (on) position.

X = Switch is on or off as required to obtain a combination option. Example: If Switch 2 and Switch 0 are placed in the on position, the option becomes Special Test Tape, Read.

\- = Position of switch is immaterial. Example: If Switch 4 is on, the test will Terminate regardless of positions of all other switches.

a. READ (SWITCH 0 OFF): This option results in the reading of the standard or the special test tape. If Switch 2 is off, the standard test tape is read; if Switch 2 is on, the special test tape is read. For both tapes, reading can be performed with or without interrupt control (see step "i").

b. PUNCH (SWITCH 0 ON): This option results in the standard or the special test tape being generated on the teleprinter tape punch. If Switch 2 is off, the standard test tape is punched; if Switch 2 is on, the special test tape is punched. (No punching is done under interrupt control.)

c. NO-STOP READ (SWITCH 1): This option allows the reading of the standard test tape in the continuous mode. Normally, start-stop tests are made while reading each data record on the tape. When Switch 1 is on, these stops are omitted.

d. SPECIAL TEST TAPE (SWITCH 2): This option allows the punching or reading of the special test tape. The character to be punched in or read from the special test tape must be stored in Switches 8 through 15 of the Computer Switch Register before the punch or read operation starts. Changing the position of the switches after a punch or a read operation starts has no effect on the data pattern. The pattern can be changed only after a TERMINATE (see step "f").

e. PAUSE (SWITCH 3): This option allows the test to be interrupted momentarily by the operator at any time without effecting the test or data sequence. The Switch is turned off to continue.

f. TERMINATE (SWITCH 4): This option allows termination of the current operation in an orderly manner. When the termination occurs, the program halts. At this time, option changes can be made as the program will start with the option analysis at the beginning of the operational test when the Computer RUN button is pressed.

g. RESYNC PAUSE (SWITCH 5): This option inhibits continuation of the test when an error condition has been detected that results in the program resyncing to the start of a test block within a data record. (The resync conditions are defined in step "d" of Paragraph 5-24.) When this error condition exists, a 'RESYNC" message will be typed by the teleprinter and then the pause occurs. The switch must be turned off before the test will continue.

h. ERROR TYPE-OUT BYPASS (SWITCH 6): This option allows bypassing of the error type-out by the teleprinter when the special test tape is being read.

i. INTERRUPT (SWITCH 7): This option allows running of the operational test under interrupt control. While under interrupt control and before an interrupt occurs, the B-Register on the front panel of the Computer will indicate 177777 and the B-Register lights should flicker. If the lights stop flickering, an "interrupt hang" condition exists which can be visually determined by the operator.

5-14. TEST TAPES

5-15. STANDARD TEST TAPE

5-16. GENERAL. The standard test tape is prepared on the teleprinter tape punch and represents the most-difficult data pattern for both continuous and start-stop reading. It contains three identical 55-character data records with each record separated by 15 leader characters as illustrated in Figure 5-1. The tape ends as illustrated in Figure 5-1 are formed when the tape is torn from the teleprinter tape punch. The ends should be joined to form a continuous loop for continuous punched tape reader testing and an infinite number of data records.

5-17. TEST SEQUENCE: The sequence in reading the standard test tape is as follows; the testing is terminated only by the operator placing Switch 4 of the Computer Switch Register in the up (on) position:

a. Read four 55-character data records and store the data characters in computer memory, ignoring all leader characters.

b. Analyze the data for correctness and sequencing.

c. Repeat the test sequence.

5-18. DATA RECORD CONFIGURATION. The configuration for each data record on the standard test tape is listed in Table 5-2. The indicated "Data-to-Drive Signal" delays in Table 5-2 check the response time of the punched tape reader. The delays are inserted between the receipt of data (Flag signal) and the issuance of a Drive Signal to advance the tape to the next row of data holes.

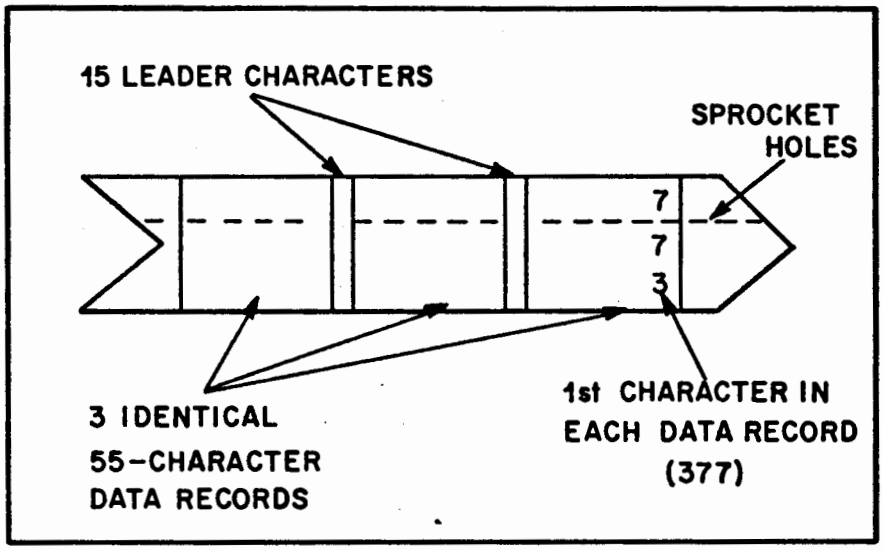


Figure 5-1. Standard Test Tape

Table 5-2. Data Record Configuration

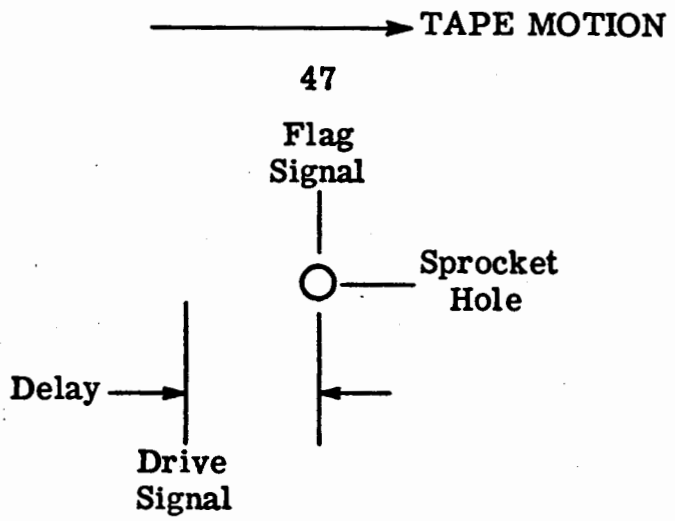
TAPE CHANNEL 8 7 6 5 4 3 2 1	OCTAL NO.	CHARACTER NO.		TAPE CHANNEL 8 7 6 5 4 3 2 1	OCTAL NO.	CHARACTER NO.	
x x x x x x x x	377	1		x x	102	34	
x x	201	2	-s	x x	201	35	-s
x x x x	125	3	-s	x x x x x x x x	377	36	
x x x x	252	4	-s	x x x x	252	37	TEST
x x x x x x	333	5		x x x x	125	38	BLOCK
x x x x x	155	6		x x x	250	39	
x x x x	066	7	TEST	x x x x x x x x	377	40	
x x x x	033	8	BLOCK		000	41	-s
x x	204	9		x x x x x x	347	42	TEST
x x x x x	037	10		x x x	122	43	BLOCK
x x x	340	11		x x x x x	255	44	
x x x x x x x x	377	12		x x x	211	45	
x x x x x	127	13	-s	x x x	152	46	-s
x x	201	14	-s	x x x x x	235	47	-s
x	102	15		x x	052	48	-D
x x x x	145	16		x x x x x x	367	49	-D
x x x	132	17		x	010	50	-s
x x x x x	347	18		x x x x x x	267	51	-D
x x	030	19		x x	030	52	-D
x x x x x x x x	377	20		x x x x	245	53	-s
x x x x	132	21	TEST	x x	044	54	-D
x x x x	245	22	BLOCK	x x x x x x	333	55	-D
x x	030	23					-s
x x	102	24					
x x	044	25					
x x	030	26					
x x	201	27					
x x x x	245	28					
x x	102	29					
x x	044	30					
x x	030	31					
x x x x	231	32					
x x	044	33	-s				

NOTES: -s Punched Tape Reader stops, then automatically proceeds.

-D Data-to-Drive Signal delay. Delays for each Data Record are as follows:

Data Record 1	0.5 ms delay	Data Record 3	1.00 ms delay
Data Record 2	0.75 ms delay	Data Record 4	1.25 ms delay

EXAMPLE:



5-19. SPECIAL TEST TAPE

5-20. The special test tape is prepared on the teleprinter tape punch and consists of the continuous repetition of a single character. The special test tape is used only for special diagnostic problems and is not used for an overall operational test of the tape reader. The character to be punched or read is determined by the positions of Switches 8 through 15 of the Computer Switch Register. No special start-stop timing or data block tests are performed. This continuous-read operation provides a steady data output pattern to facilitate punched tape reader testing. Any data pattern changes must be made by the operator as follows:

a. Terminate the existing punch or read operation by placing Switch 4 of the Computer Switch Register up (on).

b. Change the character represented by Switches 8 through 15 of the Switch Register.

c. Press the Computer RUN switch.

5-21. TELEPRINTER TYPING OUTPUTS

5-22. DATA ERRORS

5-23. RECORDING OF DATA ERRORS. All errors made by the punched tape reader during the reading of a test tape are recorded in two lines on the teleprinter. The first line contains the character which should have been read, preceded by the letter "G". The second line contains the character read in error, preceded by the letter "B". If the error is

recorded during performance of the standard test tape, this error is followed, on the same line, by information identifying the character number in the Data Record and in the Test Block (see Table 5-2), the Data-to-Drive Signal delay if any, and the type of error. Example 1 below identifies the error information typed-out by the teleprinter. Example 2 illustrates an actual error type-out by the teleprinter.

EXAMPLE 1:

Correct Character (1st line):

G XXXXXXXX

Character Read in Error (2nd line):

B XXXXXXXX XX XX XXXX X----------X

- XX: Character 1 thru 55
- XX: FC: 1st Character of Test Block. LC: Last Character of Test Block. SC: Single Character Read. XX: Character of Test Block other than 1st or Last Character.
- XXXX: Data-to-Drive Signal Delay, if any (MS)
- X----------X: Type of Error

EXAMPLE 2:

G 1111Ø111

B 11Ø1Ø111 49 LC Ø.5Ø BIT ERROR

5-24. TYPES OF DATA ERRORS: The following steps describe the types of errors typed-out by the teleprinter as illustrated in the previous paragraph. This information is typed out only during performance of the standard test tape.

a. BIT ERROR: This indicates that the character read is in error (one or more bits dropped, for example) but the sequence of reading is correct. Also, three consecutive BIT ERROR messages are typed out if two or more characters are skipped.

b. REREAD CH.: This indicates that the character read is identical to the last character read so it is assumed to be a reread of that character. This is generally caused by tape reader noise. Following this type-out,

a RESYNC message will be typed, the program will automatically position the test tape to the next group of leader characters, and the testing is restarted.

c. MISSED CH.: This indicates that the character just read is out of place so it is assumed that at least one character was skipped. This is generally caused by feed-hole photodiode sensitivity. Following this type-out, a RESYNC message will be typed, the program will automatically position the test tape to the next group of leader characters, and the testing is restarted.

d. RESYNC: This indicates character sequence errors or that three consecutive bit errors have been detected. The program automatically positions the test tape to the next group of leader characters, and the testing is restarted.

5-25. INTERRUPT ERRORS

5-26. PRESET INTERRUPT. The teleprinter types "INTERRUPT ON PRESET (CONTROL)" if an interrupt occurs in the preliminary steps of the functional test on the interface card. If there were no error type-outs prior to this one, it implies that the Control FF on the interface card was not reset when the PRESET switch was pressed at the beginning of the test.

5-27. NORMAL INTERRUPT. The teleprinter types "NO NORMAL INTERRUPT" if an interrupt signal was not received from the interface card within 30 milliseconds after the Drive signal was sent to the tape reader. If there were no error type-outs prior to this one, the circuits in the tape reader which supply the Flag signal to the interface card or the interrupt logic on the interface card should be suspected of malfunctioning.

5-28. PRESET ERRORS

5-29. SYSTEM FLAG. The teleprinter types "SYSTEM FLAG ON - PRESET" if the Interrupt System Enable FF (System Flag) on the I/O Control card did not reset when the PRESET switch was pressed.

5-30. READER FLAG. The teleprinter types "READER FLAG OFF - PRESET" if the Flag FF (Reader Flag) on the interface card did not set when the PRESET switch was pressed.

5-31. FLAG COMMAND ERRORS

5-32. CLEAR FLAG ERROR. The teleprinter types "READER CLF ERROR (CLF OR SFC)" to indicate one or both of the following error conditions:

a. The Flag FF on the interface card did not respond to a Clear Flag (CLF) instruction.

b. The Skip on Flag Clear (SFC) instruction used in testing the Flag FF did not function properly on the interface card.

5-33. SET FLAG ERROR. The teleprinter types "READER STF ERROR (STF OR SFS)" to indicate one or both of the following error conditions:

a. The Flag FF on the interface card did not respond to a Set Flag (STF) instruction.

b. The Skip on Flag Set (SFS) instruction used in testing the Flag FF did not function properly on the interface card.

5-34. TEST COMPLETED.

5-35. FUNCTIONAL TEST. The teleprinter types "FUNCTIONAL TEST COMPLETE" when the functional test of the interface card is completed.

5-36. TERMINATE. The teleprinter types "-TERMINATE-" when Switch 4 of the Computer Switch Register is placed in the up (on) position and the test is terminated. The test can be continued if the Computer RUN switch is pressed.

5-37. OPERATING PROCEDURE

5-38. The following steps provide the procedure to be followed in performing the diagnostic program. The procedure assumes that the HP 2752A Teleprinter and the HP 2737A/B Tape Reader are connected to the Computer.

a. Place the teleprinter LINE/OFF/LOCAL switch in the LOCAL position. Press the teleprinter tape punch ON switch. Press the HERE IS key on the teleprinter to obtain about 6 inches of tape leader. Press the teleprinter tape punch OFF switch and then place the LINE/OFF/LOCAL switch to LINE.

b. Place the Tape Reader Test - Binary Tape in the punched tape reader and turn the tape reader POWER switch to ON. Do not remove the tape until instructed to do so in step "k".

c. If the Computer contains 8K of memory, position the switches of the Switch Register to 17700_8. If the Computer contains 4K of memory, position the switches to 7700_8. Press the LOAD ADDRESS switch to load the contents of the Switch Register into the P-Register.

d. Place the Computer LOADER ENABLED /PROTECTED switch to ENABLED.

e. Press the Computer RUN switch. When the diagnostic program is loaded, the Computer halts. (The T-Register on the front panel of the Computer indicates 102077 if the program was loaded properly. If not, repeat steps "c" and "d", then press the RUN switch again.)

f. Place the LOADER ENABLED/PROTECTED switch to PROTECTED.

g. Load 100 (Starting Address) in the P-Register using the Switch Register and the LOAD ADDRESS switch.

h. Place the lower Select Code of the teleprinter (noted on the inside of the front panel of the Computer) in the A-Register using the switches of the Switch Register. Press the LOAD A switch.

i. Place the Select Code of the punched tape reader in the B-Register using the Switch Register. Press the LOAD B switch.

j. Press the PRESET switch and then the RUN switch. The functional test will run and the teleprinter will type out any errors detected by the program.

k. At completion of the functional test, the teleprinter will type-out "FUNCTIONAL TEST COMPLETE" and the Computer will halt. If the functional test is to be repeated, load 101 into the P-Register and press the RUN switch. If the test is not to be repeated, remove the test tape from the tape reader and proceed to step "l" to perform the operational test on the punched tape reader.

l. Prepare the standard test tape and use it to perform the operational test as follows:

1. Press the teleprinter tape punch ON switch.

2. Place Switch 0 of the Switch Register up (on).

3. Press the Computer RUN switch. (While the tape is being punched, the teleprinter types irrelevant information.)

4. The program will halt when the standard test tape has been generated. Tear off the tape at the teleprinter, form the tape into a loop, and splice the ends of the tape together.

5. Place Switch 0 down (off) and press the teleprinter tape punch OFF switch.

6. Place the standard test tape in the punched tape reader with the sprocket holes toward the tape reader and with character 377 being the first character to enter the tape reader. Select the desired test options by positioning Switches 0 through 7 (see Table 5-1), and then press the RUN switch.

7. Any errors detected by the diagnostic program will be typed on the teleprinter. Place Switch 4 in the up position to terminate the operational test.

m. If the special test tape must be prepared, proceed as follows:

1. Press the teleprinter tape punch ON switch.

2. Place Switches 0 and 2 of the Switch Register up (on).

3. Set-up the character to be punched in the special tape in Switches 8 through 15 of the Switch Register.

4. Press the Computer RUN switch.

5. When the desired length of tape is obtained, place Switch 4 in the up position to terminate the punching operation.

6. Place Switch 0 down (off) and press the teleprinter tape punch OFF switch.

7. Tear off the tape at the teleprinter and insert it in the punched tape reader. Select the desired test options by positioning Switches 0 through 7 (see Table 5-1). Make certain that the character punched in the special test tape is also set up in the Switch Register. Press the Computer RUN switch.

8. Any errors detected during the running of the special test tape will be typed on the teleprinter. Place Switch 4 in the up position to terminate the reading of the special test tape.

5-39. DIAGNOSTIC PROGRAM LISTING

5-40. The remaining pages in this section are divided into a listing of the Tape Reader Test - Binary Tape contents of the diagnostic program. The listing enables the user to examine the method of testing and the particular areas of testing, in detail.

LISTING
for
TAPE READER TEST - BINARY TAPE
(HP 20408B)

0001 ASMB,A,B,L,T

ABLE	000100
ABLEM	000105
ABLED	000114
ABLES	000122
ABLE1	000217
ABLX1	000225
ABLX2	000234
FRFS1	000245
FRCF1	000255
FRFC1	000256
FRSF1	000267
FRFS2	000270
ABLE2	000302
FRSC1	000306
FRCC2	000317
FEINT	000330
FRCC1	000336
RINTF	000340
FINTA	000343
EINTA	000344
RINTA	000345
CMD1	000346
CMD2	000347
CMD3	000350
CMD4	000351
CMD5	000352
CMD6	000353
CMD7	000354
CMD8	000355
CMD9	000356
CMD10	000357
CMD11	000360
SFLAG	000361
BJMP	000362
ASRA	000363
REDA	000364
ADDM	000365
T0UT4	000366
T0UT5	000367
T0UT0	000370
T0UT3	000371
T0UT	000372
DITT	000373
LASTC	000461
CTIC	000463
CTIX	000464
TCIC	000465
TCIX	000466
DITC	000467
DITX	000470
DTBS	000471
DTBX	000472
DTCS	000473
DTCX	000474
MSM3	000475
MSMK	000476

ASC0	000477
ASC1	000500
ASCA	000501
ASCC	000511
BT15	000512
PASS	000513
PUNN	000514
PUNB	000515
PUNF	000516
CX01	000517
CX0C	000524
C260	000525
CRT1	000526
CRT2	000527
IFLG	000530
SEL1	000531
SEL2	000532
SEL3	000533
SEL4	000534
SEL5	000535
SEL6	000536
D001	000537
D003	000540
D004	000541
D005	000542
D006	000543
D008	000544
D000	000545
D010	000546
DADD	000547
DBKK	000550
DCDC	000551
DCTC	000552
DE05	000553
DE08	000554
DE11	000555
DE17	000556
DE18	000557
DE34	000560
DE66	000561
DE65	000562
DEL2	000563
DEL3	000564
DEL4	000565
DEL7	000566
DELC	000567
DFBK	000570
DHBK	000571
DINTC	000572
DIXC	000573
DIXI	000574
DK03	000575
DK04	000576
DK05	000577
DK06	000600
DK07	000601
DK08	000602

DK09	000603
DLDC	000604
DLDR	000605
DSFC	000606
DTBC	000607
DTCC	000610
DWK1	000611
DWK2	000612
DWK3	000613
DWK4	000614
DWK5	000615
DWK6	000616
DWK7	000617
DWK8	000620
DWK9	000621
ERWD	000622
FM01A	000623
FM02A	000624
FM03A	000625
FM04A	000626
FM05A	000627
FM06A	000630
FM07A	000631
FRWD	000632
INTF	000633
LASTD	000634
OCTL	000635
SWCH	000636
N026	000637
CHIX	000640
PCH0	000641
CHEC	000642
RESF	000643
HEAD	000644
REAR	000645
RESD	000646
TERM0	000647
BTER	000650
RERD	000655
MSCH	000662
RESY	000667
DBKM	000675
BI03	000676
DE64	000677
PCT1	000700
PCT2	000701
PCT3	000702
PRT1	000703
PRT2	000705
PRT3	000713
PRT4	000720
PRT5	000722
PRT6	000724
PRT7	000727
MSKI	000735
MSK1	000736
REPU	000746

CHLU	000747
BAKE	000750
MA00	000751
M000	000770
M00A	001006
M00C	001023
MHLT	001032
LDPN	001034
M00B	001037
M010	001051
M01A	001062
M01B	001075
M020	001100
M030	001107
M040	001127
M050	001140
M060	001154
JMP1	001155
JMP2	001156
JMP3	001157
JMP4	001160
M061	001161
M062	001166
M063	001173
M064	001200
M070	001204
E000	001222
E00A	001233
E010	001245
E01A	001252
E01B	001254
E030	001267
E040	001301
TR1D	001303
TR1DA	001315
T1X1	001332
T1X2	001334
T1X2A	001335
RINT	001351
TR4D	001355
T4X1	001362
CHP0	001366
CHR0	001400
CHR1	001426
SWA0	001430
SWA1	001431
ER00	001442
ER01	001452
ER02	001456
ER03	001464
ER04	001475
ER05	001501
ER07	001510
ER06	001522
ER08	001537
ER09	001541
ER10	001555

ER11	001562
ER12	001567
ER13	001574
ER14	001577
ER15	001604
EP00	001611
EP0A	001612
EP01	001620
EP02	001625
EP03	001631
EP03A	001640
EP04	001641
EP04A	001643
EP04B	001647
LK00	001663
LK01	001675
LK03	001701
LK04	001715
LK05	001730
LK06	001742
LK07	001745
LK08	001754
SY00	001772
SY01	001773
DTCN	002015
DTBN	002105
FM01	002175
FM02	002213
FM03	002231
FM04	002253
FM05	002275
FM06	002317
FM07	002335
TERMM	002353
P001	002375
DITR	002407
TOUT	003133
TOUT0	003135
TOUT3	003136
TOUT4	003137
TOUT5	003140
SAVB	003144
OUT	003145

** NO ERRORS*

```
0001                    ASMB,A,B,L,T
0002  00100                   ORG 100B
0003*
0004*
0005*   REV.FEB.6, 1968
0006*
0007*
0008*   THIS IS SOURCE TAPE 1 OF 2 FOR THE HIGH SPEED TAPE READER
0009*   TEST PROGRAM.
0010*   THIS PROGRAM WILL TEST BOTH SERIAL AND BUFFERED TTY BOARDS.
0011*     WHEN TTY OUTPUT ADDRESS IS SET IN SW., SET BIT 15 TO USE
0012*     WITH SERIAL TYPE BOARDS.
0013*
0014*
0015*   THERE ARE THREE STARTING POINTS IN THE PROGRAM TO ALLOW THE
0016*   OPERATOR START OR RESTART.  THESE ARE AS FOLLOWS:
0017*
0018*         ADDRESS
0019*
0020*            100 -- START- INITIALIZE I/O ADDRESSES AND START READER
0021*                         TEST WITH FUNCTIONAL TEST THE DETAILED TE
0022*                         PRESET BEFORE START.
0023*            101 -- RESTART- FUNCTIONAL TEST IS PERFORMED THEN A HAL
0024*                            FOLLOWED BY OPTION ANALYSIS AND THE DET
0025*                            ED TEST. PRESET BEFORE STARTING AT 101.
0026*            102 -- RESTART- OPTION ANALYSIS AND DETAILED TEST. BYPA
0027*                            THE I/O ADDRESSING AND FUNCTIONAL TEST.
0028*
0029*
0030*   THE 1ST SECTION OF THIS PROGRAM ALLOWS CHANNEL ADDRESS SELECTION
0031*   FOR THE PERIPHERALS INVOLVED. THIS IS DONE AS FOLLOWS:
0032*
0033*              SET P REG = 100
0034*              SET A REG = ASF OUTPUT CHANNEL #
0035*                  SELECT TYPE OF TTY BOARD BY USE OF BIT 15.
0036*              SET B REG = READER CHANNEL #
0037*
0038*              PRESET
0039*
0040*              RUN
0041*
0042*  THIS IS THE STARTING ADDRESS FOR I/O ADDRESSING.
0043*
0044  00100 024105  ABLE  JMP ABLEM     GO TO ADDRESSING
0045*
0046*   RESTART ADDRESS FOR FUNCTIONAL TEST (PRESET BEFORE RUN)
0047*
0048  00101 024217        JMP ABLE1     GO TO FUNCTIONAL TEST
0049*
0050*  RESTART ADDRESS FOR DETAILED TEST
0051*
0052  00102 024750        JMP BAKE      GO TO DETAILED TEST
0053  00103 102000        HLT
0054  00104 102000        HLT
0055  00105 002020  ABLEM SSA           CHECK FOR SERIAL/BUFFER BD.
0056  00106 024114        JMP ABLEO
0057  00107 070361        STA SFLAG     BUFFERED TYPE.
```

```
0058  00110 013365          AND ADDM      MASK ADDRESS
0059  00111 073363          STA ASRA      STORE ASR ADDRESS
0060  00112 074364          STB REDA       STORE SELECTED HSTR CHANNEL #.
0061  00113 024122          JMP ABLES
0062  00114 013365  ABLE0   AND ADDM
0063  00115 073363          STA ASRA
0064  00116 074364          STB REDA
0065  00117 002400          CLA
0066  00120 073361          STA SFLAG
0067  00121 071531          STA EP03
0068  00122 107700  ABLES   CLC 0,C        CLEAR CONTROL AND INTERRUPT
0069  00123 063363          LDA ASRA
0070  00124 013365          AND ADDM
0071  00125 073363          STA ASRA
0072  00126 107700          CLC 0,C        CLEAR CONTROL AND INTERRUPT
0073  00127 063364          LDA REDA
0074  00130 013365          AND ADDM       MASK FOR ADDRESS ONLY (HSTR)
0075  00131 073364          STA REDA
0076  00132 043347          ADA CMD2       ADD SFS TO CHANNEL #
0077  00133 071332          STA T1X1
0078  00134 073245          STA FRFS1
0079  00135 073270          STA FRFS2
0080  00136 063364          LDA REDA
0081  00137 043352          ADA CMD5       ADD STC ,C TO CHANNEL #
0082  00140 071315          STA TR1DA
0083  00141 063346          LDA CMD1
0084  00142 043364          ADA REDA
0085  00143 073306          STA FRSC1
0086  00144 063352          LDA CMD5
0087  00145 043363          ADA ASRA
0088  00146 173366          STA T0UT4,I
0089  00147 063364          LDA REDA
0090  00150 043353          ADA CMD6       ADD LIA TO CHANNEL #
0091  00151 071335          STA T1X2A
0092  00152 063364          LDA REDA       SET SFC
0093  00153 043355          ADA CMD8
0094  00154 073256          STA FRFC1
0095  00155 063364          LDA REDA       SET CLF
0096  00156 043354          ADA CMD7
0097  00157 073255          STA FRCF1
0098  00160 063364          LDA REDA       SET STF
0099  00161 043356          ADA CMD9
0100  00162 073257          STA FRSF1
0101  00163 063364          LDA REDA       SET CLC
0102  00164 043351          ADA CMD4
0103  00165 073336          STA FRCC1
0104  00166 073317          STA FRCC2
0105  00167 063346          LDA CMD1
0106  00170 043363          ADA ASRA       ADD STC TO CHANNEL #
0107  00171 071540          STA EP03A
0108  00172 063347          LDA CMD2
0109  00173 043363          ADA ASRA       ADD SFS TO CHANNEL #
0110  00174 071541          STA EP04
0111  00175 173367          STA T0UT5,I
0112  00176 063350          LDA CMD3
0113  00177 043363          ADA ASRA       ADD OTA ,C TO CHANNEL #
0114  00200 071543          STA EP04A
```

```
0115  00201 060351          LDA CMD4
0116  00202 040353          ADA ASRA        ADD CLC TO CHANNEL #
0117  00203 071547          STA EP048
0118  00204 060357          LDA CMD10
0119  00205 040363          ADA ASRA      ADD OTB TO CHANNEL #
0120  00206 170370          STA T0UT0,I
0121  00207 060350          LDA CMD11     ADD OTA TO CHANNEL #
0122  00210 040363          ADA ASRA
0123  00211 170371          STA T0UT3,I
0124  00212 060351          LDA SFLAG     CHECK SERIAL FLAG
0125  00213 002003          SZA,RSS
0126  00214 024217          JMP *+3
0127  00215 060362          LDA BJMP
0128  00216 071531          STA EP03
0129*  THIS SECTION OF THE PROGRAM PREFORMS A FUNCTIONAL TEST OF ALL
0130*  COMMANDS RELATED TO THE READER OPERATION.  ALL DETECTED ERRORS AR
0131*  TYPED OUT, THEN THE COMPLETION MESSAGE, THEN HALT.
0132*
0133  00217 002400  ABLE1 CLA
0134  00220 070516          STA PUNF
0135  00221 060540          LDA D003       SET UP COUNT TO -60
0136  00222 070511          STA DWK1
0137  00223 060532          LDA SEL2       SET STARTING ADDRESS AT 4
0138  00224 070512          STA DWK2
0139  00225 034511  ABLX1 ISZ DWK1        IS THIS THE LAST HALT?
0140  00226 024230          JMP *+2        NOT LAST HALT STORE
0141  00227 024234          JMP ABLX2       LAST INT HALT, CONTINUE
0142  00230 061032          LDA MHLT
0143  00231 170512          STA DWK2,I     STORE IN INDEXED ADDRESS
0144  00232 034512          ISZ DWK2        INCREMENT STORE ADDRESS
0145  00233 024225          JMP ABLX1       GO STORE NEXT HALT
0146  00234 060344  ABLX2 LDA EINTA       SET UP PRESET INTERRUPT RETURN.
0147  00235 170364          STA REDA,I     STORE IN READER CHANNEL ADDRESS
0148  00236 102300          SFS 0          IS THE INTERRUPT OFF ON PRESET?
0149  00237 024245          JMP FRFS1      YES THIS (SFS AND SYSTEM FLAG) S
0150  00240 060560          LDA DE34       SET UP # OF CHS IN ERROR MESSAGE
0151  00241 070521          STA DWK9
0152  00242 060523          LDA FM01A      SET UP ORIGIN OF SYSTEM FLAG ERR
0153  00243 070520          STA DWK8
0154  00244 015511          JSB EP00       TYPE MESSAGE
0155  00245 102300  FRFS1 SFS 0           IS THE READER FLAG SET ON PRESET
0156  00246 024250          JMP *+2        NO THE FLAG IS OFF
0157  00247 024255          JMP FRCF1      FLAG ON, EVERYTHING SEEMS O.K.,
0158  00250 060550          LDA DE34       SET UP TO TYPE THE READER FLAG O
0159  00251 070521          STA DWK9       PRESET MESSAGE
0160  00252 060524          LDA FM02A
0161  00253 070520          STA DWK8
0162  00254 015511          JSB EP00       TYPE THE MESSAGE
0163  00255 103100  FRCF1 CLF 0           CLEAR THE READER FLAG
0164  00256 102200  FRFC1 SFC 0           IS THE READER FLAG CLEAR?
0165  00257 024251          JMP *+2        NO, THERE IS AN ERROR IN READER
0166  00260 024267          JMP FRSF1      O.K.
0167  00261 060541          LDA PCH0       PREPARE TO TYPE READER CLF ERROR
0168  00262 070521          STA DWK9
0169  00263 060525          LDA FM03A
0170  00264 070520          STA DWK8
0171  00265 015511          JSB EP00       TYPE THE MESSAGE
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0172  00266 024317          JMP FRCC2      BYPASS REMAINING TESTS
0173  00267 102100  FRSF1 STF 0            SET THE READER FLAG
0174  00270 102300  FRFS2 SFS 0            IS THE READER FLAG SET?
0175  00271 024273          JMP *+2        NO, THERE IS AN ERROR IN STF
0176  00272 024300          JMP *+6        O.K.
0177  00273 060541          LDA PCH0       PREPARE TO TYPE THE STF ERROR ME
0178  00274 070521          STA DWK9
0179  00275 060526          LDA FM04A
0180  00276 070520          STA DWK8
0181  00277 015511          JSB EP00       TYPE STF ERROR MESSAGE
0182  00300 102100          STF 0          TURN ON THE SYSTEM INTERRUPT
0183  00301 000000          NOP
0184  00302 060343  ABLE2 LDA FINTA       SET UP NORMAL FUNCTION INTERRUPT
0185  00303 170364          STA REDA,I
0186  00304 060572          LDA DINTC
0187  00305 070511          STA DWK1
0188  00306 102700  FRSC1 STC 0            SET THE READER TO READ
0189  00307 034611          ISZ DWK1       IS THE INTERRUPT DELAY OVER? (30
0190  00310 024307          JMP *-1        NO, CONTINUE DELAY
0191  00311 103100          CLF 0
0192  00312 060560          LDA DE34       THERE WAS NO INTERRUPT IN 30MS S
0193  00313 070521          STA DWK9
0194  00314 060530          LDA FM06A
0195  00315 070520          STA DWK8
0196  00316 015511          JSB EP00       TYPE THE MESSAGE
0197  00317 106700  FRCC2 CLC 0            CLEAR THE READER CONTROL
0198  00320 103100          CLF 0          TURN OFF SYSTEM INTERRUPT
0199  00321 060560          LDA DE34       PREPARE TO TYPE FUNCTIONAL TEST
0200  00322 070521          STA DWK9       COMPLETED MESSAGE
0201  00323 060631          LDA FM07A
0202  00324 070520          STA DWK8
0203  00325 015611          JSB EP00       TYPE COMPLETION MESSAGE
0204  00326 102000          HLT
0205  00327 024750          JMP BAKE       CONTINUE WITH NORMAL TEST
0206*
0207*  ERROR INTERRUPT RETURN FROM PRESET
0208*
0209  00330 000000  FEINT NOP
0210  00331 060541          LDA PCH0       PREPARE TO TYPE PRESET INTERRUPT
0211  00332 070521          STA DWK9       ERROR MESSAGE
0212  00333 060627          LDA FM05A
0213  00334 070520          STA DWK8
0214  00335 015611          JSB EP00
0215  00336 106700  FRCC1 CLC 0            CLEAR READER CONTROL
0216  00337 024302          JMP ABLE2
0217*
0218*  THIS IS THE NORMAL FUNCTION INTERRUPT RETURN
0219*
0220  00340 000000  RINTF NOP
0221  00341 000000          NOP
0222  00342 024317          JMP FRCC2      BYPASS REMAINING TESTS
0223  00343 014340  FINTA JSB RINTF       NORMAL INTERRUPT RETURN--FUNCTIO
0224  00344 014330  EINTA JSB FEINT       ERROR INTERRUPT RETURN
0225  00345 015351  RINTA JSB RINT        STANDARD TEST INTERRUPT RETURN.
0226  00346 102700  CMD1  STC 00B          ASR
0227  00347 102300  CMD2  SFS 00B          ASR AND HSTR
0228  00350 103500  CMD3  OTA 00B,C        ASR
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0229  00351 106700  CMD4   CLC 00B          ASR
0230  00352 103700  CMD5   STC 0,C
0231  00353 102500  CMD6   LIA 0
0232  00354 103100  CMD7   CLF 0
0233  00355 102200  CMD8   SFC 0
0234  00356 102100  CMD9   STF 0
0235  00357 105500  CMD10  OTB 0
0236  00360 102500  CMD11  OTA 0
0237  00361 000000  SFLAG  NOP
0238  00362 124372  BJMP   JMP T0UT,I
0239  00363 000000  ASRA   OCT 0            CONTAINS ASR CHANNEL ADDRESS.
0240  00364 000000  REDA   OCT 0            CONTAINS HSTR CHANNEL ADDRESS.
0241  00365 000077  ADDM   OCT 000077       MASK FOR CHANNEL ADDRESS.
0242  00366 003137  T0UT4  DEF TOUT4
0243  00367 003140  T0UT5  DEF TOUT5
0244  00370 003135  T0UT0  DEF TOUT0
0245  00371 003136  T0UT3  DEF TOUT3
0246  00372 003133  T0UT   DEF TOUT
0247  00373 000377  DITT OCT 000377        TEST TAPE CH TABLE
0248  00374 000201        OCT 000201
0249  00375 000125       OCT 000125
0250  00376 000252       OCT 000252
0251  00377 000333       OCT 000333
0252  00400 000155       OCT 000155
0253  00401 000066       OCT 000066
0254  00402 000033       OCT 000033
0255  00403 000204        OCT 000204
0256  00404 000037       OCT 000037
0257  00405 000340       OCT 000340
0258  00406 000377       OCT 000377
0259  00407 000127       OCT 000127
0260  00410 000201       OCT 000201
0261  00411 000102       OCT 000102
0262  00412 000145       OCT 000145
0263  00413 000132       OCT 000132
0264  00414 000347       OCT 000347
0265  00415 000030       OCT 000030
0266  00416 000377       OCT 000377
0267  00417 000132        OCT 000132
0268  00420 000245       OCT 000245
0269  00421 000030       OCT 000030
0270  00422 000102       OCT 000102
0271  00423 000044       OCT 000044
0272  00424 000030       OCT 000030
0273  00425 000201       OCT 000201
0274  00426 000245       OCT 000245
0275  00427 000102       OCT 000102
0276  00430 000044       OCT 000044
0277  00431 000030       OCT 000030
0278  00432 000231        OCT 000231
0279  00433 000044       OCT 000044
0280  00434 000102       OCT 000102
0281  00435 000201       OCT 000201
0282  00436 000377       OCT 000377
0283  00437 000252       OCT 000252
0284  00440 000125       OCT 000125
0285  00441 000250        OCT 000250
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0286  00442 000377        OCT 000377
0287  00443 000000        OCT 000000
0288  00444 000347        OCT 000347
0289  00445 000122        OCT 000122
0290  00446 000255        OCT 000255
0291  00447 000211        OCT 000211
0292  00450 000152        OCT 000152
0293  00451 000235        OCT 000235
0294  00452 000052        OCT 000052
0295  00453 000367        OCT 000367
0296  00454 000010        OCT 000010
0297  00455 000167        OCT 000167
0298  00456 000030        OCT 000030
0299  00457 000245        OCT 000245
0300  00460 000044        OCT 000044
0301  00461 000333  LASTC OCT 000333
0302  00462 000000        OCT 000000
0303  00463 002375  CTIC  DEF P001        CONSTANT FOR COUNT TABLE
0304  00464 000000  CTIX  OCT 0           COUNT TABLE IN INDEX
0305  00465 002407  TCIC  DEF DITR        CONSTANT FOR DI AREA
0306  00466 000000  TCIX  OCT 0           DI INDEX
0307  00467 000373  DITC  DEF DITT        CONSTANT FOR DATA TABLE
0308  00470 000000  DITX  OCT 0           DATA TABLE INDEX
0309  00471 002105  DTBS  DEF DTBN
0310  00472 000000  DTBX  OCT 0           INDEX
0311  00473 002115  DTCS  DEF DTCN
0312  00474 000000  DTCX  OCT 0           INDEX
0313  00475 000007  MSM3  OCT 000007      3 BIT MASK
0314  00476 000377  MSMK  OCT 000377      MS CH MASK
0315  00477 000260  ASC0  OCT 000260      ASCII 0
0316  00500 000261  ASC1  OCT 000261      ASCII 1
0317*
0318*  THIS IS A TABLE OF READ DELAYS USED IN THE LAST 3 TAPE BLOCK TEST
0319*  EACH DELAY REQUIRES 2 WDS.
0320*
0321  00501 130256  ASCA  OCT 130256      0.50 MS DELAY
0322  00502 132660        OCT 132660
0323  00503 130256        OCT 130256      0.75 MS DELAY
0324  00504 133665        OCT 133665
0325  00505 130656        OCT 130656      1.00 MS DELAY
0326  00506 130260        OCT 130260
0327  00507 130656        OCT 130656      1.25 MS DELAY
0328  00510 131265        OCT 131265
0329  00511 000501  ASCC  DEF ASCA
0330  00512 100000  BT15  OCT 100000      MASK FOR MS BIT
0331  00513 000000  PASS  OCT 0           COUNT OF TEST PASSES
0332  00514 000007  PUNN  OCT 000007
0333  00515 000000  PUNB  OCT 0           BUFFER FOR 1 WD DATA TRANSFERS
0334  00516 000000  PUNF  OCT 0           FLAG THAT PUNCH IS TO BE RAN
0335  00517 177761  CX01  OCT 177761      OCTAL SHIFT TABLE
0336  00520 177764        OCT 177764
0337  00521 177767        OCT 177767
0338  00522 177772        OCT 177772
0339  00523 177775        OCT 177775
0340  00524 000517  CX0C  DEF CX01
0341  00525 000260  C260  OCT 000260      ASCII CONSTANT FOR NUMERIC
0342  00526 106612  CRT1  OCT 106612      CR AND LF
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0343  00527 000215  CRT2 OCT 000215      RIGHT CARRIAGE RETURN
0344  00530 000000  IFLG OCT 0           FLAG FOR TABLE INDEX
0345  00531 000002  SEL1 OCT 2
0346  00532 000004  SEL2 OCT 4
0347  00533 000010  SEL3 OCT 10
0348  00534 000020  SEL4 OCT 20
0349  00535 000040  SEL5 OCT 40
0350  00536 000100  SEL6 OCT 100
0351  00537 177777  D001 OCT 177777      0 DELAY
0352*
0353*     DELAY COUNT AT 8.4 MICRO SEC/COUNT LOP
0354*
0355  00540 177704  D003 OCT 177704      0.50 MS  (60 LOOPS)
0356  00541 177647  D004  OCT 177647       0.75 MS (89 LOOPS)
0357  00542 177611  D005 OCT 177611      1.00 MS  (119 LOOPS)
0358  00543 177553  D006 OCT 177553      1.25 MS  (149 LOOPS)
0359  00544 174776  D008 OCT 174776
0360  00545 000000  D000 OCT 0
0361  00546 174175  D010 OCT 174175
0362  00547 003000  DADD OCT 003000      ASR33 2 TRAILING ONES
0363*
0364*   DEFINES STARTING ADDRESS OF DATA USING DELAYED READS
0365*
0366  00550 002163  DBKK DEF DTBN+46
0367  00551 000000  DCDC OCT 0           COUNT OF DELAY BETWEEN CHS
0368  00552 000000  DCTC OCT 0           TIME COUNT FROM READ TO DATA
0369  00553 177773  DE05 OCT 177773      -5
0370  00554 177770  DE08 OCT 177770      -8
0371  00555 177765  DE11 OCT 177765      -11
0372  00556 177761  DE17 OCT 177761      -15
0373  00557 177760  DE18 OCT 177760      -16
0374  00560 177744  DE34 OCT 177744      -28 (34 OCTAL)
0375  00561 177712  DE66  OCT 177712     -54
0376  00562 177711  DE65 OCT 177711      - 55
0377  00563 177776  DEL2 OCT 177776      -2
0378  00564 177775  DEL3 OCT 177775      -3
0379  00565 177774  DEL4 OCT 177774      -4
0380  00566 177771  DEL7 OCT 177771      -7
0381  00567 000000  DELC OCT 0           DELAY COUNT BETWEEN CHS
0382  00570 120240  DFBK OCT 120240      2 BLANKS
0383  00571 120000  DHBK OCT 120000      MS CH 2 BLANK
0384  00572 012640  DINTC OCT 012640     COUNT FOR 33MS DELYA ON FUNCT IN
0385  00573 000000  DIXC OCT 0           STORAGE FOR DELAY CUNT
0386  00574 000000  DIXI OCT 0           INDEX FOR DELAY COUNT
0387  00575 000000  DK03 OCT 0           WORKING STORAGE
0388  00576 000000  DK04 OCT 0
0389  00577 000000  DK05 OCT 0
0390  00600 000000  DK06 OCT 0
0391  00601 000000  DK07 OCT 0
0392  00602 000000  DK08 OCT 0
0393  00603 000000  DK09 OCT 0
0394  00604 000515  DLDC DEF PUN8        SINGLE WORD PRINT WORD LOCATION
0395  00605 000000  DLDR OCT 000000      LEADER CH
0396  00606 000010  DSFC OCT 000010      SLIP FACTOR (TIME BETWEEN READS)
0397  00607 000000  DTBC OCT 0           DATA TEST SEQUENCE #
0398  00610 000000  DTCC OCT 0           CH # IN DATA BLK
0399  00611 000000  DWK1 OCT 0           WORKING STORAGE
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0400  00612 000000  DWK2 OCT 0
0401  00613 000000  DWK3 OCT 0
0402  00614 000000  DWK4 OCT 0
0403  00615 000000  DWK5 OCT 0
0404  00616 000000  DWK6 OCT 0
0405  00617 000000  DWK7 OCT 0
0406  00620 000000  DWK8 OCT 0
0407  00621 000000  DWK9 OCT 0
0408  00622 000000  ERWD OCT 0          ERROR CH
0409  00623 002175  FM01A DEF FM01      ORG SYS FLG ON PRESET
0410  00624 002213  FM02A DEF FM02      ORG READER FLG ON PRESET
0411  00625 002231  FM03A DEF FM03      ORG CLF ERROR
0412  00626 002253  FM04A DEF FM04      ORG STF ERROR
0413  00627 002275  FM05A DEF FM05      ORG PRESET INTERRUPT
0414  00630 002317  FM06A DEF FM06      ORG NO NORMAL INTERRUPT
0415  00631 002335  FM07A DEF FM07      ORG FUNCTIONAL TEST COMPLETED
0416  00632 000000  FRWD OCT 0          ERROR WORD TO BE ANALYZED
0417  00633 000000  INTF  OCT 0         INTERRUPT FLAG (0 = NO INTERRUPT
0418  00634 003461  LASTD DEF LASTC     DEFINES LAST TEST CH ADDRESS.
0419  00635 000000  OCTL OCT 0          CONTAINS TIME COUNT WORD FOR TYP
0420  00636 000000  SWCH OCT 0          CH BUFFER FOR SW SELECTED CH
0421  00637 177746  N026 OCT 177746     -26
0422  00640 000536  CHIX DEF SWCH       DEFINES ORIGIN OF SINGLE SW CH B
0423  00641 177734  PCH0 OCT 177734     -36
0424  00642 000000  CHEC OCT 0          CHARACTER ERROR COUNT(3 CONSECUT
0425  00643 000000  RESF OCT 0          RESYNC FLAG
0426  00644 000000  HEAD OCT 0          CONTAINS ADDRESS OF LOOK-AHEAD C
0427  00645 000000  REAR OCT 0          CONTAINS ADDRESS OF LAST CH READ
0428  00646 000567  RESD DEF RESY       STARTING ADDRESS OF RESYNC MESSA
0429  00647 002353  TERM0 DEF TERMM     TERMINATE MESSAGE ORIGIN
0430*  BIT ERROR MESSAE
0431  00650 141311  BTER OCT 141311     B  I
0432  00651 152240       OCT 152240     T BLK
0433  00652 142722       OCT 142722     E  R
0434  00653 151317       OCT 151317     R  O
0435  00654 151240       OCT 151240     R
0436*  REREAD ERROR MESSAGE
0437  00655 151305  RERD OCT 151305     R E
0438  00656 151305       OCT 151305     R E
0439  00657 140704       OCT 140704     A D
0440  00660 120303       OCT 120303       C
0441  00661 144240       OCT 144240     H
0442*  MISSED CH ERROR MESSAGE
0443  00662 146711  MSCH  OCT 146711    M I
0444  00663 151723       OCT 151723     S S
0445  00664 142704       OCT 142704     E D
0446  00665 120303       OCT 120303       C
0447  00666 144240       OCT 144240     H
0448*
0449* RESYNC MESSA3E
0450*
0451  00667 106512  RESY  OCT 106612    CR LF
0452  00670 105322       OCT 105322     LF  R
0453  00671 142723       OCT 142723      E  S
0454  00672 154716       OCT 154716      Y  N
0455  00673 141515       OCT 141615      C CR
0456  00674 105240       OCT 105240     LF BLK
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0457  00675 000550  DBKM DEF DBKK       DEFINES START OF DELAYED READS
0458  00676 000003  B103 OCT 3
0459  00677 177714  DE64 OCT 177714     -52
0460  00700 000703  PCT1 DEF PRT1
0461  00701 000705  PCT2 DEF PRT2
0462  00702 000713  PCT3 DEF PRT3
0463*
0464*  THIS IS THE DATA ERROR TYPE OUT TABLE.  IF THIS S A CHARACTER
0465*   LOOP TEST ONLY THE DATA THROUGH PRT4 IS TYPED.
0466*
0467  00703 106612  PRT1 OCT 106612     CR,LF
0468  00704 143540       OCT 143640     G BLK, THE NEXT 4 WDS ARE FOR GO
0469  00705 000000  PRT2 OCT 0
0470  00706 000000       OCT 0
0471  00707 000000       OCT 0
0472  00710 000000       OCT 0
0473  00711 105512       OCT 106612
0474  00712 141240       OCT 141240     B BLK, START OF BAD DATA
0475  00713 000000  PRT3 OCT 0
0476  00714 000000       OCT 0
0477  00715 000000       OCT 0
0478  00716 000000       OCT 0
0479  00717 120240       OCT 120240     2 BLANKS FOLLOWING BAD DATA
0480  00720 000000  PRT4 OCT 0
0481  00721 120240       OCT 120240     2 BLKS FOLLOWING BLK #
0482  00722 000000  PRT5 OCT 0
0483  00723 120240       OCT 120240     2 BLKS FOLLOWING CH #
0484  00724 000000  PRT6 OCT 0
0485  00725 000000       OCT 0
0486  00726 120240       OCT 120240     2 BLKS FOLLOWING DELAY DATA
0487  00727 000000  PRT7 OCT 0          1ST ERROR WD
0488  00730 000000       OCT 0          2ND ERROR WD
0489  00731 000000       OCT 0          3RD ERROR WD
0490  00732 000000       OCT 0          4TH ERROR WD
0491  00733 000000       OCT 0          5TH ERROR ED
0492  00734 105512       OCT 106612     CR LF
0493  00735 000736  MSKI DEF MSK1       START ADDRESS OF MASK TABLE
0494  00736 000200  MSK1 OCT 000200     MASK TABLE FOR 1 BIT MASK ON CH
0495  00737 000100       OCT 00100
0496  00740 000040       OCT 000040
0497  00741 000020       OCT 000020
0498  00742 000010       OCT 000010
0499  00743 000004       OCT 000004
0500  00744 000002       OCT 000002
0501  00745 000001       OCT 000001
0502  00746 000000  REPU  OCT 0          CONTAINS READ OR PUNCH OPTION (1
0503  00747 000000  CHLU  OCT 0          CONTAINS SPECIA CH OPTION  (1=CH
0504  00750 024751  BAKE  JMP MA00      GO TO PROGRAM START.
0505*
0506*  START OF READER MAIN LINE.
0507*
0508  00751 102501  MA00 LIA 01        LOAD SW REG.
0509  00752 010745       AND MSK1+7     MASK FOR BIT ZERO (READ/PUNCH).
0510  00753 070746       STA REPU       STORE IN OPTION TABLE.
0511  00754 102501       LIA 01
0512  00755 010532       AND SEL2       MASK FOR BIT 3 (CH LOOP).
0513  00756 070747       STA CHLU       STORE IN OPTION TABLE.
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0514  00757 102501          LIA 01
0515  00760 010736          AND MSK1        MASK FOR INTERRUPT OPTION
0516  00761 070533          STA INTF        SET FLAG AS INDICATED BY THE SWI
0517  00762 102501          LIA 01          LOAD SW REGISTER
0518  00763 001700          ALF             RIGHT JUSTIFY MS CH OF SW REG
0519  00764 001700          ALF
0520  00765 010476          AND MSMK        MASK OFF LS CH OF SW REG.
0521  00766 070536          STA SWCH        STORE SELECTED CH IN CH BUFFER
0522  00767 024770          JMP M000
0523  00770 050565  M000    LDA DEL4        SET UP 4 PASS INDEX.
0524  00771 070512          STA DWK2
0525  00772 051155          LDA JMP1        SET UP ORIGINAL DELAY OF 3 MS ON
0526  00773 071154          STA M060
0527  00774 060746          LDA REPU        LOAD READ/PUNCH OPTION.
0528  00775 002002          SZA             WAS THE PUNCH SELECTED? (SW 1)
0529  00776 025000          JMP *+2         YES
0530  00777 025051          JMP M010        NO
0531  01000 050564          LDA DEL3        SET THE BLK COUNT
0532  01001 070515          STA DWK5
0533  01002 015034          JSR LDPN        PUNCH LEADER CHS
0534  01003 060747          LDA CHLU        LOAD CH LOOP OPTION.
0535  01004 002002          SZA             IS THE CH LOOP SELECTED? (SW 2)
0536  01005 025356          JMP CHP0        YES, GO PUNCH A TAPE
0537  01006 060537  M00A    LDA D0001       SET THE PUNCH FLAG
0538  01007 070516          STA PUNF
0539  01010 060552          LDA DE65        LOAD CH COUNT (-55) FOR CH OUTPU
0540  01011 070521          STA DWK9
0541  01012 060457          LDA DITC        LOAD THE ADDRESS INDEX
0542  01013 070520          STA DWK8
0543  01014 015511          JSB EP00        PUNCH THE DATA BLOCK
0544  01015 015034          JSR LDPN
0545  01016 034515          ISZ DWK5
0546  01017 025005          JMP M00A
0547  01020 002400          CLA
0548  01021 070516          STA PUNF
0549  01022 025032          JMP MHLT        NORMAL PUNCHING, DON'T TYPE TERM
0550*
0551*  TYPE TERMINATE MESSAGE
0552*
0553*  THERE WILL BE 20 ZERO CHS TYPED BEFORE THE TERMINATE
0554*  MESSAGE TO SPACE PAST THE SPECIAL CH DATA.  NO TERMINATE
0555*  IS TYPED FOR NORMAL DATA PUNCHING.  ONLY A HALT.
0556*
0557  01023 002400  M00C  CLA             CLEAR THE PUNCH FLAG SO THE COMP
0558  01024 070516        STA PUNF        MESSAGE WILL BE TYPED
0559  01025 060541        LDA PCH0        LOAD # CHS IN MESSAGE.
0560  01026 070521        STA DWK9
0561  01027 060547        LDA TERM0
0562  01030 070520        STA DWK8
0563  01031 015511        JSB EP00
0564  01032 102700  MHLT  HLT
0565  01033 024751        JMP MA00        GO TO PROGRAM RESTART.
0566*
0567*  THIS ROUTINE PUNCHES 15 LEADER CHARACTERS.
0568*
0569  01034 000000  LDPN  NOP
0570  01035 060556        LDA DE17        SET UP LEADER INDEX (-15)
```

```
0571   01036 070516          STA DWK6
0572   01037 060605  M00B LDA DLDR        LOAD 1 WD PUNCH DATA (LEADER CH)
0573   01040 070515          STA PUNB
0574   01041 060537          LDA D001      SET UP # LEADER CH'S (1)
0575   01042 070521          STA DWK9
0576   01043 060504          LDA DLDC      LOAD STARTING ADDRESS OF LEADER
0577   01044 070520          STA DWK8
0578   01045 015511          JSB EP00      PUNCH LEADER CH
0579   01046 034616          ISZ DWK6      IS THIS THE 15TH LEADER CH?
0580   01047 025037           JMP M00B     NOT 15TH LEADER CH, PUNCH ANOTHE
0581   01050 125034           JMP LDPN,I   15TH CH, EXIT THE ROUTINE.
0582   01051 000000  M010  NOP
0583   01052 002400          CLA           CLEAR PUNCH ONLY FLAG
0584   01053 070516          STA PUNF
0585   01054 060747           LDA CHLU     LOAD CH LOOP OPTION.
0586   01055 002002          SZA           IS THE CH LOOP SELECTED? (SW 2)
0587   01056 025400          JMP CHR0      YES, GO READ A TAPE
0588   01057 015772           JSB SY00        RESYNC TO LEADER
0589   01060 060455           LDA TCIC      SET UP INPUT IX TO ORIGIN
0590   01061 070466           STA TCIX
0591   01062 060537  M01A LDA D001        SET UP FOR NO DELAY BETWEEN READ
0592   01063 070557          STA DELC
0593   01064 060466          LDA TCIX      SAVE THE INPUT INDEX
0594   01065 070503          STA DK09
0595   01066 015303          JSB TR1D      READ 1 CH
0596   01067 060515          LDA PUNB      LOAD THE INPUT CH
0597   01070 050505          CPA DLDR      IS THIS LEADER
0598   01071 025075          JMP M01B       LEADER, CONT LOOP
0599   01072 060564          LDA DEL3      SET UP 3 CH LOOP
0600   01073 070511          STA DWK1
0601   01074 025100          JMP M020      START DATA INPUT
0602   01075 060503  M01B LDA DK09        RESTORE THE INPUT INDEX
0603   01076 070466          STA TCIX
0604   01077 025062          JMP M01A      READ NEXT CH FOR LEADER TEST
0605   01100 060546  M020 LDA D010        SET UP 10 MS DPLAY AFTER EACH RE
0606   01101 070567          STA DELC
0607   01102 015303          JSB TR1D      READ 1 CH
0608   01103 034511          ISZ DWK1      IS THIS THE 3RD CH?
0609   01104 025100          JMP M020      NO
0610   01105 060566          LDA DEL7      SET UP 7 CH INDEX
0611   01106 070511          STA DWK1
0612   01107 060537  M030 LDA D001        SET UP NO DELAY
0613   01110 070557          STA DELC
0614   01111 015303          JSB TR1D      READ A CH
0615   01112 034511          ISZ DWK1      IS THIS THE 7TH CH
0616   01113 025107          JMP M030      NO
0617   01114 060546          LDA D010      SET UP 10 MS  ELAY (STOP)
0618   01115 070567          STA DELC
0619   01116 015303          JSB TR1D      READ 8TH CH
0620   01117 060546          LDA D010      SET UP 10 MS DELAY (STOP)
0621   01120 070567          STA DELC
0622   01121 015303          JSB TR1D      READ A CHARACTER
0623   01122 060556          LDA DE17      SET UP TO READ 15 CH'S
0624   01123 070511          STA DWK1
0625   01124 060537          LDA D001      SET NO DELAY
0626   01125 070567          STA DELC
0627   01126 015355           JSB TR4D     READ FOUR CHARACTERS
```

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0628  01127 015303  M040  JSB  TR1D      READ 1 CH
0629  01130 034611        ISZ  DWK1      15TH CH?
0630  01131 025127        JMP  M040      NO
0631  01132 060546        LDA  D010      SET UP 10MS DELAY (STOP)
0632  01133 070567        STA  DELC
0633  01134 015303        JSB  TR1D      READ 1 CH
0634  01135 015303        JSB  TR1D      READ NEXT CH AND STOP
0635  01136 060563        LDA  DEL2      SET UP FOR 2 PASS COUNT
0636  01137 070611        STA  DWK1
0637  01140 060537  M050  LDA  D001      SET UP NO DELAY
0638  01141 070567        STA  DELC
0639  01142 015355         JSB TR4D      READ FOUR CHARACTERS
0640  01143 060546        LDA  D010      SET UP STOP DELAY (10 MS)
0641  01144 070567        STA  DELC
0642  01145 015303        JSB  TR1D      READ A CH.
0643  01146 034511        ISZ  DWK1      IS THIS THE 2ND PAST?
0644  01147 025140        JMP  M050      NO
0645  01150 015303        JSB  TR1D      READ A SINGLE CH AND STOP
0646  01151 015303        JSB  TR1D      READ A SINGLE CH AND STOP
0647  01152 060564        LDA  DEL3      SET UP FOR 3, 3CH BLKS
0648  01153 070614        STA  DWK4
0649  01154 000000  M060  NOP
0650  01155 025161  JMP1  JMP  M061
0651  01156 025166  JMP2  JMP  M062
0652  01157 025173  JMP3  JMP  M063
0653  01160 025200  JMP4  JMP  M064
0654  01161 060540  M061  LDA  D003      SET UP .5MS DELAY
0655  01162 070613        STA  DWK3
0656  01163 061156        LDA  JMP2      SET UP FOR 2ND PASS
0657  01164 071154        STA  M060
0658  01165 025204        JMP  M070
0659  01166 060541  M062  LDA  D004      SET UP .75 MS DELAY
0660  01167 070613        STA  DWK3
0661  01170 061157        LDA  JMP3      SET UP FOR 3RD PASS
0662  01171 071154        STA  M060
0663  01172 025204        JMP  M070
0664  01173 060542  M063  LDA  D005      ST UP 1.MS DELAY
0665  01174 070613        STA  DWK3
0666  01175 061160        LDA  JMP4      SET UP FOR 4TH PASS
0667  01176 071154        STA  M060
0668  01177 025204        JMP  M070
0669  01200 060543  M064  LDA  D006      SET UP 1.25MS DELAY
0670  01201 070513        STA  DWK3
0671  01202 061155        LDA  JMP1      SET UP FOR 1ST PASS
0672  01203 071154        STA  M060
0673  01204 060513  M070  LDA  DWK3      SET UP SELECTED DELAY
0674  01205 070567        STA  DELC
0675  01206 060563        LDA  DEL2      SET UP FOR 2 PASSES
0676  01207 070611        STA  DWK1
0677  01210 015303        JSB  TR1D      READ 1 CH
0678  01211 034611        ISZ  DWK1
0679  01212 025210        JMP  *-2       READNEXT CH
0680  01213 060546        LDA  D010      SET UP STOP DELAY
0681  01214 070567        STA  DELC
0682  01215 015303        JSB  TR1D      READ 3RD CH
0683  01216 034614        ISZ  DWK4      IS THIS THE 3RD3 CH BLK?
0684  01217 025204        JMP  M070      NO, PREPARE DELAYS FOR 2ND 3CH B
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0685  01220 034512        ISZ DWK2        IS THIS THE 4TH TAPE TEST?
0686  01221 025062        JMP M01A        NO, PREPARE FOR 2ND DATA GROUP T
0001*
0002*  THIS IS SOURCE TAPE 2 OF 2 FOR THE HIGH SPEED READER
0003*  TEST PROGRAM.
0004*
0005*
0006  01222 060465  E000  LDA TCIC        INITIALIZE DATA INPUT INDEX
0007  01223 070466        STA TCIX
0008  01224 002400         CLA
0009  01225 070642         STA CHEC       CLEAR CH ERROR COUNTER
0010  01226 070643         STA RESF       CLEAR RESYNC FLAG
0011  01227 060511        LDA ASCC        LOAD ASCII CONSTANT
0012  01230 070613        STA DWK3
0013  01231 060565        LDA DEL4        SET BLOCK COUNT IX
0014  01232 070512        STA DWK2
0015  01233 060467  E00A LDA DITC        INITIALIZE TEST TABLE IX
0016  01234 070470        STA DITX
0017  01235 060534         LDA LASTD      LOAD LOOK BEHIND DDSESS GOR MAST
0018  01236 070545         STA REAR
0019  01237 060471        LDA DTBS        INITIALIZE BLK # IX
0020  01240 070472        STA DTBX
0021  01241 060473        LDA DTCS        INITIALIZE CH # IX
0022  01242 070474        STA DTCX
0023  01243 060552        LDA DE65        SET UP IX FOR CH ANALYSIS (-55)
0024  01244 070511        STA DWK1
0025  01245 160466  E010 LDA TCIX,I      LOAD READ IN CH
0026  01246 150470        CPA DITX,I      IS THIS THE CORRECT CH?
0027  01247 025252         JMP E01A       YES ITS OK, GO TOM NEXT CH
0028  01250 015563         JSB LK00       DO LOOK- AROUND AND ERROR PRINT
0029  01251 025254         JMP E01B
0030  01252 002400  E01A   CLA
0031  01253 070542         STA CHEC       CLEAR ERROR COUNT
0032  01254 034511  E01B   ISZ DWK1       IS TIS THE LAST CH?
0033  01255 025257        JMP *+2         NO
0034  01256 025267        JMP E030        YES
0035  01257 060470         LDA DITX       SAVE THIS CH ADDRESS FOR REFERE
0036  01260 070545         STA REAR       REREAD TEST.
0037  01261 034466         ISZ TCIX       INCREMENT DATA INPUT BUFFER INDE
0038  01262 034470        ISZ DITX        INCREMENT TEST INDEX
0039  01263 034472        ISZ DTBX        INCREMENT BLK # INDEX
0040  01264 034474        ISZ DTCX        INCREMENT CH # INDEX
0041  01265 025245        JMP E010        GO TEST NEXT CH
0042  01266 025245        JMP E010
0043  01267 034512  E030 ISZ DWK2         IS THIS THE 4TH BLOCK TEST?
0044  01270 025272        JMP *+2         CONTINUE ERROR ANALYSIS
0045  01271 025301         JMP E040       TEST COMPLETED, PERFORM SW ANAL
0046  01272 060613        LDA DWK3
0047  01273 002004         INA            INCREMENT DELAY INDEX BY 2 TO P
0048  01274 002004         INA            UP NEXT 2 WD DELAY DATA.
0049  01275 070613        STA DWK3
0050  01276 034466        ISZ TCIX        INCREMENT INPUT TEST TABLE IX
0051  01277 025233        JMP E00A
0052  01300 025233        JMP E00A
0053  01301 015430  E040   JSB SWA0       SWITCH ANALYSIS (PAUSE-TERMINATE
0054  01302 024770         JMP M000       NO TERMINATE, CONTINUE READER TE
0055  01303 000000  TR1D NOP
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0056  01304 102501          LIA 01          LOAD SW REGISTER
0057  01305 010531          AND SEL1        MASK FOR READ-NO-STOP
0058  01306 002002          SZA             IS THIS A STRAIGHT READ?
0059  01307 025311          JMP *+2         YES, DONT STOP ON CH
0060  01310 025313          JMP *+3         NO, STOP AS DIRECTED BY MAIN LI
0061  01311 060537          LDA D001        SET TO NOT STOP ON CH.
0062  01312 070567          STA DELC
0063  01313 060567        LDA DELC        LOAD DELAY FACTOR
0064  01314 070574        STA DIX1
0065  01315 103700  TR1DA STC 00R,C      SET CONTROL TO READ HSTR
0066  01316 060633          LDA INTF
0067  01317 002002          SZA             IS THIS AN INTERRUPT READ?
0068  01320 025322          JMP *+2         YES
0069  01321 025330          JMP *+7         NO, CONTINUE PROCESSING
0070  01322 050345          LDA RINTA       SET INTERRUPT RETURN ADDRESS
0071  01323 170354          STA REDA,I
0072  01324 064537          LDB D001        SET B TO -1 TO INDICATE INTERRUP
0073  01325 102100          STF 0
0074  01326 000000          NOP
0075  01327 025326          JMP *-1         LOOP WAITING FOR INTERRUPT
0076  01330 061023          LDA M00C        PUT A HALT IN THE READER INTERRU
0077  01331 170364          STA REDA,I
0078  01332 102300  T1X1    SFS 00R         IS A CH AVAILABLE ?
0079  01333 025332          JMP *-1          DATA IS NOT AVAILABLE, LOOP ON
0080  01334 002400  T1X2 CLA
0081  01335 102500  T1X2A LIA 00R          LOAD INPUT CH FROM READER
0082  01336 170466        STA TCIX,I      STORE THE CH IN THE TEST TABLE
0083  01337 070515        STA PUNR
0084  01340 034574        ISZ DIX1        IS THERE MORE DELAY?
0085  01341 025340        JMP *-1
0086  01342 060747         LDA CHLU       LOAD H LOOP OPTION.
0087  01343 002002        SZA
0088  01344 125303        JMP TR1D,I        CH LOOP, DONT INCREMENT INPUT
0089  01345 050466        LDA TCIX
0090  01346 002004        INA             INCREMENT TEST CH INDEX
0091  01347 070466        STA TCIX
0092  01350 125303        JMP TR1D,I
0093*
0094*  THIS IS THE INTERRUPT RETURN FROM THE NORMAL TEST INTERRUPT.
0095*
0096  01351 000000  RINT  NOP
0097  01352 103100          CLF 0           TURN OFF SYSTEM INTERRUPT
0098  01353 006400          CLB             CLEAR TO INDICATE NO INTERRUPT L
0099  01354 025332          JMP T1X1        GO DO DATA PROCESSING.
0100*
0101*  THIS ROUTINE READS FOUR CHARACTERS, NO STOP.
0102*
0103  01355 000000  TR4D  NOP
0104  01356 050537          LDA D001        SET FOR NO READ DELAY.
0105  01357 070567          STA DELC
0106  01360 060565          LDA DEL4        SET TO READ 4 CHS.
0107  01361 070514          STA DWK4
0108  01362 015303  T4X1    JSB TR1D        READ 1 CH
0109  01363 034514          ISZ DWK4        WAS THIS THE 4TH CH?
0110  01364 025362          JMP T4X1        NO, READ ANOTHER CH.
0111  01365 125355          JMP TR4D,I      YES, EXIT THE ROUTINE.
0112*
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0113*  PUNCH SINGLE CH FROM DESIGNATED SW REG CH.
0114*
0115   01366 060537  CHP0 LDA D001
0116   01367 070516       STA PUNF        SET PUNCH FLAG
0117   01370 070521       STA DWK9        SET TO OUTPUT 1 CH
0118   01371 060536       LDA SWCH        LOAD OUTPUT CH
0119   01372 070515       STA PUNB
0120   01373 060504       LDA DLDC      LOAD OUTPUT DATA ORIGIN (PUNB)
0121   01374 070520       STA DWK8
0122   01375 015611       JSB EP00        PUNCH A CH
0123   01376 015430       JSB SWA0        ANALYZE SW REG FOR HANG AND TERM
0124   01377 025366       JMP CHP0
0125*
0126*  READ SINGLE CH FOR TEST AGAINST SW REG CH
0127*
0128   01400 060640  CHR0 LDA CHIX        SET SW CH ORIGIN TO SWCH (GOOD C
0129   01401 070470       STA DITX
0130   01402 060504       LDA DLDC        SET DATA INPUT ORIGIN TO PUNB (R
0131   01403 070466       STA TCIX
0132   01404 060546        LDA D010          SET TO STOP ON CH
0133   01405 070567        STA DELC
0134   01406 015303       JSB TR1D        READ A CH
0135   01407 060515       LDA PUNB
0136   01410 002002       SZA             IS THIS A LEADER CH?
0137   01411 025413       JMP *+2         NO
0138   01412 025400       JMP CHR0        YES
0139   01413 050536       CPA SWCH        IS THE CH CORRECT
0140   01414 025426       JMP CHR1        YS, GO ANALYZE THE SW REGISTER
0141   01415 102501       LIA 01          NO, LOAD SW REG
0142   01416 010536       AND SEL6        MASK FOR SW 6--ERROR TYPE OUT BY
0143   01417 002002       SZA             ERROR TYPE BYPASS?
0144   01420 025426        JMP CHR1       YES, GO ANALYZE SW REGISTER
0145   01421 060567       LDA DELC         BLANK OUT EXTRA ERROR INFORMATI
0146   01422 070720       STA PRT4
0147   01423 070722       STA PRT5
0148   01424 070724       STA PRT6
0149   01425 015442       JSB ER00        TYPE ERRR DATA
0150   01426 015430  CHR1 JSB SWA0        ANALZE SW FOR HANG AND TERMINATE
0151   01427 025400       JMP CHR0        READ NEXT CH.
0152*
0153*  THIS ROUTINE ANALYZES THE SW REGISTER FOR HANG AND TERMINATE
0154*
0155   01430 000000  SWA0 NOP
0156   01431 102501  SWA1 LIA 01          LOAD SW REG
0157   01432 010533       AND SEL3        MASK FOR HANG (SW 3)
0158   01433 002002       SZA             IS THIS A HANG?
0159   01434 025431       JMP SWA1        RETEST SW REG FOR CONTINUED HANG
0160   01435 102501        LIA 01
0161   01436 010534       AND SEL4
0162   01437 002002        SZA            IS THIS A TERMINATE?
0163   01440 025023       JMP M00C         YES, RESTART (HALT THEN RESTART
0164   01441 125430       JMP SWA0,I      NO, THEN DO NOT TERMINATE
0165   01442 000000  ER00 NOP
0166   01443 160470       LDA DITX,I      LOAD THE GOOD CH
0167   01444 070622       STA ERWD
0168   01445 060701       LDA PCT2        LOAD OUTPUT INDEX
0169   01446 070614       STA DWK4
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0170  01447 060563        LDA DEL2        SET 2 PASS INDEX
0171  01450 070515        STA DWK5
0172  01451 070616        STA DWK6
0173  01452 060735  ER01  LDA MSKI        SET UP MASK INDEX
0174  01453 070621        STA DWK9
0175  01454 060554        LDA DE08        SET 8 BIT INDEX
0176  01455 070617        STA DWK7
0177  01456 060622  ER02  LDA ERWD        LOAD CH TO BE PRINTED
0178  01457 110621        AND DWK9,I      MASK OFF ALL BUT DESIRED BIT
0179  01460 002002        SZA             IS THE BIT A 0
0180  01461 025464        JMP ER03        NO, THE BIT IS A 1
0181  01462 060477        LDA ASC0        LOAD AN ASCII ZER CH
0182  01463 025465        JMP *+2
0183  01464 060500  ER03  LDA ASC1        LOAD AN ASCII ONE CH
0184  01465 034616        ISZ DWK6        IS THIS THE 2ND CH OF OUTPUT WD?
0185  01466 025470        JMP *+2         NO
0186  01467 025501        JMP ER05
0187  01470 010476        AND MSMK        MASK OFF MS CH
0188  01471 001700        ALF             MOVE LS CH TO MS CH POSITION
0189  01472 001700        ALF
0190  01473 170614        STA DWK4,I      STORE THE MS HALF OF DATA IN PRT
0191  01474 025510        JMP ER07        GO TEST FOR 8TH BIT
0192  01475 060621  ER04  LDA DWK9
0193  01476 002004        INA             INCREMENT MASK INDEX FOR NEXT CH
0194  01477 070621        STA DWK9
0195  01500 025456        JMP ER02        ANALYZE NEXT CH.
0196  01501 130614  ER05  IOR DWK4,I      OR THE TWO CH'S TOGETHER
0197  01502 170614        STA DWK4,I      STORE WORD IN PRINT BUFFER
0198  01503 060563        LDA DEL2        RESTORE CH IX TO -2
0199  01504 070616        STA DWK6
0200  01505 060614        LDA DWK4
0201  01506 002004        INA             INCREMENT PRINT TABLE INDEX
0202  01507 070614        STA DWK4
0203  01510 034617  ER07  ISZ DWK7        IS THIS THE 8TH BIT OF THE CH?
0204  01511 025475        JMP ER04        NO
0205  01512 034515        ISZ DWK5        IS THIS THE 2ND WORD PASS
0206  01513 025515        JMP *+2         NO, PREPARE FOR 2ND PASS
0207  01514 025522        JMP ER06        YES, COMPLETE ERROR PRINT OUT OC
0208  01515 160466        LDA TCIX,I      LOAD THE ERROR CH
0209  01516 070522        STA ERWD
0210  01517 060702        LDA PCT3        LOAD ERROR LOCATION IN PRT TABLE
0211  01520 070614        STA DWK4
0212  01521 025452        JMP ER01
0213  01522 060700  ER06  LDA PCT1        LOAD PRINT TABLE STARTING ADDRES
0214  01523 070520        STA DWK8
0215*
0216*  THIS SECTION OF TE ROUTINE PUTS THE DELAY, CH #, AND CH
0217*  LOCATION IN THE PRINT LINE.
0218*
0219  01524 060747        LDA CHLU        LOAD CH LOP OPTION
0220  01525 002002        SZA              IS THIS A CH LOOP?
0221  01526 025504        JMP ER15         CH LOOP, MODIFY FOR SHORT ERROR
0222  01527 060677        LDA DE64         SET UP TO TYPE 52 CHARACTERS.
0223  01530 070621        STA DWK9
0224  01531 060472        LDA DTBX         LOAD TEST TABLE INDEXING ADDRES
0225  01532 003000        CMA             COMPLEMENT-
0226  01533 040550        ADA DBKK
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0227  01534 002020          SSA             IS THIS A DELAYED READ?
0228  01535 025541          JMP ER09        YES, THIS IS A DELAYED READ
0229  01536 025574          JMP ER13        NO, THIS IS A NORMAL READ
0230  01537 015611  ER08 JSB EP00           TYPE ERROR DATA
0231  01540 125442        JMP ER00,I       EXIT THE ROJTINE
0232  01541 060512  ER09  LDA DWK2         LOAD DELAY NDEX
0233  01542 050555          CPA DEL4        IS THIS THE 1ST PASS (DWK3 =-4)
0234  01543 025555          JMP ER10        YES
0235  01544 050564          CPA DEL3        NO, IS THIS THE 2ND PASS (DWK3=
0236  01545 025562          JMP ER11        YES
0237  01546 050563          CPA DEL2        NO, IS THIS THE 3RD PASS (DWK3=
0238  01547 025567          JMP ER12        YES
0239  01550 060507          LDA ASCA+6      NO, ASSUME 4TH PASS, LOAD 1.25
0240  01551 070724          STA PRT6
0241  01552 060510          LDA ASCA+7
0242  01553 070725          STA PRT6+1
0243  01554 025577          JMP ER14
0244  01555 060501  ER10 LDA ASCA          LOAD 0.50 MS DELAY FOR 1ST PASS.
0245  01556 070724          STA PRT6
0246  01557 060502          LDA ASCA+1
0247  01560 070725          STA PRT6+1
0248  01561 025577          JMP ER14
0249  01562 060503  ER11 LDA ASCA+2       LOAD 0.75 MS DELAY FOR AND PASS
0250  01563 070724          STA PRT6
0251  01564 060504          LDA ASCA+3
0252  01565 070725          STA PRT6+1
0253  01566 025577          JMP ER14
0254  01567 060505  ER12 LDA ASCA+4       LOAD 1.00 MS DELAY FOR 3RD PASS
0255  01570 070724          STA PRT6
0256  01571 060506          LDA ASCA+5
0257  01572 070725          STA PRT6+1
0258  01573 025577          JMP ER14
0259  01574 060570  ER13 LDA DFBK          SET BLANKS IN DELAY
0260  01575 070724          STA PRT6
0261  01576 070725          STA PRT6+1
0262  01577 160474  ER14 LDA DTCX,I        LOAD CH # FROM TABLE
0263  01600 070720          STA PRT4
0264  01601 160472          LDA DTBX,I      LOAD 1ST OR LAST FROM TABLE
0265  01602 070722          STA PRT5
0266  01603 025537          JMP ER08
0267  01604 060560  ER15 LDA DE34          LOAD # CHS FOR SHORT ERROR PRINT
0268  01605 070621          STA DWK9        ON CHARACTER LOOP OPTION. (28 C
0269  01606 060703          LDA PRT1        LOAD CR AND LF FOR SHORT PRINT.
0270  01607 070720          STA PRT4
0271  01610 025537          JMP ER08
0272  01611 000000  EP00 NOP
0273  01612 060516  EP0A LDA PUNF          LOAD THE PUNCH FLAG
0274  01613 002002          SZA             IS THIS A PUNCH OUTPUT
0275  01614 025620          JMP EP01        YES
0276  01615 002400          CLA             CLEAR LS FLAG
0277  01616 070530          STA IFLG
0278  01617 025625          JMP EP02
0279  01620 060563  EP01 LDA DEL2
0280  01621 070530          STA IFLG        SET FLAG INDICATING LS CH BEING
0281  01622 160620          LDA DWK8,I      LOAD THE WORD TO BE OUTPUT
0282  01623 010476          AND MSMK        MASK OFF MS CH
0283  01624 025631          JMP EP03        GO COMPLETE LS CH OUTPUT
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0284   01625 160520  EP02 LDA DWKA,I          LOAD DATA WD TO PREPARE MS
0285   01626 001700       ALF                 SHIFT MS TO LS CH
0286   01627 001700       ALF
0287   01630 014476       AND MSMK            MASK OFF OLD LS CH (CURRENT MS)
0288   01631 000000  EP03  NOP               LOCATION FOR SER/BUF JMP INST.
0289   01632 001000       ALS
0290   01633 040547       ADA DADD            ADD IN 2 TRAILING ONES
0291   01634 070517       STA DWK7
0292   01635 060555       LDA DE11            LOAD SHIFT IX (-11)
0293   01636 070577       STA DK05
0294   01637 060517       LDA DWK7            LOAD THE OUTPUT DATA CH
0295   01640 102700 EP03A STC 00B             SET ASR CONTROL
0296   01641 102300 EP04  SFS 00B             WAIT FOR I/O FLAG
0297   01642 025641       JMP EP04
0298   01643 103500 EP04A OTA 00B,C           OUTPUT THE BIT
0299   01644 001300       RAR                 MOVE NEXT BIT FOR OUTPUT
0300   01645 034577       ISZ DK05            IS THIS THE LAST BIT
0301   01646 025641       JMP EP04            NO, CONTINUE OUTPUT
0302   01647 106700 EP04B CLC 00B             CLEAR TTY CONTROL
0303   01650 034521       ISZ DWK9            IS THIS THE LAST CH FOR OUTPUT?
0304   01651 025653       JMP *+2
0305   01652 125511       JMP EP00,I          EXIT THE ROUTINE
0306   01653 060530       LDA IFLG
0307   01654 002002       SZA                 IS THIS THE MS CH
0308   01655 025657       JMP *+2             YES
0309   01656 025520       JMP EP01            MS CH JUST OUTPUT, NOW OUTPUT LS
0310   01657 050520       LDA DWK8
0311   01660 002004       INA                 INCREMENT DATA TABLE INDEX
0312   01661 070520       STA DWK8
0313   01662 025512       JMP EP0A
0314*  THIS ROUTINE PROVIDES DETAILED ERROR ANALYSIS.
0315*         LOOK-AHEAD
0316*         LOOK-BEHIND
0317*         SEQUENTIAL BIT ERRORS
0318*         RESYNC
0319*
0320   01663 000000  LK00 NOP
0321   01664 060470       LDA DITX            INCREMENT TEST TABLE IX FOR LOOK
0322   01665 002004       INA
0323   01666 070544       STA HEAD
0324   01667 060511       LDA DWK1
0325   01670 050537       CPA D001            IS THIS THE LAST CH OF BLOCK?
0326   01671 025675       JMP LK01            YES THIS IS THE LAST DATA CH, LO
0327   01672 160544       LDA HEAD,I          NOT LAST CH, LOOK AHEAD AND BEHI
0328   01673 150466       CPA TCIX,I          IS THIS THE SAME AS THE NEXT CH?
0329   01674 025715       JMP LK04            YES, ASSUME A CH WAS SKIPPED.
0330   01675 160545  LK01  LDA REAR,I         PREPARE TO LOOK BEHIND.
0331   01676 150466       CPA TCIX,I          IS THIS THE SAME AS THE LAST CH?
0332   01677 025730       JMP LK05            YES, ASSUME A RE-READ.
0333   01700 025701       JMP LK03            ASSUME BIT ERROR ONLY.
0334*
0335*  THIS SECTION LOADS THE "BIT ERROR" FOR ERROR TYPE
0336*
0337   01701 060550  LK03 LDA BTER            LOAD THE BIT ERROR MESSAGE TO PR
0338   01702 070727       STA PRT7
0339   01703 060651       LDA BTER+1
0340   01704 070730       STA PRT7+1
```

```
0341  01705 060652          LDA BTER+2
0342  01706 070731          STA PRT7+2
0343  01707 060653          LDA BTER+3
0344  01710 070732          STA PRT7+3
0345  01711 060654          LDA BTER+4
0346  01712 070733          STA PRT7+4
0347  01713 034642          ISZ CHEC          INCREMENT BIT ERROR COUNT
0348  01714 025745          JMP LK07          GO TYPE ERROR MESSAGE
0349  01715 060562  LK04 LDA MSCH            LOAD "MISSED CH" ERROR MESSAGE
0350  01716 070727          STA PRT7
0351  01717 060563          LDA MSCH+1
0352  01720 070730          STA PRT7+1
0353  01721 060564          LDA MSCH+2
0354  01722 070731          STA PRT7+2
0355  01723 060565          LDA MSCH+3
0356  01724 070732          STA PRT7+3
0357  01725 060666          LDA MSCH+4
0358  01726 070733          STA PRT7+4
0359  01727 025742          JMP LK06
0360  01730 060555  LK05 LDA RERD
0361  01731 070727          STA PRT7
0362  01732 060656          LDA RERD+1
0363  01733 070730          STA PRT7+1
0364  01734 060657          LDA RERD+2
0365  01735 070731          STA PRT7+2
0366  01736 060660          LDA RERD+3
0367  01737 070732          STA PRT7+3
0368  01740 060561          LDA RERD+4
0369  01741 070733          STA PRT7+4
0370  01742 060537  LK06 LDA D001          SET RESYNC FLAG
0371  01743 070643          STA RESF
0372  01744 025745          JMP LK07          GO TYPE ERROR MESSAGE
0373  01745 015442  LK07 JSB ER00          GO ANALYZE THE ERROR DATA FOR PR
0374  01746 060542          LDA CHEC
0375  01747 050576          CPA B103          IS THIS THE 3RD CONSECUTIVE CHA
0376  01750 025754          JMP LK08          YES, 3RD CONSECUTIVE CH ERROR.
0377  01751 060543          LDA RESF
0378  01752 050505         CPA DLDR          IS THE RESYNC FLAG ON (DLDR IS A
0379  01753 125563          JMP LK00,I         RESYNC IS OFF, EXIT THE ROUTINE
0380  01754 060546  LK08 LDA RESD          LOAD STARTING ADDRESS OF RESYNC
0381  01755 070520          STA DWK8
0382  01756 060555          LDA DE11          LOAD # CH'S IN RESYNC MESSAGE.
0383  01757 070521          STA DWK9
0384  01760 002400          CLA
0385  01761 070516          STA PUNF          CLEAR PUNCH FLAG TO OUTPUT COMP
0386  01762 070643          STA RESF          CLEAR RESYNC FLAG.
0387  01763 015511          JSB EP00          TYPE RESYNC MESSAGE.
0388*
0389*  THIS PORTION OF THE ROUTINE  CHECKS FOR HANG ON ERROR-RESYNC
0390*  SW 5 ON = HANG ON ERROR, CLEAR TO CONTINUE
0391*
0392  01764 102501          LIA 01          LOAD SW REGISTER
0393  01765 010535          AND SEL5        MASK FOR SW 5 (BIT 6)
0394  01766 002002          SZA             IS THE SW ON ?
0395  01767 025764          JMP *-3         YES, LOOP
0396  01770 015430          JSB SWA0         SWITCH ANALYSIS
0397  01771 024770          JMP M000         RESTART THE PROGRAM (RESYNC)
```

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0398*
0399*  THIS ROUTINE SYNCS TO LEADER, TEST FOR 3 LEADER CH5.
0400*
0401   01772 000000  SY00 NOP
0402   01773 060546  SY01 LDA D010        SET DELAY TO STOP ON CH
0403   01774 070567        STA DELC
0404   01775 015303        JSB TR1D       READ A CHARACTER
0405   01776 015430        JSB SWA0       SWITCH ANALYSIS (PAUSE=TERMINATE
0406   01777 060465        LDA TCIC        RESTORE INPUT ORIGIN INDEX
0407   02000 070466        STA TCIX
0408   02001 060515        LDA PUNB
0409   02002 002002        SZA             IS THIS A LEADER CH?
0410   02003 025773        JMP SY01        NO, READ ANOTHER CH
0411   02004 015303        JSB TR1D        YES
0412   02005 060515        LDA PUNB
0413   02006 002002        SZA             IS THIS THE 2ND CONSECUTIVE LEA
0414   02007 025773        JMP SY01       NO, RESTART SYNC OPERATION
0415   02010 015303        JSB TR1D        YES, READ NEXT CH
0416   02011 060515        LDA PUNB
0417   02012 002002        SZA             IS THIS THE 3RD CONSECUTIVE LEA
0418   02013 025773        JMP SY01        NO, RESTART SYNC OPERATION
0419   02014 125772        JMP SY00,I      3 CONSECUTIVE LEADER CHS. RESYN
0420*
0421*  THIS TABLE CONTAINS THE CHARACTER SEQUENCE #'S FOR
0422*  EACH TAPE BLOCK. THESE #'S RUN FROM 1 THRU 55.
0423*
0424   02015 020061  DTCN  ASC 20, 1 2 3 4 5 6 7 8 9101112131415161718192
       02016 020062
       02017 020063
       02020 020064
       02021 020065
       02022 020066
       02023 020067
       02024 020070
       02025 020071
       02026 030460
       02027 030461
       02030 030462
       02031 030463
       02032 030464
       02033 030465
       02034 030466
       02035 030467
       02036 030470
       02037 030471
       02040 031060
0425   02041 031061        ASC 20,21222324252627282930313233343536373839 4
       02042 031062
       02043 031063
       02044 031064
       02045 031065
       02046 031066
       02047 031067
       02050 031070
       02051 031071
       02052 031460
       02053 031461
```

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      02054 031462
      02055 031463
      02056 031464
      02057 031465
      02060 031466
      02061 031467
      02062 031470
      02063 031471
      02064 032060
0426  02065 032061          ASC 16,41424344454647484950515253545500
      02066 032062
      02067 032063
      02070 032064
      02071 032065
      02072 032066
      02073 032067
      02074 032070
      02075 032071
      02076 032460
      02077 032461
      02100 032462
      02101 032463
      02102 032464
      02103 032465
      02104 030060
0427*
0428*  THIS TABLE CONTAINS THE 1ST AND LAST CH DESIGNATION
0429*  FOR EACH TEST DATA BLOCK.
0430*
0431  02105 051503  DTBN  ASC 20,SCSCSCSCFC02030405060LCSCFC02030405060
      02106 051503
      02107 051503
      02110 051503
      02111 043103
      02112 030062
      02113 030063
      02114 030064
      02115 030065
      02116 030066
      02117 030067
      02120 046103
      02121 051503
      02122 043103
      02123 030062
      02124 030063
      02125 030064
      02126 030065
      02127 030066
      02130 030067
0432  02131 030070          ASC 20,08091011121314151617181 9LCSCFC020304LCF
      02132 030071
      02133 030460
      02134 030461
      02135 030462
      02136 030463
      02137 030464
      02140 030465
```

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        02141 030466
        02142 030467
        02143 030470
        02144 030471
        02145 046103
        02146 051503
        02147 043103
        02150 030062
        02151 030063
        02152 030064
        02153 046103
        02154 043103
0433    02155 030062          ASC 16,020304LCSCSCFC02LCFC02LCFC02LC00
        02156 030063
        02157 030064
        02160 046103
        02161 051503
        02162 051503
        02163 043103
        02164 030062
        02165 046103
        02166 043103
        02167 030062
        02170 046103
        02171 043103
        02172 030062
        02173 046103
        02174 030060
0434*
0435*     SYSTEM FLAG ERROR ON PRESET
0436*
0437    02175 106512  FM01  OCT 106612
0438    02176 051531        ASC 12,SYSTEM FLAG ON - PRESET
        02177 051524
        02200 042515
        02201 020106
        02202 046101
        02203 043440
        02204 047516
        02205 020055
        02206 020120
        02207 051105
        02210 051505
        02211 052040
0439    02212 106612        OCT 106612
0440*
0441*     READER FLAG ERROR ON PRESET
0442*
0443    02213 106512  FM02  OCT 106612
0444    02214 051105        ASC 12,READER FLAG OFF - PRESET
        02215 040504
        02216 042522
        02217 020106
        02220 046101
        02221 043440
        02222 047506
        02223 043040
```
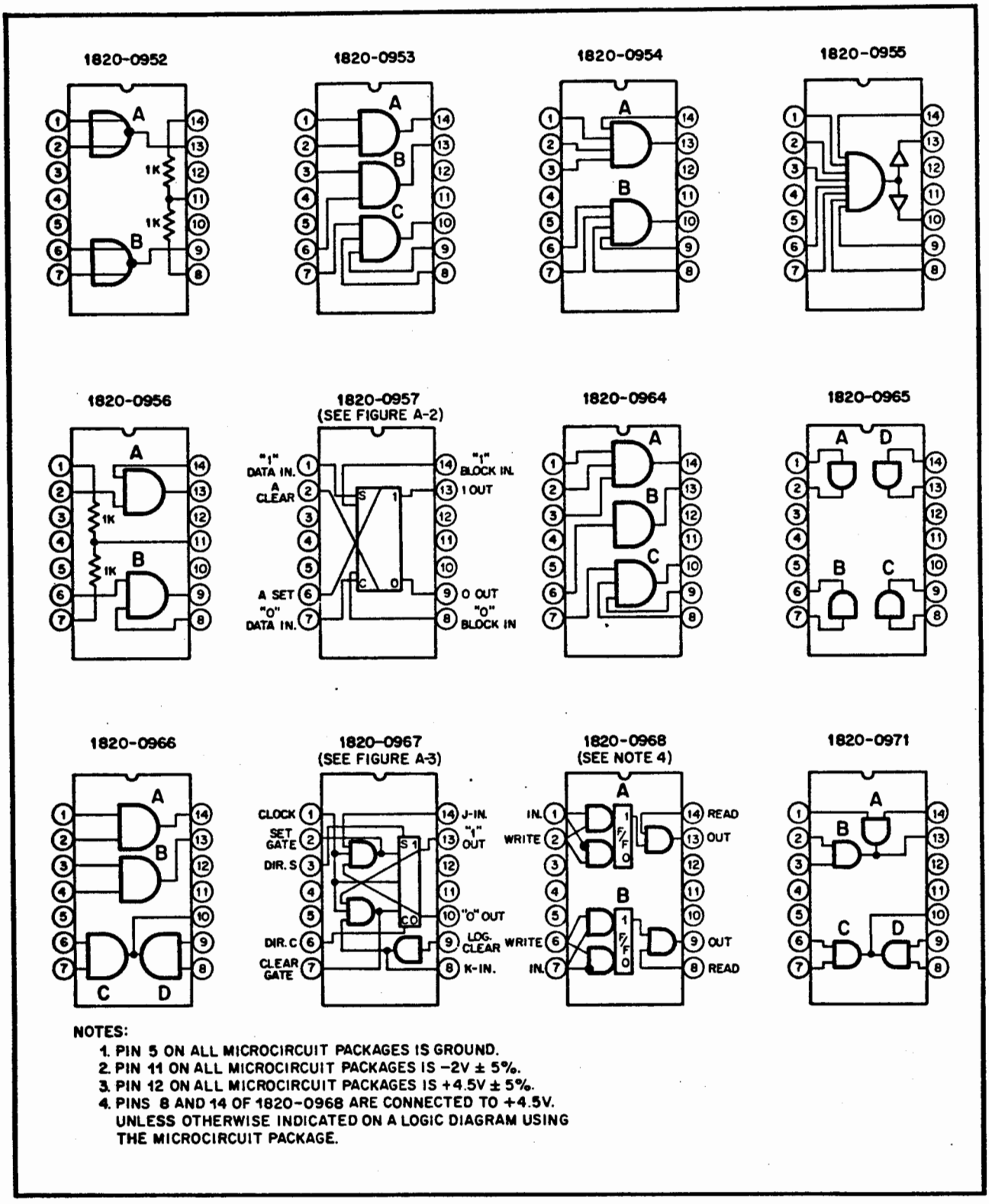

```
      02224 026440
      02225 050122
      02226 042523
      02227 042524
0445  02230 106612          OCT 106612
0446*
0447*   READER CLF ERROR
0448*
0449  02231 106612  FM03    OCT 106612
0450  02232 051105          ASC 16,READER CLF ERROR (CLF OR SFC)
      02233 040504
      02234 042522
      02235 020103
      02236 046106
      02237 020105
      02240 051122
      02241 047522
      02242 020050
      02243 041514
      02244 043040
      02245 047522
      02246 020123
      02247 043103
      02250 024440
      02251 020040
0451  02252 106612          OCT 106612
0452*
0453*   READER STF ERROR
0454*
0455  02253 106612  FM04    OCT 106612
0456  02254 051105          ASC 16,READER STF ERROR (STF OR SFS)
      02255 040504
      02256 042522
      02257 020123
      02260 052106
      02261 020105
      02262 051122
      02263 047522
      02264 020050
      02265 051524
      02266 043040
      02267 047522
      02270 020123
      02271 043123
      02272 024440
      02273 020040
0457  02274 106612          OCT 106612
0458*
0459*   PRESET INTERRUPT ERROR
0460*
0461  02275 106612  FM05    OCT 106612
0462  02276 044516          ASC 16,INTERRUPT ON PRESET (CONTROL)
      02277 052105
      02300 051122
      02301 052520
      02302 052040
      02303 047516
```

```
       02304 020120
       02305 051105
       02306 051505
       02307 052040
       02310 024103
       02311 047516
       02312 052122
       02313 047514
       02314 024440
       02315 020040
0463   02316 106612          OCT 106612
0464*
0465*    NO NORMAL INTERRUPT
0466*
0467   02317 106512  FM06    OCT 106612
0468   02320 047117          ASC 12,NO NORMAL INTERRUPT
       02321 020116
       02322 047522
       02323 046501
       02324 046040
       02325 044516
       02326 052105
       02327 051122
       02330 052520
       02331 052040
       02332 020040
       02333 020040
0469   02334 106612          OCT 106612
0470*
0471*    FUNCTIONAL TEST COMPLETED
0472*
0473   02335 106512  FM07    OCT 106612
0474   02336 043125          ASC 12,FUNCTIONAL TEST COMPLETE
       02337 047103
       02340 052111
       02341 047516
       02342 040514
       02343 020124
       02344 042523
       02345 052040
       02346 041517
       02347 046520
       02350 046105
       02351 052105
0475   02352 106612          OCT 106612
0476*
0477*   TERMINATE MESSAGE
0478*         36 CHARACTERS
0479*           20 LEADING ZEROS TO PRECEDE THE TERMINATE MESSAGE
0480*           WHEN THE SPECIAL CHARACTER IS BEING PUNCHED TO SEPERATE
0481*           THE CHARACTER DATA FROM THE TERMINATE MESSAGE PUNCHED.
0482*
0483*
0484   02353 020040  TERMM ASC 10,
       02354 020040
       02355 020040
       02356 020040
```

```
      02357 020040
      02360 020040
      02361 020040
      02362 020040
      02363 020040
      02364 020040
0485  02365 106512          OCT 106612
0486  02366 026524          ASC 06,-TERMINATE-
      02367 042522
      02370 046511
      02371 047101
      02372 052105
      02373 026440
0487  02374 106512          OCT 106612
0488  02375 000000  P001    BSS 10
0489  02407 000000  DITR    BSS 340
0490*
0491*
0492*    OUTPUT ROUTINE FOR BUFFERED OUTPUT BOARD
0493*
0494*
0495  03133 077144  TOUT    STB SAVB
0496  03134 067145          LDB OUT
0497  03135 106500  TOUT0   OTB 0          OUTPUT THE INSTRUCTION
0498  03136 102500  TOUT3   OTA 0          OUTPUT A REG.
0499  03137 103700  TOUT4   STC 0,C        SET CONTROL
0500  03140 102300  TOUT5   SFS 0          WAIT
0501  03141 027140          JMP *-1
0502  03142 067144          LDB SAVB       RESTORE B REG.
0503  03143 025647          JMP EP04B      RETURN
0504  03144 000000  SAVB    NOP
0505  03145 130000  OUT     OCT 130000
0506                        END M000
**  NO ERRORS*
```

APPENDIX A



NOTES:

1. PIN 5 ON ALL MICROCIRCUIT PACKAGES IS GROUND.
2. PIN 11 ON ALL MICROCIRCUIT PACKAGES IS −2V ± 5%.
3. PIN 12 ON ALL MICROCIRCUIT PACKAGES IS +4.5V ± 5%.
4. PINS 8 AND 14 OF 1820-0968 ARE CONNECTED TO +4.5V. UNLESS OTHERWISE INDICATED ON A LOGIC DIAGRAM USING THE MICROCIRCUIT PACKAGE.

Figure A-1. Logic Diagrams for Microcircuit Packages, Top View

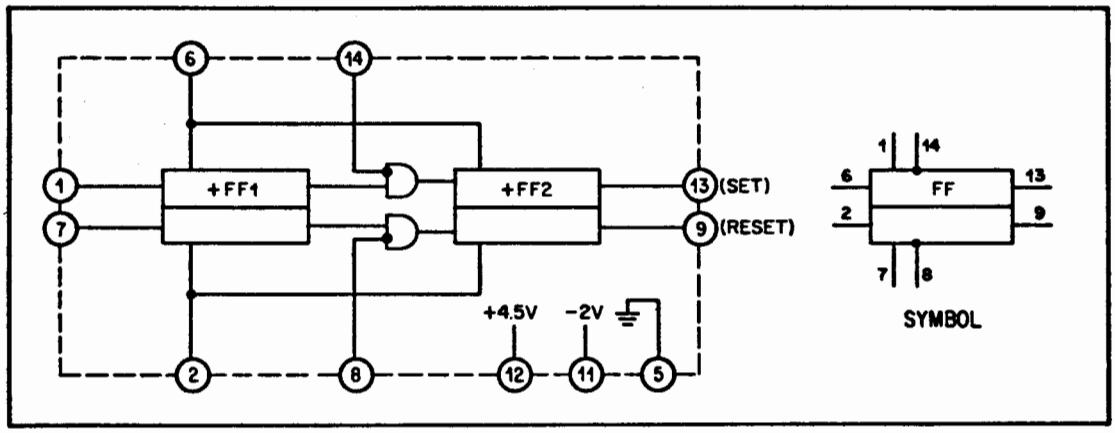
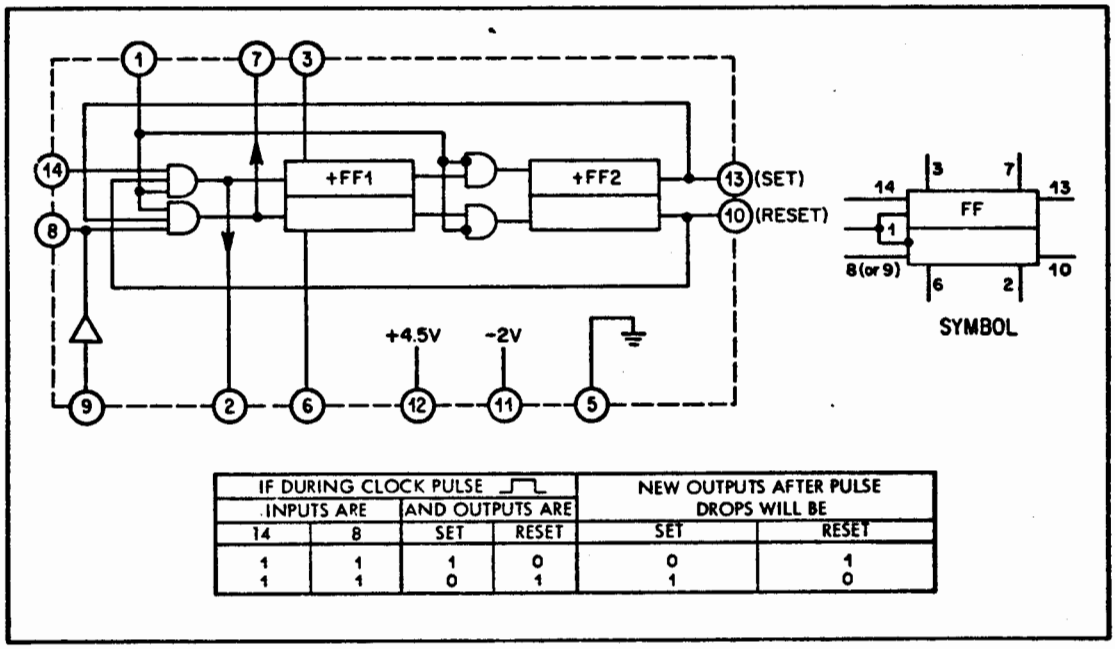
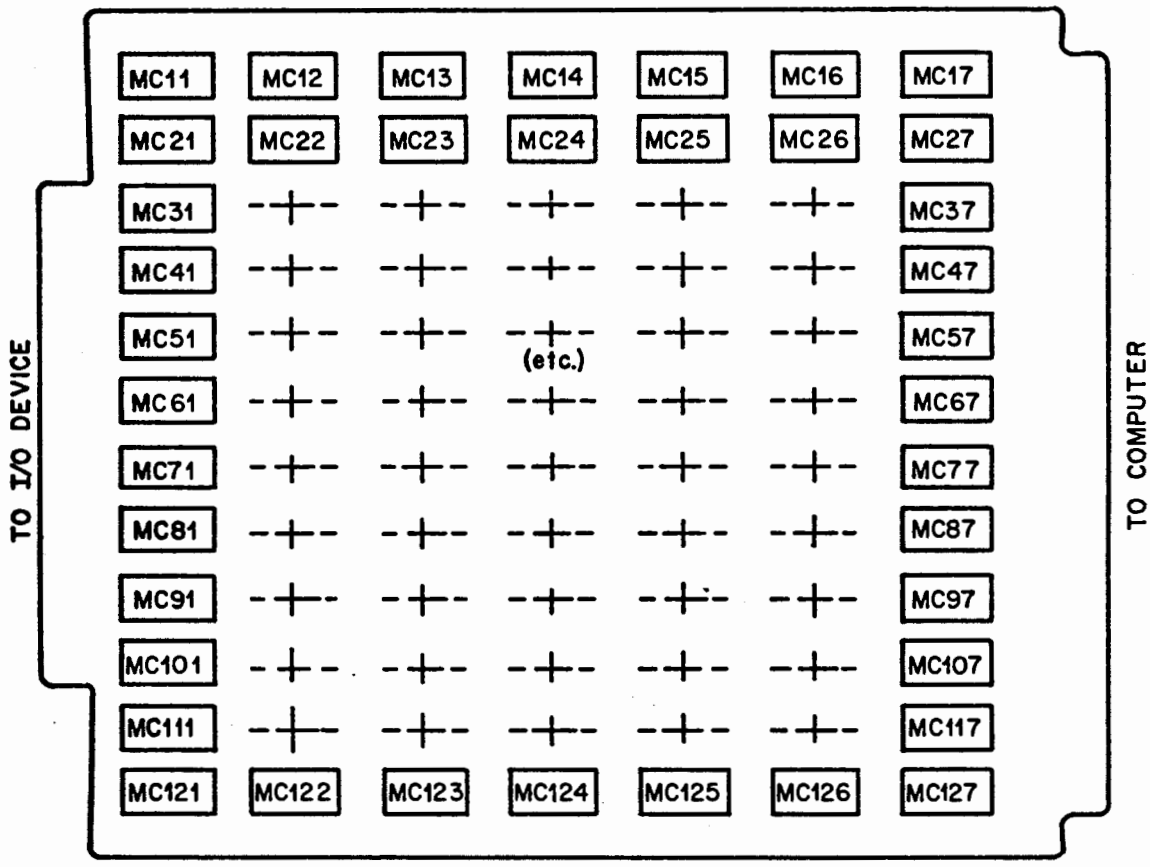


Figure A-2. Simplified Logic Diagram of 1820-0957 Microcircuit Package



IF DURING CLOCK PULSE ⎍ INPUTS ARE		AND OUTPUTS ARE		NEW OUTPUTS AFTER PULSE DROPS WILL BE	
14	8	SET	RESET	SET	RESET
1	1	1	0	0	1
1	1	0	1	1	0

Figure A-3. Simplified Logic Diagram of 1820-0967 Microcircuit Package



NOTE: A Microcircuit Package always assumes the reference designation assigned to its location on the card as illustrated in this figure.

Figure A-4. Microcircuit Package Locations