CARTRIFILE/DEC-O INTERFACE

INTRODUCTION

This section describes the Tri-Data interface circuitry supplied with CartriFile 20 and CartriFile 40 magnetic tape systems for operation with Digital Equipment Corporation PDP-8/E and -8/M computers. The interface equipment consists of a printed circuit board which installs in the computer's OMNIBUS and a cable which interconnects the circuit board and CartriFile tape units.

DESCRIPTION

The CartriFile/DEC-O Interface Assembly (10881) consists of the interface circuit board (10880-0) which installs in the computer's OMNIBUS and the attached cable which connects to the rear of the tape unit, as shown in Figure 1.

INSTALLATION

The interface circuit board installs in the PDP-8E computer's OMNIBUS. Before installing the board, check that the address jumpers and bits-per-word selection jumper are appropriate for your application. The standard factory-installed jumpers select octal addresses 31, 32, and 33 and BPW12, but they can be changed. Only the four highest significant bits are actually patched; the remaining two bits are automatically decoded. (Refer to "MAINTENANCE: Address Selection; Data Word Length" in this section.)

After installing the circuit board in the OMNIBUS, connect P1 to the rear panel of the CartriFile tape unit. Seat the connector firmly, then secure it to the rear panel using the screws provided.

OPERATION

The selection and operation of the CartriFile/DEC-O Interface are described below. It is assumed that the user is familiar with the PDP-8 instruction repertoire and its usage. The instructions required to control the interface follow the same format as other PDP-8 I/O instructions.

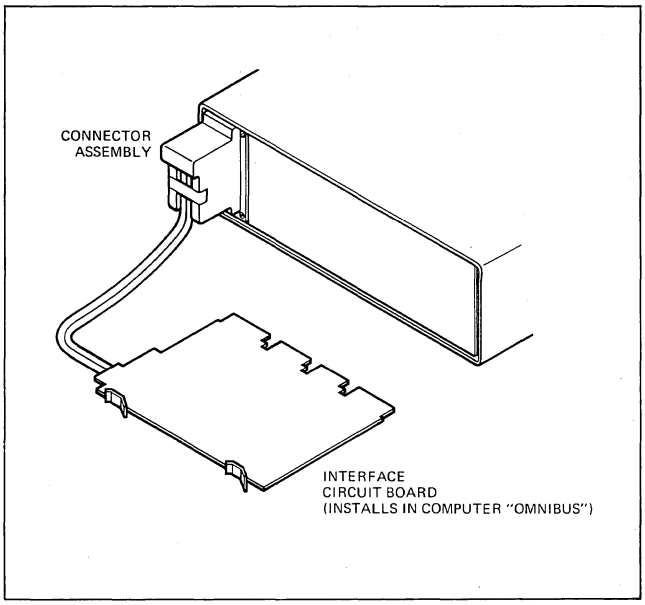


Figure 1. Interface Installation

Selection

The standard I/O addresses used by the interface are 31, 32, and 33 (octal); however, the interface may be wired to the upper three addresses of any set of four I/O addresses whose low-order digit is 0 or 4 (refer to "MAINTENANCE: Address Selection" in this section).

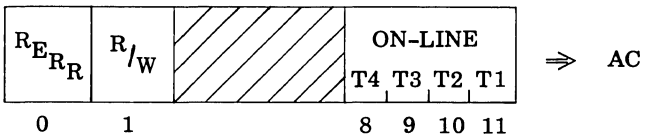
The standard factory-wired interface is wired for 12-bit transfers; however, 8-bit transfers are possible by moving a jumper on the interface board (refer to "MAINTENANCE: Data Word Length" in this section).

I/O Instruction Set

The CartriFile I/O instructions provide the capabilities of sensing status, issuing tape-motion commands, transferring data to or from the computer, or testing two CartriFile flags. All data are transferred between the interface and the PDP-8 accumulator (AC). The CartriFile I/O instruction set is the same for CartriFile 20 and CartriFile 40 tape units. The mnemonic and octal code for each are given below.

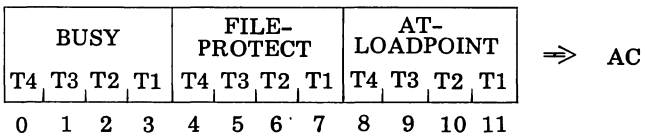
"OR" Tape Status B OTSB 6312
Load Tape Status B LTSB 6313

Loads or inclusive-ORs the AC with the CartriFile "B" status bits. The record-error bit is 1 if an error was detected on the last input record; this bit is reset to 0 by each read-start command. The read-write bit is 1 if a read or write command is in progress. The on-line bits are 1 if the corresponding tapes are on-line.



"OR" Tape Status A OTSA 6314
Load Tape Status A LTSA 6315

Loads or inclusive-ORs the AC with the CartriFile "A" status bits. The busy, file-protected, and at-loadpoint bits are 1 if the appropriate condition is met for each tape.



Skip on CartriFile Status Change SCSC 6322

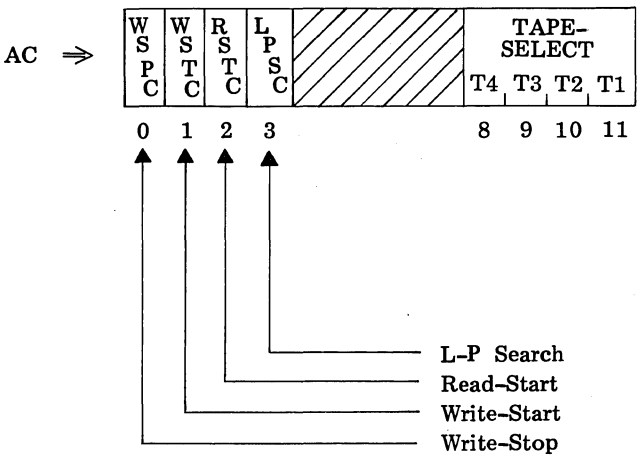
The next instruction is skipped if the CartriFile status-change flag is set. This instruction also clears the status-change flag if the flag was found to be set. The status-change flag is set when:

A tape completes reading a record.
A tape completes writing a record.
A tape arrives at loadpoint.
A tape goes from on-line to off-line.

A program interrupt will be generated when the status-change flag sets if interrupts are enabled. The flag is cleared by a computer RESET signal.

Tape Action Command ACMD 6324

The contents of the AC are sent to the interface and cause a write-stop, write-start, read-start, or loadpoint-search command to be sent to the CartriFile tape unit, depending upon which AC bits are set to 1. The latter three commands also require tape-select bits to be specified along with the command bit; simultaneous operation of multiple tapes is permitted only for loadpoint-search commands. Note that a loadpoint-search command must be issued to a tape before beginning each read or write pass across the tape; this resets special end-of-tape circuitry within the tape unit. Also note that if a loadpoint-search command is issued to a tape that is already at loadpoint, no tape motion and no status-change interrupt will occur.



Skip on CartriFile Data Call SDCL 6332

The next instruction is skipped if the data-call flag is set. The data-call flag sets each time a word of data is available for input while reading a record; it also sets each time a word of data must be output while writing a record. Normally, data calls occur every 777 μsec when 12-bit words are being read or written. The program has all 777 μsec in which to read a word from the tape unit before the next word overlays it; while writing, the program has about 660 μsec after the rise of the data-call flag in which to output the next word of data. A program interrupt will be generated when the data-call flag sets if interrupts are enabled. The flag is cleared by an OTB/LTB (see below); by a write-stop, write-start, or read-start command; or by a computer RESET signal.

"OR" Tape Buffer OTB 6334
Load Tape Buffer LTB 6335

This is a bidirectional data-transfer command. If a record is being read, the command either loads or inclusive-ORs the AC with the next 12-bit input word. If a record is being written, the OTB outputs the contents of the AC to the CartriFile tape unit as the next 12-bit output word. Note that LTB used while writing clears the AC and outputs 12 zeroes. Either OTB or LTB clears the data-call flag.

CARTRIFILE PROGRAM SUBROUTINES

A basic subroutine used to read records of up to 1023 words from a CartriFile tape is shown below. This subroutine does not use interrupts and has no provisions for splitting records longer than 50 words when load point is sensed; consequently, a tape long enough to contain all desired records should be used. The sequence of instructions used to "call" this subroutine is as follows:

```
        TAD TPBITS      /LOAD INPUT TAPE COMMAND BITS.
        JMS CFIN        /GO ENTER SUBROUTINE.
        IOSIZE          /INPUT AREA SIZE (BINARY 1-1023)
        IOADDR          /INPUT AREA STARTING ADDRESS.
```

The accumulator is first loaded with a 12-bit word containing zeroes in bits 0-7 and a tape command bit corresponding to the desired input tape in bits 8-11 (see the ACMD instruction above). Upon exit from the subroutine, the link bit will be set if a read error occurred, bit 0 of the accumulator will be set if load point was sensed, and bit 1 will be set if an incorrect size record was read. Bits 2-11 of the accumulator will contain the binary number of words not read if the record was short; if bits 2-11 are all zero, the input record was too big for the input area, and the excess data words will be lost. The subroutine coding is as follows:

```
CFIN,   0
        DCA CMDBIT      /STORE READ COMMAND BIT.
        TAD I CFIN      /GET INPUT AREA SIZE.
        ISZ CFIN        /BUMP RETURN ADDRESS.
        CMA             /COMPLEMENT INPUT SIZE.
        DCA IOCT        /STORE INPUT COUNT BELOW.
        TAD I CFIN      /GET INPUT AREA ADDRESS.
        ISZ CFIN        /BUMP RETURN ADDRESS.
        DCA IOADDR      /STORE INPUT ADDRESS BELOW.
        DCA STATUS      /CLEAR STATUS WORD.
        TAD RDBIT       /GET READ COMMAND BITS.
        TAD CMDBIT
CFIN1,  ACMD            /ISSUE READ-START COMMAND.
        SDCL            /TEST FOR READ-DATA CALL.
        JMP CFIN1       /IF NOT, WAIT.
CFIN2,  LTSA            /GET TAPES STATUS.
        AND CMDBIT      /CLEAR UNWANTED BITS.
        SNA CLA         /TEST FOR LOAD POINT.
        JMP CFIN3       /IF NOT, GET TAPES STATUS.
        CCL CML RAR     /SET LOAD POINT FLAG.
        DCA STATUS      /STORE IN STATUS WORD.
CFIN3,  LTSB            /GET TAPES STATUS.
        RAL             /ISOLATE READ-WRITE BIT.
        SZA CLA         /TEST FOR END OF RECORD.
        JMP CFIN6       /IF SO, GET RESIDUAL COUNT.
        SDCL            /TEST FOR NEXT DATA CALL.
        JMP CFIN2       /IF NOT, WAIT.
        TAD IOCT        /LOAD INPUT COUNT.
        SNA CLA         /TEST FOR OVERSIZE RECORD.
        JMP CFIN4       /IF SO, GO READ NEXT WORD.
        ISZ IOCT        /BUMP INPUT COUNT.
        JMP CFIN5       /IF NON-ZERO, READ WORD.
CFIN4,  LTB             /READ & IGNORE NEXT WORD.
        CLA             /CLEAR A-C.
        JMP CFIN1       /GO WAIT FOR END OF RECORD.
CFIN5,  LTB             /READ NEXT WORD.
        DCA I IOADDR    /STORE NEXT WORD.
        ISZ IOADDR      /BUMP INPUT ADDRESS.
        JMP CFIN1       /GO WAIT FOR NEXT RWC
CFIN6,  TAD IOCT        /GET INPUT COUNT.
        SNA             /TEST FOR OVERSIZE RECORD.
```

```
                JMP CFIN7       /IF SO, SET STATUS BIT 1.
                CMA             /COMPLEMENT INPUT COUNT.
                SZA             /TEST FOR CORRECT SIZE.
CFIN7,          TAD WLMASK      /IF NOT, SET STATUS BIT 1.
                TAD STATUS      /GET LOAD POINT STATUS.
                JMP I CFIN      /RETURN TO MAIN PROGRAM.
RDBIT,          1000
WLMASK,         2000
CMDBIT,         0
IOCT,           0
IOADDR,         0
STATUS,         0
```

A basic subroutine used to write records onto a CartriFile tape is shown below. This subroutine does not use interrupts and has no provisions for splitting records longer than 50 words when load point is sensed; consequently, a tape long enough to contain all desired records should be used. The sequence of instructions used to "call" this subroutine is as follows:

```
                TAD TPBITS      /LOAD OUTPUT TAPE COMMAND BITS.
                JMS CFOUT       /GO ENTER SUBROUTINE.
                IOSIZE          /OUTPUT AREA SIZE (BINARY).
                IOADDR          /OUTPUT AREA STARTING ADDRESS.
```

The accumulator is first loaded with a 12-bit word containing zeroes in bits 0-7 and the tape command bits corresponding to the desired output tapes in bits 8-11 (see the ACMD instruction above). Upon exit from the subroutine, bit 0 of the accumulator will be set if load point was sensed. The subroutine coding is as follows:

```
CFOUT,          0
                DCA CMDBIT      /STORE WRITE COMMAND BIT.
                TAD I CFOUT     /GET OUTPUT AREA SIZE.
                ISZ CFOUT       /BUMP RETURN ADDRESS.
                CMA             /COMPLEMENT OUTPUT SIZE.
                DCA IOCT        /STORE OUTPUT COUNT BELOW.
                TAD I CFOUT     /GET OUTPUT AREA ADDRESS.
                ISZ CFOUT       /BUMP RETURN ADDRESS.
                DCA IOADDR      /STORE OUTPUT ADDRESS BELOW.
                DCA STATUS      /CLEAR STATUS WORD.
                CCL CML RTR     /GET WRITE COMMAND BITS.
                TAD CMDBIT
CFOUT1,         ACMD            /ISSUE WRITE-START COMMAND.
                SDCL            /TEST FOR WRITE-DATA CALL.
                JMP CFOUT1      /IF NOT, WAIT.
CFOUT2,         LTSA            /GET TAPES STATUS.
                AND CMDBIT      /CLEAR UNWANTED BITS.
                SNA CLA         /TEST FOR LOAD POINT.
                JMP CFOUT3      /IF NOT, GET TAPES STATUS.
                CLL CML RAR     /SET LOAD POINT FLAG.
                DCA STATUS      /STORE IN STATUS WORD.
CFOUT3,         LTSB            /GET TAPES STATUS.
                RTL             /ISOLATE READ-WRITE BIT.
                SNL CLA         /TEST FOR END OF RECORD.
                JMP CFOUT5      /IF SO, GO LOAD STATUS.
                SDCL            /TEST FOR NEXT DATA CALL.
                JMP CFOUT2      /IF NOT, WAIT.
                ISZ IOCT        /BUMP OUTPUT COUNT.
                JMP CFOUT4      /IF NON-ZERO, WRITE WORD.
                CLL CML RAR     /ISSUE WRITE-STOP.
                ACMD
                JMP CFOUT2      /GO WAIT FOR END OF RECORD.
```

```
CFOUT4,     TAD I IOADDR        /LOAD NEXT OUTPUT WORD.
            ISZ IOADDR          /BUMP OUTPUT ADDRESS.
            OTB                 /WRITE NEXT WORD.
            CLA                 /CLEAR A-C.
            JMP CFOUT2          /GO WAIT FOR NEXT WWC.
CFOUT5,     TAD STATUS          /GET LOAD POINT STATUS.
            JMP I CFOUT         /RETURN TO MAIN PROGRAM.
```

A basic subroutine used to execute a load point-search command on one or more CartriFile tapes is shown below. This subroutine does not use interrupts; also, since the read-write subroutines shown above wait for a tape to become ready (i.e., stopped) before proceeding, this subroutine will not wait for tapes to reach load point. The sequence of instructions used to "call" this subroutine is as follows:

```
            TAD TPBITS          /LOAD L-P SEARCH COMMAND BITS.
            JMS LOADPT          /GO ENTER SUBROUTINE.
```

The accumulator is first loaded with a 12-bit word containing zeroes in bits 0-7 and command bits corresponding to the tapes to be load point-searched in bits 8-11 (see the ACMD instruction above). Note that more than one tape may be load point-searched using a single call to the subroutine; also note that the link and accumulator will be zero upon exit from the subroutine. The coding is as follows:

```
LOADPT,     0
            DCA CMDBIT          /STORE LOAD POINT COMMAND BITS.
LP1,        LTSB                /GET TAPES STATUS.
            AND CMDBIT          /CLEAR UNWANTED BITS.
            CIA                 /COMPLEMENT ON-LINE BITS.
            TAD CMDBIT          /ADD COMMAND BITS.
            SZA CLA             /TEST IF ALL TAPES ARE ON-LINE.
            JMP LP1             /IF NOT, GO TEST AGAIN.
            TAD LPBIT           /GET L-P SEARCH COMMAND BITS.
            TAD CMDBIT
            ACMD                /ISSUE L-P SEARCH COMMAND.
            CLA CLL             /CLEAR A-C & LINK.
            JMP I LOADPT        /RETURN TO MAIN PROGRAM.
LPBIT,      0400
```

MAINTENANCE

The interface circuit board is essentially maintenance-free. Should a malfunction occur, isolate the faulty component using normal troubleshooting procedures. Refer to the logic diagram (10880) as a troubleshooting aid. For reference, Table 1 lists and describes the signals used between the interface and the CartriFile tape unit. The interface assembly contains 35 integrated circuits. The type of integrated circuits and their locations are listed in Table 2.

Address Selection

The standard addresses used by the interface are 31, 32, and 33 (octal); however, the interface may be wired to the upper three addresses of any set of four I/O addresses whose low-order digit is 0 or 4.

The addresses are a result of address jumpers on the interface board which are labeled A, B, C, D, E, F, G, and H. These jumpers are coded as follows:

0	1	
A	B	MSB
C	D	
E	F	
G	H	

The two least-significant bits are decoded internally. The standard board has jumpers at A, D, F and G, resulting in addresses 31, 32, and 33.

Data Word Length

The standard interface is wired for 12-bit transfers; however, the data word length is selectable at the interface board by the use of jumpers. Selection is as follows: jumper terminal K for 8-bit transfers; jumper terminal L for 12-bit transfers. With no jumper, the tape format will be 16 BPW; however, only 12 bits will be read into or written from the accumulator.

Table 1. CartriFile Connector J3 Input/Output Signal Specifications

FUNCTION	MNEMONIC	J3 PIN	SIGNAL LEVEL	REMARKS
BITS PER WORD SELECT	BPW8 BPW12	10 12	True: 0 v False: +5 v	To select BPW16, both BPW8 and BPW12 must be kept False. All records must be read with the same BPW selected as when written.
TAPE X SELECT 20: 1,2 40: 1,2,3,4	T1SL T2SL T3SL T4SL	36 34 32 30	True: 0 v False: +5 v	Must be True for the duration of the Read Start, Write Start, or Load Point Search pulse.
LOAD POINT SEARCH COMMAND	LPSC	49	True: 0 v pulse, 0.5 to 5 μsec. False: +5 v	Tape selected will advance to Load Point and stop. If writing or reading selected tape when LPSC goes true, tape will advance to Load Point after completing the record.
WRITE START COMMAND	WSTC	47	True: 0 v pulse, 0.5 to 5 μsec. False: +5 v	At trailing edge of this pulse, the controller is committed to write a record on the selected tape.
WRITE STOP COMMAND	WSPC	51	True: 0 v pulse, 0.5 to 5 μsec. False: +5 v	WSPC True commits the tape writing to end the record after completing the last word previously transferred by WXFR.
READ START COMMAND	RSTC	45	True: 0 v pulse, 0.5 to 5 μsec. False: +5 v	At trailing edge of this pulse, the controller is committed to read a record from the selected tape.
WRITE MODE STATUS	WM	6	True: 0 v False: +5 v	Indicates the controller's acceptance of the Write Start Command pulse; goes True at the leading edge of WSTC and stays True for the duration of the Write operation.
READ MODE STATUS	RM	8	True: 0 v False: +5 v	Indicates the controller's acceptance of the Read Start Command pulse; goes True at the leading edge of RSTC and stays True for the duration of the Read operation.
TAPE X AT LOAD POINT STATUS 20: 1,2 40: 1,2,3,4	T1LP T2LP T3LP T4LP	28 26 24 22	True: 0 v False: +5 v	True when associated tape is positioned at Load Point; False otherwise.
TAPE X FILE PROTECTED STATUS 20: 1,2 40: 1,2,3,4	T1FP T2FP T3FP T4FP	20 18 16 14	True: 0 v False: +5 v	Indicates status of the PROTECT/ENABLE switch on the tape cartridge. True indicates that tape is file-protected.
TAPE X ON LINE STATUS 20: 1,2 40: 1,2,3,4	T1OL T2OL T3OL T4OL	44 42 40 38	True: 0 v False: +5 v	True indicates that a tape cartridge is inserted in that slot.
TAPE X BUSY STATUS 20: 1,2 40: 1,2,3,4	T1BY T2BY T3BY T4BY	52 50 48 46	True: 0 v False: +5 v	Indicates operating status of associated tape. True indicates that tape is Load-Point Searching, in Write mode, or in Read mode. Status line stays True for duration of complete operation.
POWER ON STATUS	RESET	5	True: 0 v False: +5 v	True only when power is OFF and for about 100 msec after power is turned ON. This output is guaranteed to be at ground under a current sink condition with power OFF.
WRITE WORD TRANSFER	WXFR	7	True: 0 v pulse, 0.5 to 5 μsec. False: +5 v	Transfers the data word to be written on tape into the storage register of the tape unit.

Table 1. CartriFile Connector J3 Input/Output Signal Specifications (Continued)

<table>
<tr><th>FUNCTION</th><th>MNEMONIC</th><th>J3 PIN</th><th>SIGNAL LEVEL</th><th>REMARKS</th></tr>
<tr><td>READ OR WRITE CLOCK</td><td>RWCL</td><td>11</td><td>True: 0 v pulse, 0.5 to 2 μsec.
False: +5 v</td><td rowspan="2">In Write mode, the first RWCL occurs at the end of a delay initiated with WSTC; subsequent RWCL outputs occur at a fixed rate until a WSPC input. After each RWCL, a WXFR pulse within a fixed period sets the input registers to the "1" or "0" condition of the DBT inputs. The registers are sampled for writing at the end of the fixed period. Timing for the various BPW settings is given below. A WSPC command occurring prior to the end of the fixed period inhibits writing that word and inhibits any subsequent RWCL. If neither WXFR nor WSPC inputs occur during the period after RWCL, the last previous word is repeated on tape.

BPW True | Time between RWCL pulses | Period after RWCL during which WXFR may occur
BPW8 | 0.56 msec | 0.4 msec
BPW12 | 0.78 msec | 0.6 msec
BPW16 | 1.00 msec | 0.8 msec

In Read mode, the first RWCL occurs 16 msec after RSTC (375 to 675 msec at beginning of tape), with subsequent RWCL outputs occurring as each data word is read from the tape. DBT outputs remain on line, representing the data word, from the fall of the significant RWCL until the rise of the next RWCL. Timing for the various BPW settings is given below.

BPW True | Nominal time between RWCL output pulses
BPW8 | 0.56 msec
BPW12 | 0.78 msec
BPW16 | 1.00 msec</td></tr>
<tr><td>DATA BIT X LINE (1 through 16)</td><td>DBT1
DBT2
DBT3
DBT4
DBT5
DBT6
DBT7
DBT8
DBT9
DBT10
DBT11
DBT12
DBT13
DBT14
DBT15
DBT16</td><td>43
41
39
37
35
33
31
29
27
25
23
21
19
17
15
13</td><td>ONE: 0 v
ZERO: +5 v
for Write input or Read output

(During Write, DBT input must be held True at time of WXFR and maintained for 0.5 μsec (min.) following lagging edge of WXFR.)</td></tr>
<tr><td>RECORD ERROR</td><td>RERR</td><td>9</td><td>True: 0 v
False: +5 v</td><td>True indicates that an error has occurred in the data output for this record. RERR goes True with RWCL and remains True until the next RSTC.</td></tr>
<tr><td>+15 V BUS</td><td>—</td><td>53</td><td>—</td><td>Maximum current available is 200 ma.</td></tr>
<tr><td>-15 V BUS</td><td>—</td><td>3</td><td>—</td><td>Maximum current available is 200 ma.</td></tr>
<tr><td>+5 V BUS</td><td>—</td><td>55
56</td><td>—</td><td>Maximum current available:

CartriFile 20 800 ma
CartriFile 40 800 ma</td></tr>
<tr><td>GROUND BUS</td><td>GND</td><td>1
2</td><td>—</td><td>Power Supply ground.</td></tr>
</table>

Table 2. Integrated Circuit Location and Type

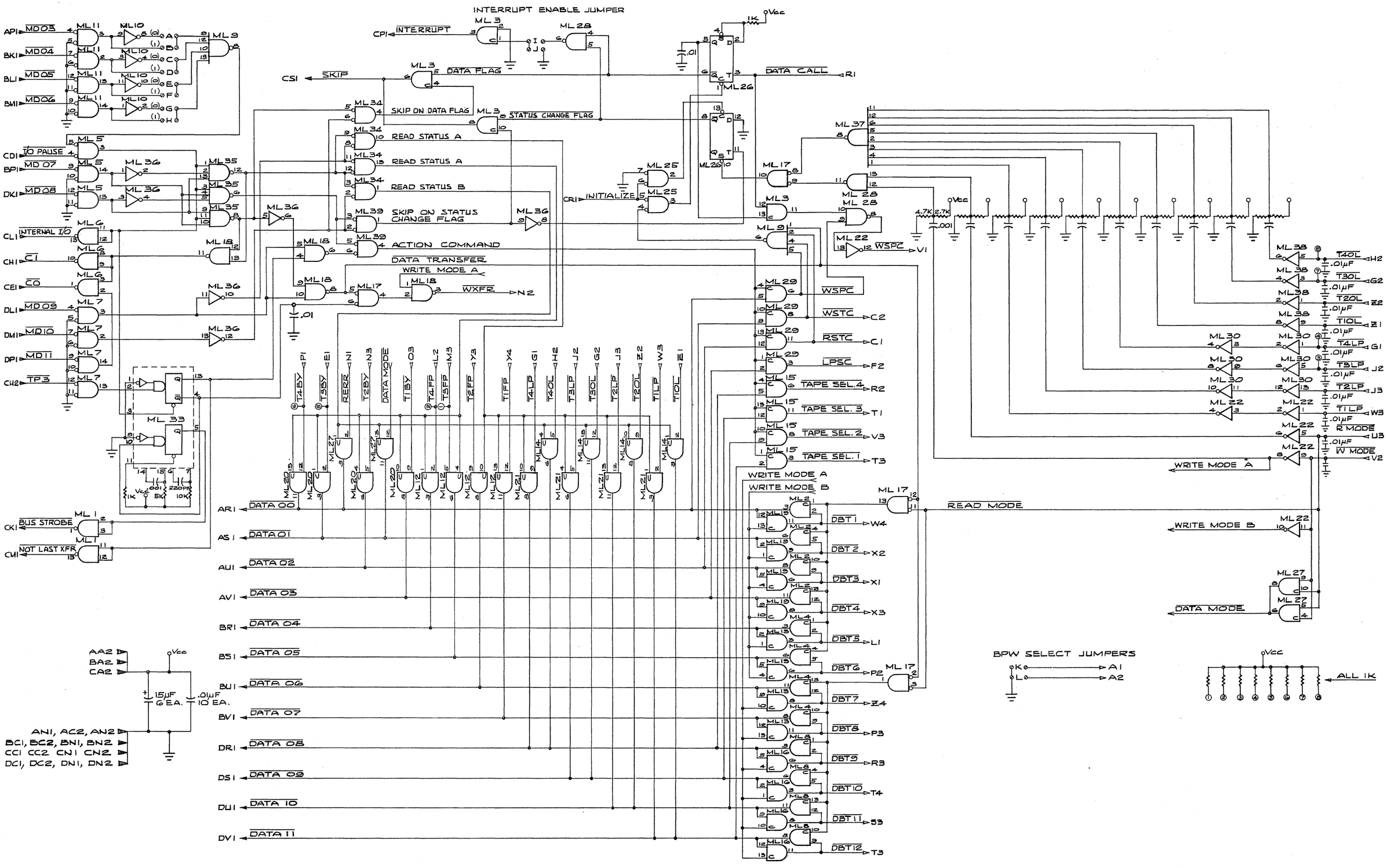
Location	Type	Location	Type
ML1	881	ML19	8094
ML2	8094	ML20	8094
ML3	8094	ML21	8094
ML4	8094	ML22	7404
ML5	380	ML25	380
ML6	8881	ML26	7474
ML7	380	ML27	8094
ML8	8094	ML28	7400
ML9	7420	ML29	8094

Table 2. Integrated Circuit Location and Type (Continued)

Location	Type	Location	Type
ML10	7404	ML30	7404
ML11	380	ML33	74123
ML12	8094	ML34	7402
ML13	8094	ML35	7410
ML14	8094	ML36	7404
ML15	8094	ML37	7430
ML16	8094	ML38	7404
ML17	7402	ML39	7402
ML18	7400		

SOFTWARE

The CartriFile software package for the Digital Equipment Corporation PDP-8 series computers consists of the Tri-Data 8-010B-BIN CartriFile I/O Driver program and the Tri-Data 8-006B-BIN CartriFile Exercise program. The program listings and instructions for operation follow this Interface Section.


INTERRUPT ENABLE JUMPER
INTERRUPT
DATA FLAG
SKIP
SKIP ON DATA FLAG
STATUS CHANGE FLAG
READ STATUS A
READ STATUS A
READ STATUS B
SKIP ON STATUS CHANGE FLAG
ACTION COMMAND
DATA TRANSFER
WRITE MODE A
WXFR
DATA CALL
INITIALIZE
IO PAUSE
INTERNAL IO
BUS STROBE
NOT LAST XFR
WSPC
WSTC
RSTC
LPSC
TAPE SEL. 4
TAPE SEL. 3
TAPE SEL. 2
TAPE SEL. 1
WRITE MODE A
WRITE MODE B
READ MODE
DATA MODE
R MODE
W MODE
DBT 1
DBT 2
DBT 3
DBT 4
DBT 5
DBT 6
DBT 7
DBT 8
DBT 9
DBT 10
DBT 11
DBT 12
DATA 00
DATA 01
DATA 02
DATA 03
DATA 04
DATA 05
DATA 06
DATA 07
DATA 08
DATA 09
DATA 10
DATA 11
BPW SELECT JUMPERS
ALL 1K
AA2 BA2 CA2
AN1, AC2, AN2
BC1, BC2, BN1, BN2
CC1 CC2 CN1 CN2
DC1, DC2, DN1, DN2
15μF 6 EA.
.01μF 10 EA.

10881-0,-1 CARTRIFILE/PDP-8e INTERFACE ASSEMBLY (MODEL 20/40)

ITEM NO.	TRI-DATA PART NUMBER	DESCRIPTION		QTY PER NEXT ASSY	SPARES
	10881-0	PDP-8e INTERFACE ASSEMBLY (Model 20)			
	10881-1	PDP-8e INTERFACE ASSEMBLY (Model 40)			
1	10797-0	. Clamp, cable, modified		1	
2	10798-0	. Circuit Board, card cable		1	
3	10880-0	. PDP-8e, Interface Board Assembly		1	
3.1	10879-0	.. P.C. Board		1	
3.2	00011-001	.. Cap., cer, fxd, .01uf		21	
3.3	00011-017	.. Cap., cer, fxd, 220pf		1	
3.4	00011-020	.. Cap., cer, fxd, .001uf		11	
3.5	00015-027	.. Cap., cer, fxd, 15uf		6	
3.6	00045-001	.. Integrated Circuit, SN7400	ML18,28	2	
3.7	00045-002	.. Integrated Circuit, SN7420	ML9	1	
3.8	00045-006	.. Integrated Circuit, SN7474	ML26	1	
3.9	00045-011	.. Integrated Circuit, SN7410	ML35	1	
3.10	00045-013	.. Integrated Circuit, SN7404	ML10,22,30,36,38	5	
3.11	00045-019	.. Integrated Circuit, SN7430	ML37	1	
3.12	00045-031	.. Integrated Circuit, SIG8881	ML1,6	2	
3.13	00045-037	.. Integrated Circuit, SN7402	ML17,34,39	3	
3.14	00045-040	.. Integrated Circuit, SIG380	ML6,8,11,25	4	
3.15	00045-044	.. Integrated Circuit, SN74123	ML33	1	
3.16	00045-046	.. Integrated Circuit, NAT'L 8094	ML2/4,8,12/16, 19/21,27,29	14	
3.17	00057-025	.. Res., fxd, comp., 1K, 1/4W, 10%		10	
3.18	00057-030	.. Res., fxd, comp., 2.7K, 1/4W, 10%		10	
3.19	00057-033	.. Res., fxd, comp., 4.7K, 1/4W, 10%		10	
3.20	00057-034	.. Res., fxd, comp., 5.6K, 1/4W, 10%		1	
3.21	00057-037	.. Res., fxd, comp., 10K, 1/4W, 10%		1	
3.22	00098-010	.. Terminal Lug		24	
4	10916-1	. Housing, interconnect	-0:	1	
5	10917-0	. Retainer, cable		1	
6	10916-2	. Housing, interconnect	-1:	1	
7	00027-014	. Handle, flip clip		2	
8	00048-002	. Nut, hex, #4-40		A/R	
9	00049-002	. Nut, self-locking, #4-40		A/R	
10	00062-016	. Screw, pan hd., #4-40 x 5/8		A/R	
11	00062-039	. Screw, pan hd., #6-32 x 1/2		A/R	

10881-0,-1 CARTRIFILE/PDP-8e INTERFACE ASSEMBLY (MODEL 20/40) (continued)

ITEM NO.	TRI-DATA PART NUMBER	DESCRIPTION	QTY PER NEXT ASSY	SPARES
12	00062-087	. Screw, pan hd., #4-40 x 2	A/R	
13	00076-003	. Washer, int. tooth lock, #6	A/R	
14	00077-001	. Washer, lock, ext. tooth, #4	A/R	
15	00078-002	. Washer, plain, #4	A/R	
16	00078-003	. Washer, flat, #6	A/R	
17	00108-140	. Wire, unshielded, twisted pair	A/R	
18	00099-110	. Tubing, heat shrinkable	A/R	

TRI-DATA

TRI-DATA 8-010B-BIN CARTRIFILE I-O DRIVER 10505-102

PURPOSE

This is a non-interrupt-driven I-O subroutine intended for use as an I-O driver in PDP-8 programs desiring basic CartriFile services from CartriFile 20 or 40 models.

REQUIREMENTS

This program requires two consecutive pages (245 words) of PDP-8 main storage. The program may be located *anywhere* within main storage and requires *no* special PDP-8 hardware (such as EAE, extended memory, etc.).

USAGE

The CartriFile I-O Driver is accessed from user programming as a subroutine. The user may request the I-O Driver to read a block, write a block, write an end-of-file mark, or issue a Load-Point Search command. Multiple tapes within a CartriFile may be loadpoint-searched simultaneously; the driver supports extended memory and can handle up to eight CartriFiles. Subroutine entry points for abnormal-condition and input end-of-file processing are specified in the calling sequence for I-O functions; these subroutines are entered using a simulated JMS instruction when the indicated conditions occur.

The I-O Driver entry point is the label CFIO, which is at location 7200 in the standard version of the driver. The calling sequence in PAL-III code for an I-O request is as follows:

```
IO, CFIO                        /PAGE-ZERO SUBROUTINE PTR.
    CIF n                       /CHANGE TO DRIVER FIELD.
    JMS I IO                    /ENTER I-O DRIVER.
    F   F | I-O FIELD | C/F NO. | T4 | T3 | T2 | T1
    I-O WORD COUNT
    I-O AREA ADDRESS
    END-OF-FILE ADDRESS
    ABNORMAL-EXIT ADDRESS
                                /NORMAL RETURN POINT.
```

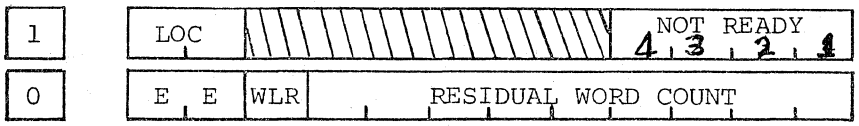
The CIF instruction is necessary only when using extended memory and the I-O Driver is located in some field other than the current field. The first word after the JMS instruction is the I-O function word. Bits 0 and 1 specify what function is to be executed and are set to 00 for a write end-of-file, 01 for a Load-Point Search,

10 for a write, and 11 for a read function. Bits 2 - 4 specify the data field number (0 - 7) for a read or write function; the data field number is ignored during a write end-of-file or loadpoint-search function and has no effect while reading or writing unless extended memory is present. Bits 5 - 7 specify which of up to eight CartriFiles is to be used; the relationship between the CartriFile number in the calling sequence and the actual hardware address of a CartriFile is as follows:

CartriFile Number	CartriFile Hardware Address
0	30 - 33
1	34 - 37
2	40 - 43
3	44 - 47
4	50 - 53
5	54 - 57
6	60 - 63
7	64 - 67

The base hardware address associated with CartriFile number 0 is contained in the I-O Driver at label Z918 and may be modified by the user if desired; for each increment to the CartriFile number, the I-O Driver will add 4 to the base hardware address and access the corresponding CartriFile. Bits 8 - 11 specify which tapes in the CartriFile are to be used. (Note that *multiple* tapes may be specified only for a loadpoint-search function.) The I-O word count specifies between 1 and 4095 12-bit words to be read or written; it and the I-O area address are present in the calling sequence *only* for a read or write function. The end-of-file address is present *only* for a read operation; it specifies the address of a subroutine entered when a read operation detects an end-of-file mark. The abnormal-exit address is *always* present and specifies the address of a subroutine entered when a function is rejected or abnormally completed. Either of these subroutines is entered with a simulated JMS instruction; the driver stores the address of the calling-sequence function word in word 0 of the subroutine and transfers control to word 1 of the subroutine. Note that these subroutines *must* be located in the *same* memory field as the I-O calling sequence.

The accumulator and link bit will not be saved upon entering the CartriFile I-O Driver. Upon a normal return or an input end-of-file exit, the accumulator and link will both be set to zero. Upon an abnormal-condition exit, the accumulator and link will contain status information as follows:



If the link bit is set, the requested operation has been rejected. Bits 0 and 1 of the accumulator will be set if a tape is in off-line mode; bits 8 - 11 of the accumulator will be set indicating which tapes were not ready. Note that if the link bit is set but the accumulator is all zeroes, the user has issued an I-O request which specified *no* tapes. If the link bit is not set, the operation was initiated,

but completed abnormally. Bits 0 and 1 of the accumulator will be set to 01 if end-of-tape was detected, 10 if an input read error was detected, or 11 if a tape switched into off-line mode. Bit 2 will be set if a wrong-length record was read or written; if so, bits 3 - 11 will indicate how many words were *not* read or written (up to a maximum of 511 words). Note that if bit 2 is set but bits 3 - 11 are zero, an input record was too big for the input area and has been truncated.

CartriFile data records are always recorded with *one extra* 12-bit word generated by the driver at the end of the record; this word is 0000 for a normal record, 7777 for a record that has been split due to end-of-tape, or 0017 for an end-of-file mark. When an end-of-tape condition occurs, the record being read or written is a split record; the residual count in the accumulator will indicate how many data words were not read or written. The programmer must prepare to access the *next* tape in the data file, either by modifying his I-O calling sequences or by halting the program to allow the next tape to be inserted. The new tape should be given a Load-Point Search command. Then the programmer has two choices: (1) read or write the *remainder* of the split record on the new tape, using the residual count and an updated I-O area address, or (2) ignore the partial record and read or write the *entire* record over on the new tape.

RESTRICTIONS

The user program must set interrupts off before entering the CartriFile I-O Driver; the driver will not set interrupts on or off while it is operating. The user must clear all CartriFile interrupt flags if he later desires to set interrupts on since the I-O Driver does *not* clear CartriFile interrupt conditions before exiting.

DESCRIPTION

The CartriFile I-O Driver is written in PAL-III assembly language and occupies two full pages (245 words) of PDP-8 main storage. It may be located in any field of memory and may be reorigined to the top of any two consecutive pages within the field. Execution time is I-O device dependent. For further details, refer to the accompanying program listing.

PROGRAMMING NOTE

It is strongly recommended that the user calculate and record a checksum at the end of each data record, as this I-O driver uses only the CartriFile record-error flag in determining when an input data error has occurred. The checksum should then be used as the primary means of data error detection when each record is read. The CartriFile record-error flag is of limited use in error detection since it cannot isolate errors that occurred while writing a record and it cannot trap 100% of all input errors. Thus, the record-error flag should be used as a diagnostic check on the operation of the CartriFile unit (if the user is interested) only *after* the user's checksum procedures determine that an input data error has occurred. Normally, a record error and a checksum error will occur simultaneously to indicate a CartriFile or tape cartridge malfunction.

```
PAGE 0001
0001            /
0002            /TRI-DATA 8-010B-BIN NON-INTERRUPT I-O DRIVER FOR MODEL
0003            /20 & 40 CARTRIFILES.  ENTRY AND INITIALIZATION ROUTINE.
0004            /
0005 7200 0000 CFIO, 0
0006 7201 7332        CLA STL RTR       /SET WRITE-START COMMAND BIT.
0007 7202 3371        DCA Z920
0008 7203 3372        DCA Z922          /CLEAR I-O COUNT.
0009 7204 1200 Z870,  TAD CFIO          /STORE CALLING-SEQUENCE POINTER.
0010 7205 3340        DCA Z888
0011 7206 1600        TAD I CFIO        /SET I-O FIELD CDF-CIF.
0012 7207 0335        AND Z886
0013 7210 7012        RTR
0014 7211 7012        RTR
0015 7212 1363        TAD Z908
0016 7213 3341        DCA Z890
0017 7214 1600        TAD I CFIO        /STORE CARTRIFILE NUMBER.
0018 7215 0366        AND Z914
0019 7216 7004        RAL
0020 7217 1370        TAD Z918
0021 7220 3374        DCA Z926
0022 7221 1600        TAD I CFIO        /STORE SELECTED-TAPE BITS.
0023 7222 0367        AND Z916
0024 7223 3375        DCA Z928
0025 7224 4334        JMS Z884          /LOAD FUNCTION CODE.
0026 7225 0345        AND Z896
0027 7226 7550        SPA SNA           /TEST FOR L-P SEARCH REQUEST.
0028 7227 5232        JMP Z872          /IF NOT, TEST FOR I-O REQUEST.
0029 7230 7012        RTR               /SET L-P SEARCH COMMAND BIT.
0030 7231 3371        DCA Z920
0031 7232 7006 Z872,  RTL               /ISOLATE I-O BIT.
0032 7233 7650        SNA CLA           /TEST FOR I-O REQUEST.
0033 7234 5260        JMP Z876          /IF NOT, STORE ABN ROUTINE ADDR.
0034 7235 4334        JMS Z884          /LOAD I-O COUNT.
0035 7236 7450        SNA               /TEST FOR ZERO COUNT.
0036 7237 7001        IAC               /IF SO, SET A-C TO +1.
0037 7240 7041        CIA               /COMPLEMENT & STORE I-O COUNT.
0038 7241 3372        DCA Z922
0039 7242 4334        JMS Z884          /STORE I-O ADDRESS.
0040 7243 3373        DCA Z924
0041 7244 7420        SNL               /TEST FOR READ REQUEST.
0042 7245 5256        JMP Z874          /IF NOT, SET UP I-O INSTRUCTION.
0043 7246 1204        TAD Z870          /SET READ-START COMMAND BIT.
0044 7247 3371        DCA Z920
0045 7250 4334        JMS Z884          /STORE EOF ROUTINE ADDRESS.
0046 7251 3376        DCA Z930
0047 7252 1340        TAD Z888          /SET EOF ROUTINE EXIT ADDRESS.
0048 7253 3776        DCA I Z930
0049 7254 2376        ISZ Z930          /BUMP EOF ROUTINE ADDRESS.
0050 7255 7012        RTR               /SET A-C TO 2000.
0051 7256 1365 Z874,  TAD Z910          /SET I-O TAD-DCA INSTRUCTION.
0052 7257 3342        DCA Z892
0053 7260 4334 Z876,  JMS Z884          /STORE ABN ROUTINE ADDRESS.
0054 7261 3377        DCA Z932
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0055 7262 1340        TAD Z888          /SET ABN ROUTINE EXIT ADDRESS.
0056 7263 3777        DCA I Z932
0057 7264 2377        ISZ Z932          /BUMP ABN ROUTINE ADDRESS.
0058 7265 1363        TAD Z908          /SET EXITING CDF-CIF INSTRUCTION.
0059 7266 6214        RDF
0060 7267 3324        DCA Z880
0061 7270 1363        TAD Z908          /SET DRIVER CDF-CIF INSTRUCTIONS.
0062 7271 6224        RIF
0063 7272 3343        DCA Z894
0064 7273 1343        TAD Z894
0065 7274 3275        DCA .+1
0066 7275 0000        0                 /CHANGE D.F. TO CURRENT I.F.
0067 7276 1371        TAD Z920          /LOAD TAPE COMMAND BIT.
0068 7277 7004        RAL               /ISOLATE WRITE-START BIT.
0069 7300 7700        SMA CLA           /TEST FOR WRITE REQUEST.
0070 7301 5304        JMP Z878          /IF NOT, TEST FOR BUSY.
0071 7302 4762        JMS I Z906        /TEST IF TAPE IS FILE-PROTECTED.
0072 7303 5324        JMP Z880          /IF SO, TAKE ABNORMAL EXIT.
0073 7304 7120 Z878,  STL               /SET LINK BIT ON.
0074 7305 4762        JMS I Z906        /TEST IF ANY TAPE IS BUSY.
0075 7306 5304        JMP Z878          /IF SO, WAIT.
0076 7307 4761        JMS I Z904        /EXIT TO USER IF OFF-LINE.
0077 7310 3334        DCA Z884          /CLEAR STATUS WORD.
0078 7311 1375        TAD Z928          /LOAD SELECTED-TAPE BITS.
0079 7312 7450        SNA               /TEST FOR NO TAPE BITS.
0080 7313 5324        JMP Z880          /IF SO, GO TAKE ABN EXIT.
0081 7314 1371        TAD Z920          /ISSUE TAPE-START COMMAND.
0082 7315 4347        JMS Z898
0083 7316 6024        6024
0084 7317 7006        RTL               /ISOLATE I-O START BITS.
0085 7320 7710        SPA CLA           /TEST FOR READ REQUEST.
0086 7321 5760        JMP I Z902        /IF SO, GO TO READ ROUTINE.
0087 7322 7430        SZL               /TEST FOR WRITE REQUEST.
0088 7323 5757        JMP I Z900        /IF SO, GO TO WRITE ROUTINE.
0089 7324 0000 Z880,  0                 /RESET USER FIELD NUMBER.
0090 7325 7420        SNL               /TEST FOR REJECT.
0091 7326 7440        SZA               /TEST FOR ABNORMAL STATUS.
0092 7327 5777        JMP I Z932        /IF EITHER, TAKE ABNORMAL EXIT.
0093 7330 5600        JMP I CFIO        /TAKE NORMAL OR EOF EXIT.
0094            /
0095            /CARTRIFILE END-OF-FILE ROUTINE.
0096            /
0097 7331 1376 Z882,  TAD Z930          /SET END-OF-FILE EXIT ADDRESS.
0098 7332 3200        DCA CFIO
0099 7333 5324        JMP Z880          /GO TAKE END-OF-FILE EXIT.
0100            /
0101            /CARTRIFILE SUBROUTINE TO RETRIEVE NEXT PARAMETER WORD.
0102            /
0103 7334 0000 Z884,  0
0104 7335 1600 Z886,  TAD I CFIO        /LOAD NEXT PARAMETER WORD.
0105 7336 2200        ISZ CFIO          /BUMP CALLING-SEQUENCE POINTER.
0106 7337 5734        JMP I Z884        /EXIT.
0107            /
0108            /CARTRIFILE SUBROUTINE TO LOAD OR STORE NEXT I-O WORD.
0109            /
```

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0110            Z888, *.+4
0111            Z890=.-3              /SET USER I-O FIELD NUMBER.
0112            Z892=.-2              /LOAD OR STORE NEXT I-O WORD.
0113            Z894=.-1              /RESET DRIVER FIELD NUMBER.
0114 7344 2373        ISZ Z924        /BUMP I-O ADDRESS.
0115 7345 6000 Z896,  6000            /(SPECIAL NO-OP).
0116 7346 5740        JMP I Z888      /EXIT.
0117            /
0118            /CARTRIFILE SUBROUTINE TO SET UP TAPE OPCODES.
0119            /
0120 7347 0000 Z898,  0
0121 7350 3340        DCA Z888        /SAVE A-C.
0122 7351 1747        TAD I Z898      /LOAD C-F OPCODE.
0123 7352 0364        AND Z909        /MASK OUT OLD ADDRESS.
0124 7353 1374        TAD Z926        /ADD IN NEW ADDRESS.
0125 7354 3747        DCA I Z898      /RESTORE C-F OPCODE.
0126 7355 1340        TAD Z888        /RELOAD A-C.
0127 7356 5747        JMP I Z898      /EXIT.
0128            /
0129            /CARTRIFILE PAGE 1 CONSTANTS AND DATA AREAS.
0130            /
0131 7357 7400 Z900,  Z934            /ADDRESS OF WRITE ROUTINE.
0132 7360 7430 Z902,  Z942            /ADDRESS OF READ ROUTINE.
0133 7361 7522 Z904,  Z964            /ADDRESS OF ON-LINE ROUTINE.
0134 7362 7533 Z906,  Z966            /ADDRESS OF READY ROUTINE.
0135 7363 6203 Z908,  6203            /SKELETON CDF-CIF INSTRUCTION.
0136 7364 6037 Z909,  6037            /C-F OPCODE MASK.
0137 7365 1773 Z910,  TAD I Z924      /I-O TAD INSTRUCTION.
0138 7366 0160 Z914,  0160            /CARTRIFILE NUMBER MASK.
0139 7367 0017 Z916,  0017            /SELECTED-TAPE BIT MASK.
0140 7370 0300 Z918,  0300            /BASE CARTRIFILE HARDWARE ADDR.
0141            Z920, *.+7            /I-O COMMAND BIT HOLDER.
0142            Z922=.-6              /I-O COUNT HOLDER.
0143            Z924=.-5              /I-O ADDRESS HOLDER.
0144            Z926=.-4              /CARTRIFILE ADDRESS HOLDER.
0145            Z928=.-3              /SELECTED-TAPE BIT HOLDER.
0146            Z930=.-2              /EOF ROUTINE ADDRESS HOLDER.
0147            Z932=.-1              /ABN ROUTINE ADDRESS HOLDER.
0148            /
0149            /CARTRIFILE WRITE ROUTINE.
0150            /
0151 7400 4305 Z934,  JMS Z960        /WAIT FOR 1ST DATA CALL.
0152 7401 1756        TAD I Z980      /LOAD I-O COUNT.
0153 7402 7640        SZA CLA         /TEST FOR WRITE-EOF REQUEST.
0154 7403 5206        JMP Z936        /IF NOT, WRITE 1ST WORD.
0155 7404 1363        TAD Z992        /LOAD EOF MARK.
0156 7405 5212        JMP Z938        /GO WRITE EOF MARK.
0157 7406 4752 Z936,  JMS I Z972      /GET NEXT OUTPUT WORD.
0158 7407 4305        JMS Z960        /WRITE NEXT WORD.
0159 7410 2756        ISZ I Z980      /BUMP I-O COUNT.
0160 7411 5217        JMP Z940        /IF NON-ZERO, TEST FOR L-P.
0161 7412 4305 Z938,  JMS Z960        /WRITE LAST WORD.
0162 7413 7130        STL RAR         /ISSUE WRITE-STOP COMMAND.
0163 7414 4753        JMS I Z974
0164 7415 6024        6024
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0165 7416 5310        JMP Z962        /GO WAIT FOR END OF RECORD.
0166 7417 4753 Z940,  JMS I Z974      /GET LOADPOINT FLAG.
0167 7420 6015        6015
0168 7421 0757        AND I Z982
0169 7422 7650        SNA CLA         /TEST IF TAPE HAS HIT L-P.
0170 7423 5206        JMP Z936        /IF NOT, WRITE NEXT WORD.
0171 7424 7132        STL RTR         /SET EOT STATUS BIT.
0172 7425 3754        DCA I Z976
0173 7426 7040        CMA             /SET A-C TO -1.
0174 7427 5212        JMP Z938        /GO TERMINATE RECORD.
0175            /
0176            /CARTRIFILE READ ROUTINE.
0177            /
0178 7430 3333 Z942,  DCA Z966        /CLEAR NEXT-WORD HOLDER.
0179 7431 4305        JMS Z960        /WAIT FOR 1ST DATA CALL.
0180 7432 4753 Z944,  JMS I Z974      /READ & STORE NEXT WORD.
0181 7433 6034        6034
0182 7434 3333        DCA Z966
0183 7435 4305        JMS Z960        /WAIT FOR NEXT DATA CALL.
0184 7436 1756        TAD I Z980      /LOAD I-O COUNT.
0185 7437 7640        SZA CLA         /TEST FOR OVERSIZE RECORD.
0186 7440 5244        JMP Z946        /IF NOT, STORE NEXT WORD.
0187 7441 1362        TAD Z990        /SET W.L.R. STATUS BIT.
0188 7442 3754        DCA I Z976
0189 7443 5232        JMP Z944        /GO READ NEXT WORD.
0190 7444 1333 Z946,  TAD Z966        /STORE CURRENT WORD IN I-O AREA.
0191 7445 4752        JMS I Z972
0192 7446 2756        ISZ I Z980      /BUMP I-O COUNT.
0193 7447 6000 Z948,  6000            /(SPECIAL NO-OP).
0194 7450 5232        JMP Z944        /GO READ NEXT WORD.
0195            /
0196            /CARTRIFILE END-OF-RECORD ROUTINE.
0197            /
0198 7451 4322 Z950,  JMS Z964        /EXIT TO USER IF OFF-LINE.
0199 7452 1755        TAD I Z978      /LOAD I-O COMMAND BIT.
0200 7453 7006        RTL             /ISOLATE READ-START BIT.
0201 7454 7700        SMA CLA         /TEST FOR READ REQUEST.
0202 7455 5273        JMP Z956        /IF NOT, TEST RESIDUAL COUNT.
0203 7456 4753        JMS I Z974      /GET RECORD-ERROR FLAG.
0204 7457 6012        6012
0205 7460 0247        AND Z948
0206 7461 7440        SZA             /TEST FOR RECORD-ERROR.
0207 7462 5271        JMP Z954        /IF SO, SET ERROR STATUS.
0208 7463 1333        TAD Z966        /LOAD LAST INPUT WORD.
0209 7464 7450        SNA             /TEST FOR EOF OR EOT.
0210 7465 5273        JMP Z956        /IF NOT, TEST RESIDUAL COUNT.
0211 7466 7700        SMA CLA         /TEST FOR END-OF-FILE.
0212 7467 5760        JMP I Z984      /IF SO, SET UP EOF EXIT.
0213 7470 7132        STL RTR         /SET END-OF-TAPE STATUS BIT.
0214 7471 1754 Z954,  TAD I Z976
0215 7472 3754        DCA I Z976
0216 7473 1756 Z956,  TAD I Z980      /LOAD I-O COUNT.
0217 7474 7161        STL CIA         /COMPLEMENT COUNT.
0218 7475 7450        SNA             /TEST FOR SHORT RECORD.
0219 7476 5303        JMP Z958        /IF NOT, LOAD STATUS WORD.
```

```
0220 7477 1364          TAD Z994        /ADD -511.
0221 7500 7420          SNL             /TEST FOR RESIDUAL COUNT OVER 511.
0222 7501 7200          CLA             /IF SO, CLEAR A-C.
0223 7502 1361          TAD Z988        /SET UP W.L.R. STATUS BITS.
0224 7503 1754 Z958,    TAD I Z976      /LOAD STATUS WORD.
0225 7504 5751          JMP I Z970      /GO EXIT.
0226                    /
0227                    /CARTRIFILE SUBROUTINE TO WAIT FOR DATA CALLS.
0228                    /
0229 7505 0000 Z960,    0
0230 7506 4753          JMS I Z974      /WRITE NEXT WORD.
0231 7507 6034          6034
0232 7510 4753 Z962,    JMS I Z974      /GET I-O MODE BIT.
0233 7511 6013          6013
0234 7512 7040          CMA
0235 7513 7006          RTL
0236 7514 7630          SZL CLA         /TEST FOR END OF RECORD.
0237 7515 5251          JMP Z950        /IF SO, GO TO END-OF-RECORD RTN.
0238 7516 4753          JMS I Z974      /TEST FOR NEXT DATA CALL.
0239 7517 6032          6032
0240 7520 5310          JMP Z962        /IF NOT, WAIT.
0241 7521 5705          JMP I Z960      /EXIT.
0242                    /
0243                    /CARTRIFILE SUBROUTINE TO TEST FOR ON-LINE STATUS.
0244                    /
0245 7522 0000 Z964,    0
0246 7523 4753          JMS I Z974      /GET ON-LINE STATUS BITS.
0247 7524 6013          6013
0248 7525 7040          CMA             /GET NOT-ON-LINE BITS.
0249 7526 0757          AND I Z982      /MASK WITH SELECTED-TAPE BITS.
0250 7527 7450          SNA             /TEST IF ALL TAPES ARE ON-LINE.
0251 7530 5722          JMP I Z964      /IF SO, EXIT.
0252 7531 1247          TAD Z948        /SET OFF-LINE STATUS BITS.
0253 7532 5751          JMP I Z970      /GO TAKE ABNORMAL EXIT.
0254                    /
0255                    /CARTRIFILE SUBROUTINE TO TEST FOR READY STATUS.
0256                    /
0257 7533 0000 Z966,    0
0258 7534 4753          JMS I Z974      /GET C-F TAPES STATUS.
0259 7535 6015          6015
0260 7536 7420          SNL             /TEST FOR FILE-PROTECT REQUEST.
0261 7537 5342          JMP Z968        /IF SO, SKIP 1ST 4 ROTATES.
0262 7540 7012          RTR             /GET STATUS IN LOW-ORDER A-C.
0263 7541 7012          RTR
0264 7542 7012 Z968,    RTR
0265 7543 7012          RTR
0266 7544 7120          STL             /SET LINK BIT ON.
0267 7545 0757          AND I Z982      /MASK OFF SELECTED-TAPE BITS.
0268 7546 7450          SNA             /TEST IF ALL TAPES ARE READY.
0269 7547 2333          ISZ Z966        /IF SO, BUMP RETURN ADDRESS.
0270 7550 5733          JMP I Z966      /EXIT.
0271                    /
0272                    /CARTRIFILE PAGE 2 CONSTANTS AND DATA AREAS.
0273                    /
0274 7551 7324 Z970,    Z880            /ADDRESS OF EXIT ROUTINE.
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0275 7552 7340 Z972,    Z888            /ADDRESS OF DATA I-O ROUTINE.
0276 7553 7347 Z974,    Z898            /ADDRESS OF OPCODE ROUTINE.
0277 7554 7334 Z976,    Z884            /ADDRESS OF STATUS WORD.
0278 7555 7371 Z978,    Z920            /ADDRESS OF I-O COMMAND BIT.
0279 7556 7372 Z980,    Z922            /ADDRESS OF I-O COUNT.
0280 7557 7375 Z982,    Z928            /ADDRESS OF SELECTED-TAPE BITS.
0281 7560 7331 Z984,    Z882            /ADDRESS OF EOF ROUTINE.
0282 7561 1777 Z988,    1777            /CONSTANT +1023.
0283 7562 1000 Z990,    1000            /W.L.R. STATUS BIT.
0284 7563 0017 Z992,    0017            /END-OF-FILE MARK.
0285 7564 7001 Z994,    7001            /CONSTANT -511.
```

P R O G R A M C O R R E C T I O N

It has been noted that the teletype control card used by PDP-8E, PDP-8F, and PDP-8M computers is not absolutely compatible with older PDP-8 teletype control cards. The I-O instruction used by Tri-Data 8-006B-BIN to test for and ignore a keyboard interrupt (6033 = KSF KCC) does not function on the above PDP-8 models. The following modifications are required to correct this situation:

```
0176 6032 A435, KCC       /RESET KEYBOARD.
0177 5012       JMP A025  /GO EXIT.
  ≀    ≀         ≀
2521 6031       KSF       /TEST KEYBOARD.
  ≀    ≀         ≀
2523 5176       JMP A435  /GO RESET KEYBOARD.
```

All binary paper tapes of Tri-Data 8-006B-BIN and all P100A magnetic-tape program packages supplied by Tri-Data after April 10, 1972 will contain the above modifications so that users need not "patch" the program.

TRI-DATA 8-006B-BIN CARTRIFILE DIAGNOSTIC PROGRAM 10501-003

PURPOSE

This program is the primary diagnostic aid for Tri-Data CartriFile magnetic tape units interfaced to all models of the DEC PDP-8 computers.

DESCRIPTION

The Tri-Data CartriFile Diagnostic program verifies the correct operation of CartriFiles and their interfaces by performing a write/read cycle using the PDP-8 computer. The diagnostic simultaneously tests up to seven CartriFiles under interrupt control and will log all diagnostic messages on the teletype. Any combination of Model 20/40, 4096/4196, or 1024/1124 CartriFiles may be tested simultaneously.

The program first interrogates all CartriFile interface addresses to determine whether or not a CartriFile with one or more active tapes is present. Model 20/40 CartriFile tapes that are not on-line or Model 4096/4196/1024/1124 tapes that are file-protected will *not* be tested. Any CartriFiles that are turned off or in LOCAL mode will be ignored.

The program then types its title and "PASS 0000." and writes a constant worst-case data pattern across the entire length of each active tape. Corresponding tapes in different CartriFiles will be written simultaneously (i.e., all tape 1's followed by all tape 2's, etc.). Both the length and content of the records may be set as desired by making appropriate modifications to the program, as explained below. Data are output as a string of 12-bit words with the first word of each record containing the binary record number. At the end of pass 0, the record number of the last record written on each tape will be logged on the teletype.

When pass 0 is completed, the program will begin a specified number of read passes; the number of read passes may be set as explained below. For each read pass, all active tapes will be read across their entire lengths, and the data from each record (including record numbers) will be checked for errors. Corresponding tapes in different CartriFiles will be read simultaneously. An error message will be logged for any input record on which either a data-comparison error or CartriFile record-error is detected.

The program may be set to stop at the end of all desired read passes or to continue write/read cycles indefinitely through a switch option. The program may be restarted at any time and will redetermine which CartriFile tapes are active upon being restarted or upon beginning a new write/read cycle.

HARDWARE REQUIREMENTS

1. Any PDP-8 computer with 4096 words of storage. Additional features such as EAE, data-break, etc. are *not* required.

2. An ASR- or KSR-series teletype (or any teletype-compatible printing device) having the standard PDP-8 teletype interface (I-O address 04).

3. Up to seven CartriFile magnetic tape units to be tested. Each CartriFile will be assigned a letter code by the program corresponding to its hardware interface addresses. Allowable interface addresses are as follows:

CartriFile	Interface Addresses
A	30-33
B	40-43
C	50-53
D	60-63
E	64-67
F	70-73
G	74-77

RESTRICTIONS

There are no restrictions on the use of this program *except* when it is used on a PDP-8S computer. PDP-8S users may test only *one* 4096 or 1024 CartriFile. The CartriFile *must* have an interface wired to I-O address 30-33. In addition, the following modifications must be made to the program:

Location 2077:	5711	Location 2213:	5351
2103:	5011	2223:	5012
2107:	5011	2226:	5012
2111:	2351	2432:	5321

It is suggested that PDP-8S users make these modifications and then use the Digital 8-5-U-BIN Binary Punch Program to punch a new binary tape of Tri-Data 8-006B-BIN. Using the tape so prepared will preclude the necessity of making these modifications continually.

OPERATING INSTRUCTIONS

1. Load the CartriFile Diagnostic Program from paper tape using the DEC binary loader or from a CartriFile program cartridge using the CartriFile RIM loader.

2. Place the teletype in LINE mode and make ready all CartriFiles and tapes to be tested.

3. Set locations 0136-0141 if any non-standard program options are desired (see below).

4. Set the computer switch register to 0200 and press LOAD ADDR.

5. Make any desired switch option settings (see below).

6. Press START, and the program will begin. Note that the program may be stopped and restarted at any time without being reloaded.

PROGRAM OPTIONS

Location 0136 contains the binary number of read passes to be executed during each write/read cycle. This may be set between 0000 and 7777

octal (0-4095 read passes; standard is 6).

0137 contains the loadpoint-search time limit in seconds (binary). This may be set between 0017 and 7777 octal (15-4095 seconds; standard is 300 seconds, or 5 minutes).

0140 contains the binary number of tolerable read errors per tape for each read pass. This may be set between 0001 and 3777 octal (1-2047 errors; standard is 4).

0141 contains the binary number of 12-bit words to be read or written in each I-O record. This may be set between 0001 and 0066 octal (1-54 words per record; standard is 54).

SWITCH OPTIONS

Switch 6 and 7 control the type of input record-error message, as follows:

Sw. 6	Sw. 7	Message
Off	Off	Standard error message.
Off	On	First line of standard error message.
On	Off	One "bell" code.
On	On	*No* message.

Note also that if switch 6 is on, an unlimited number of errors will be allowed for each tape.

Switch 8 requests a halt before reading or writing tape 2, 3, or 4. Cartridges may be interchanged if desired when the halt is taken.

Switch 9 requests a halt before beginning the next pass. Cartridges may be interchanged if desired when the halt is taken.

Switch 10 requests an immediate I-O halt. No further reading or writing will be initiated, and the computer will quiesce to a stop. As long as switch 10 in on, pressing CONTINUE causes a single additional record to be read or written on each active CartriFile. Full-speed operation will resume when switch 10 is turned off and CONTINUE is pressed.

Switch 11 requests a halt at the end of each write/read cycle (i.e., when all desired read passes have been completed). It also prevents certain errors at the *start* of a pass from causing a tape to be disabled. The general function of switch 11 is to indicate that an operator is present to monitor the program; for continuous unattended operation (i.e., overnight runs), switch 11 *must* be turned off.

Note that for any halt request, the computer will not actually halt until all pending teletype messages have been printed.

ERROR MESSAGES

All error messages are prefixed by the letter T, the number of the tapes involved, and the letter code of the CartriFile involved. Thus, a message prefixed by T34C indicates that the message applies to tapes 3 and 4 of CartriFile C. Error

messages typed by this program are as follows:

TnX FOUND NO L/P. A tape that was searching for loadpoint exceeded the loadpoint-search time limit, or a tape attempted to read or write more than 4095 records. This usually means that the loadpoint photosense circuitry is maladjusted. The tape will be disabled *unless* this occurs at the beginning of a pass *and* switch 11 is on, in which case the program will halt to allow the operator to correct the situation before proceeding.

TnX NOT READY. A tape appears busy to the program when the program expected it to be stopped. The tape either has gone off-line or has had a circuitry failure. The tape will be disabled except as described above.

TnX FILE-PROTECTED. A tape has become file-protected during the write pass. The tape will be disabled except as described above.

TnX NOT ON LINE. A Model 20/40 tape has gone off-line during an I-O pass. The tape will be disabled except as described above.

TnX FLASHED L/P. A tape has detected loadpoint during the reading or writing of a record, but the loadpoint indication was not present at the completion of reading or writing.

TnX READ OVER L/P. A tape has input a record numbered 0001 at some time other than at the beginning of reading the tape. This is caused either by a read error or by the tape failing to find loadpoint while reading. The tape will not be read further until the next read pass.

TnX STOPPED; TOO MANY ERRORS. This message is typed when the number of read errors reaches the tolerable limit for a tape. The tape will not be read further until the next read pass.

TnX TIMED OUT. A tape that was reading or writing has gone more than 3 seconds without a read-record-complete or write-record-complete signal being generated. This denotes serious CartriFile problems. The tape will always be disabled from any further activity.

TnX FAILED TO START I-O. A tape has been given a write-start or read-start command and has failed to start writing or reading (i.e., write-ready or read-ready is still present). This denotes serious internal problems. The tape will always be disabled from any further activity.

```
TnX Rnnnn:  LW=nnnn CE=nnnn RE=nnnn
 nnnn 0000 0003 0014 0060 0077 0140 0220 0300 0360 0410
 1004 1400 1463 1777 2002 2525 2526 2531 2545 2552 2625
 2645 3125 3146 3252 3637 3776 4001 4525 4631 4652 5132
 5152 5225 5232 5246 5251 5252 5775 6000 6314 6337 6773
 7367 7417 7477 7557 7700 7717 7763 7774 7777 7763 XXXX
```

This is the standard format of a read-error message. Rnnnn gives the record number; LW indicates the last word read from the tape; CE gives the number of comparison errors between the standard output data (shown above) and what

was actually read; and RE gives the state of the CartriFile record-error flag. An octal dump of all input words will be printed as shown above for each error record with XXXX denoting a word that was not read. Note that since the program always allows for one extra input word per record, the last word of each read-error message should be XXXX unless the input record overflows. For such overflow records, the *last* input word will be printed in place of the final XXXX. Also note that the recorded record number appears as word 1 of the octal dump.

TnX LR=nnnn. This message is output for each tape at the end of pass 0. It gives the octal number of the last record written on the tape. During all input passes, if a read-error is detected on a record whose record number is higher than the last-record number, the indicated tape has failed to sense loadpoint correctly. When standard-size records of 54 words each are written, the last-record number may be converted to decimal and multiplied by 0.1141 (4096/1024) or 0.0483 (all other CartriFiles) to obtain the tape length in feet (±5%).

TAPE DISABLED. This message accompanies any of the above error messages when the program is disabling the bad tape from further activity.

NO C/F ACTIVE. This message is typed when the program determines that no CartriFile is available for further testing. The diagnostic run is considered terminated, and the program will proceed to its end-of-job routines. A *forced* halt will occur if such a termination occurs before the start of pass 2.

```
PAGE 0001
0001            /TRI-DATA 8-006B-BIN CARTRIFILE DIAGNOSTIC.
0002            /IOT OPCODE DEFINITIONS.
0003            /
0004            A=300; B=400; C=500; D=600; E=640; F=700; G=740
0005            ION=6001; IOF=6002; OTSB1=6002; OTSA1=6004; SLPA=6011
0006            OTSB=6012; RRB=6012; WSPC=6012; ACMD1=6014; OTSA=6014
0007            SWWC=6021; PCF=6022; RSFF=6022; SCSC=6022; ACMD=6024
0008            LTB=6024; KSF=6031; KCC=6032; SDCL=6032; SRWC=6032
0009            OTB=6034; TSF=6041; TCF=6042; TLS=6046; FIXTAB
0010            /
0011            /INTERRUPT LINKAGES.
0012            /
0013 0001 3007 *1;    DCA A010          /ENTRY -- SAVE A-C.
0014 0002 7004        RAL               /SAVE LINK BIT.
0015 0003 3010        DCA A015
0016 0004 5405        JMP I A005        /GO TO INTERRUPT ROUTINES.
0017
0018            A005, *.+4              /ADDRESS OF INTERRUPT ROUTINES.
0019            A007=.-3                /INTERRUPT WORK REGISTER.
0020            A010=.-2                /INTERRUPT A-C HOLDER.
0021            A015=.-1                /INTERRUPT LINK HOLDER.
0022
0023 0011 7200 A020, CLA                /EXIT -- CLEAR A-C.
0024 0012 1010 A025, TAD A015           /RELOAD LINK BIT.
0025 0013 7110        CLL RAR
0026 0014 1007        TAD A010          /RELOAD A-C.
0027 0015 6001        ION               /ENABLE INTERRUPTS.
0028 0016 5400        JMP I 0           /RETURN TO MAIN PROGRAM.
0029            /
0030            /WORKING REGISTERS.
0031            /
0032            A030, *.+20             /WORK REGISTER 1.
0033            A035=.-17               /WORK REGISTER 2.
0034            A040=.-16               /WORK REGISTER 3.
0035            A045=.-15               /WORK REGISTER 4.
0036            A050=.-14               /WORK REGISTER 5.
0037            A055=.-13               /WORK REGISTER 6.
0038            A060=.-12               /WORK REGISTER 7.
0039            A065=.-11               /WORK REGISTER 8.
0040            /
0041            /CARTRIFILE CONTROL TABLE WORKAREA.
0042            /
0043            A070=.-10               /TABLE IDENTIFIER WORD.
0044            A075=.-7                /PERMANENT I-O BUFFER ADDRESS.
0045            A080=.-6                /ACTIVITY FLAG & RERR COUNT.
0046            A085=.-5                /TIMEOUT COUNTER.
0047            A090=.-4                /DETECTED L-P BITS.
0048            A095=.-3                /CURRENT I-O RECORD NUMBER.
0049            A100=.-2                /CURRENT I-O BUFFER POINTER.
0050            A105=.-1                /CURRENT I-O BUFFER COUNT.
0051            /
0052            /CARTRIFILE CONTROL TABLES.
0053            /
0054 0037 0140        0140              /C-F A IDENTIFIER WORD.
0055 0040 2737        D020              /I-O ADDRESS.
0056            A110, *.+6              /ACTIVITY FLAG.
0057            A115=.-4                /DETECTED L-P BITS.
0058            A120=.-2                /I-O POINTER.
0059            A125=.-1                /I-O COUNT.
0060
0061 0047 0600        0600              /C-F B IDENTIFIER WORD.
0062 0050 3026        D020+67           /I-O ADDRESS.
0063            A130, *.+6              /ACTIVITY FLAG.
0064            A135=.-4                /DETECTED L-P BITS.
0065            A140=.-2                /I-O POINTER.
0066            A145=.-1                /I-O COUNT.
0067
0068 0057 1240        1240              /C-F C IDENTIFIER WORD.
0069 0060 3115        D020+156          /I-O ADDRESS.
0070            A150, *.+6              /ACTIVITY FLAG.
0071            A155=.-4                /DETECTED L-P BITS.
0072            A160=.-2                /I-O POINTER.
0073            A165=.-1                /I-O COUNT.
0074
0075 0067 1700        1700              /C-F D IDENTIFIER WORD.
0076 0070 3204        D020+245          /I-O ADDRESS.
0077            A170, *.+6              /ACTIVITY FLAG.
0078            A175=.-4                /DETECTED L-P BITS.
0079            A180=.-2                /I-O POINTER.
0080            A185=.-1                /I-O COUNT.
0081
0082 0077 2320        2320              /C-F E IDENTIFIER WORD.
0083 0100 3273        D020+334          /I-O ADDRESS.
0084            A190, *.+6              /ACTIVITY FLAG.
0085            A195=.-4                /DETECTED L-P BITS.
0086            A200=.-2                /I-O POINTER.
0087            A205=.-1                /I-O COUNT.
0088
0089 0107 2740        2740              /C-F F IDENTIFIER WORD.
0090 0110 3362        D020+423          /I-O ADDRESS.
0091            A210, *.+6              /ACTIVITY FLAG.
0092            A215=.-4                /DETECTED L-P FLAGS.
0093            A220=.-2                /I-O POINTER.
0094            A225=.-1                /I-O COUNT.
0095
0096 0117 3360        3360              /C-F G IDENTIFIER WORD.
0097 0120 3451        D020+512          /I-O ADDRESS.
0098            A230, *.+15             /ACTIVITY FLAG.
0099            A235=.-13               /DETECTED L-P BITS.
0100            A240=.-11               /I-O POINTER.
0101            A245=.-10               /I-O COUNT.
0102            /
0103            /LOW-CORE CONSTANTS AND DATA AREAS.
0104            /
0105            A250=.-7                /PASS NUMBER.
0106            A255=.-6                /ACTIVE TAPE BIT HOLDER.
0107            A260=.-5                /ACTIVITY FLAG.
0108            A265=.-4                /ERROR, HALT FLAG.
0109            A270=.-3                /CURRENT C-F TABLE POINTER.
0110            A275=.-2                /MESSAGE BUFFER POINTER.
0111            A280=.-1                /TELEPRINTER BUFFER POINTER.
0112 0136 0006 A285, 0006               /NUMBER OF READ PASSES.
0113 0137 0454 A290, 0454               /LOADPOINT-SEARCH TIME LIMIT.
0114 0140 0004 A295, 0004               /NUMBER OF READ ERRORS PER TAPE.
0115 0141 0066 A300, 0066               /NUMBER OF WORDS PER I-O RECORD.
0116 0142 0027 A305, A070               /C-F WORKAREA ADDRESS.
0117 0143 0403 A310, B145               /READ-WRITE SUBROUTINE ADDRESS.
0118 0144 1362 A315, B530               /HALT SUBROUTINE ADDRESS.
0119 0145 1400 A320, B540               /READY-TAPES SUBROUTINE ADDRESS.
0120 0146 1470 A325, B575               /MSG-OUTPUT SUBROUTINE ADDRESS.
0121 0147 1550 A330, B610               /OCTAL-OUTPUT SUBROUTINE ADDRESS.
0122 0150 1600 A335, B640               /ERROR-MSG SUBROUTINE ADDRESS.
0123 0151 1673 A340, B675               /ACCESS SUBROUTINE ADDRESS.
0124 0152 1717 A345, B685               /RESTORE SUBROUTINE ADDRESS.
0125 0153 1730 A350, B690               /MOVE SUBROUTINE ADDRESS.
0126 0154 1740 A360, B700               /6-BIT STORE SUBROUTINE ADDRESS.
0127 0155 2024 A365, B765               /6-BIT LOAD SUBROUTINE ADDRESS.
0128 0156 2042 A370, B775               /C-F OPCODE SUBROUTINE ADDRESS.
0129 0157 2055 A375, B785               /BIT-CHANGE SUBROUTINE ADDRESS.
0130 0160 2651 A380, D015               /CONSTANT I-O DATA ADDRESS.
0131 0161 3537 A385, D020+600           /RECORD COUNTERS ADDRESS -1.
0132 0162 7400 A390, D025               /MESSAGE DATA BASE ADDRESS.
0133 0163 0560 A395, D120               /STARTING TELEPRINTER BUFFER ADDR.
0134 0164 0400 A397, 0400               /MODEL 20-40 L-P SEARCH BIT.
0135 0165 0360 A400, 0360               /C-F OPCODE MASK.
0136 0166 0077 A405, 0077               /6-BIT CHARACTER MASK.
0137 0167 0066 A407, 0066               /CONSTANT +54.
0138 0170 0060 A410, 0060               /6-BIT ASCII ZERO.
0139 0171 0040 A415, 0040               /6-BIT ASCII SPACE.
0140 0172 0017 A420, 0017               /TAPE BITS MASK.
0141 0173 0007 A425, 0007               /OCTAL DIGIT MASK.
0142 0174 0004 A427, 0004               /CONSTANT +4.
0143 0175 7774 A430, 7774               /CONSTANT -4.
0144            /
0145            /MAIN CONTROL ROUTINE.
0146            /
0147 0200 6002 *200;  IOF               /RESET INTERRUPTS.
0148 0201 6002        IOF
0149 0202 6022        PCF               /RESET NON-CARTRIFILE I-O FLAGS.
0150 0203 6042        TCF
0151 0204 6012        RRB
0152 0205 6032        KCC
0153 0206 1141        TAD A300          /LOAD I-O WORD COUNT.
0154 0207 7450        SNA               /TEST FOR ZERO WORD COUNT.
0155 0210 2141        ISZ A300          /IF SO, SET WORD COUNT TO 1.
0156 0211 7140        CLL CMA           /COMPLEMENT WORD COUNT.
0157 0212 1167        TAD A407          /ADD +54.
0158 0213 7630        SZL CLA           /TEST FOR WORD COUNT OVER 54.
0159 0214 5217        JMP B005          /IF NOT, GO CLEAR BUFFER PTRS.
0160 0215 1167        TAD A407          /SET I-O WORD COUNT TO 54.
0161 0216 3141        DCA A300
0162 0217 1142 B005,  TAD A305          /RESET C-F TABLE POINTER.
0163 0220 3133        DCA A270
0164 0221 1163        TAD A395          /RESET MESSAGE BUFFER POINTER.
0165 0222 3134        DCA A275
0166 0223 3135        DCA A280          /RESET TELEPRINTER BUFFER POINTER.
0167 0224 3127 B010,  DCA A250          /RESET PASS NUMBER.
0168 0225 1375        TAD B110          /SET INTERRUPT OPCODE POINTER.
0169 0226 3017        DCA A030
0170 0227 4551 B015,  JMS I A340        /ACCESS NEXT C-F TABLE.
0171 0230 5311        JMP B050          /AT END, GO ENABLE INTERRUPTS.
0172 0231 1027        TAD A070          /CLEAR C-F TYPE & SELECTED TAPES.
0173 0232 0376        AND B115
0174 0233 3027        DCA A070
0175 0234 1027        TAD A070          /ISOLATE C-F HARDWARE ADDRESS.
0176 0235 0165        AND A400
0177 0236 7450        SNA               /TEST IF THIS TABLE IS ACTIVE.
0178 0237 5256        JMP B020          /IF NOT, GO CLEAR ADDRESS HOLDER.
0179 0240 7104        CLL RAL           /STORE C-F HARDWARE ADDRESS.
0180 0241 3020        DCA A035
0181 0242 4556        JMS I A370        /GET NEW C-F STATUS BITS.
0182 0243 6012        OTSB
0183 0244 0172        AND A420          /MASK OFF ON-LINE BITS.
0184 0245 7440        SZA               /TEST IF ANY TAPE IS ON-LINE.
0185 0246 5262        JMP B030          /IF SO, GO STORE SELECT BITS.
0186 0247 4556        JMS I A370        /GET OLD C-F STATUS BITS.
0187 0250 6004        OTSA1
0188 0251 7012        RTR               /MASK OFF WRITE-READY BITS.
0189 0252 7012        RTR
0190 0253 4557        JMS I A375
0191 0254 7440        SZA               /TEST IF ANY TAPE IS WRITE-READY.
0192 0255 5260        JMP B025          /IF SO, GO SET 4096-4196 FLAG.
0193 0256 3020 B020,  DCA A035          /CLEAR HARDWARE ADDRESS HOLDER.
0194 0257 5264        JMP B035          /GO CLEAR I-O COMMANDS.
0195 0260 7104 B025,  CLL RAL           /SET 4096-4196 C-F TYPE FLAG.
0196 0261 7130        STL RAR
0197 0262 1027 B030,  TAD A070          /STORE C-F TYPE & SELECTED TAPES.
0198 0263 3027        DCA A070
0199 0264 4552 B035,  JMS I A345        /RESTORE C-F TABLE.
0200 0265 1027        TAD A070          /LOAD C-F IDENTIFIER WORD.
0201 0266 7700        SMA CLA           /TEST FOR MODEL 4096-4196.
0202 0267 5274        JMP B040          /IF NOT, LOAD NEW C-F TABLE PTR.
0203 0270 1377        TAD B120          /RESET 4096-4196 I-O FLAGS.
0204 0271 4556        JMS I A370
0205 0272 6022        RSFF
0206 0273 1374        TAD B105          /LOAD OLD OPCODE TABLE ADDRESS.
0207 0274 1373 B040,  TAD B100          /LOAD NEW OPCODE TABLE ADDRESS.
0208 0275 3021        DCA A040          /STORE SKELETON-OPCODE TABLE PTR.
0209 0276 1421 B045,  TAD I A040        /LOAD NEXT SKELETON OPCODE.
0210 0277 7650        SNA CLA           /TEST FOR END OF OPCODE TABLE.
0211 0300 5227        JMP B015          /IF SO, GO ACCESS NEXT TABLE.
0212 0301 1417        TAD I A030        /STORE NEXT OPCODE POINTER.
0213 0302 3022        DCA A045
0214 0303 1020        TAD A035          /LOAD C-F HARDWARE ADDRESS.
0215 0304 7440        SZA               /TEST IF THIS C-F IS ACTIVE.
0216 0305 1421        TAD I A040        /IF SO, ADD C-F OPCODE.
0217 0306 3422        DCA I A045        /STORE ZERO OR C-F OPCODE.
0218 0307 2021        ISZ A040          /BUMP SKELETON-OPCODE TABLE PTR.
0219 0310 5276        JMP B045          /LOOP UNTIL END OF TABLE.
```

```
0220 0311 1371 B050, TAD B090        /SET WRITE INTERRUPT ENTRY.
0221 0312 3005      DCA A005
0222 0313 6001      ION              /ENABLE INTERRUPTS.
0223 0314 4546      JMS I A325       /TYPE TITLE MESSAGE.
0224 0315 0000      D030+D030-D025
0225 0316 4543      JMS I A310       /EXECUTE WRITE PASS.
0226 0317 1372      TAD B095         /SET READ INTERRUPT ENTRY.
0227 0320 3005      DCA A005
0228 0321 1161      TAD A385         /SET UP RECORD COUNTERS POINTER.
0229 0322 3021      DCA A040
0230 0323 4551 B055, JMS I A340      /ACCESS NEXT C-F TABLE.
0231 0324 5355      JMP B075         /AT END, GO TEST PASS NUMBER.
0232 0325 1027      TAD A070         /LOAD C-F IDENTIFIER WORD.
0233 0326 0172      AND A420         /MASK OFF SELECTED-TAPE BITS.
0234 0327 7650      SNA CLA          /TEST FOR ANY SELECTED TAPES.
0235 0330 5333      JMP B060         /IF NOT, GO INITIALIZE SCAN BIT.
0236 0331 4546      JMS I A325       /TYPE LINE-FEED.
0237 0332 0452      D100+D100-D025
0238 0333 7124 B060, STL RAL         /INITIALIZE TAPE-SCAN BIT.
0239 0334 3130 B065, DCA A255        /STORE TAPE-SCAN BIT.
0240 0335 2021      ISZ A040         /BUMP RECORD-COUNTERS POINTER.
0241 0336 1421      TAD I A040       /CONVERT RECORD NUMBER TO OCTAL.
0242 0337 4547      JMS I A330
0243 0340 0410      D085+D085+2-D025
0244 0341 1027      TAD A070         /LOAD C-F IDENTIFIER WORD.
0245 0342 0130      AND A255         /MASK OFF CURRENT TAPE BIT.
0246 0343 7650      SNA CLA          /TEST IF THIS TAPE IS ACTIVE.
0247 0344 5347      JMP B070         /IF NOT, GO ROTATE TAPE BIT.
0248 0345 4550      JMS I A335       /TYPE LAST-RECORD MESSAGE.
0249 0346 2405      D085+D085+1777-D025
0250 0347 1130 B070, TAD A255        /LOAD TAPE-SCAN BIT.
0251 0350 7104      CLL RAL          /ROTATE BIT 1 PLACE LEFT.
0252 0351 0172      AND A420         /MASK OFF VALID TAPE BITS.
0253 0352 7440      SZA              /TEST FOR ANY REMAINING BITS.
0254 0353 5334      JMP B065         /IF SO, GO STORE SCAN BIT.
0255 0354 5323      JMP B055         /GO ACCESS NEXT TABLE.
0256 0355 1136 B075, TAD A285        /LOAD PASS NUMBER LIMIT.
0257 0356 7041      CIA              /COMPLEMENT PASS LIMIT.
0258 0357 1127      TAD A250         /ADD CURRENT PASS NUMBER.
0259 0360 2127      ISZ A250         /BUMP CURRENT PASS NUMBER.
0260 0361 7650      SNA CLA          /TEST FOR END OF JOB.
0261 0362 5365      JMP B080         /IF SO, GO TYPE END-OF-JOB MSG.
0262 0363 4543      JMS I A310       /EXECUTE NEXT READ PASS.
0263 0364 5355      JMP B075         /GO TEST PASS NUMBER AGAIN.
0264 0365 4546 B080, JMS I A325      /TYPE END-OF-JOB MESSAGE.
0265 0366 0121      D040+D040-1-D025
0266 0367 4544 B085, JMS I A315      /TAKE CONDITIONAL HALT.
0267 0370 5224      JMP B010         /GO START OVER.
0268
0269 0371 2075 B090, C005            /WRITE INTERRUPT ENTRY ADDRESS.
0270 0372 2212 B095, C175            /READ INTERRUPT ENTRY ADDRESS.
0271 0373 2526 B100, D005            /MODEL 20-40 OPCODE TABLE ADDR.
0272 0374 5311 B105, -2501+12        /4096-4196 OPCODE TABLE OFFSET.
0273 0375 2551 B110, D010-1          /INTERRUPT OPCODE TABLE ADDRESS.
0274 0376 3760 B115, 3760            /C-F IDENTIFIER WORD MASK.
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0330 0463 1130      TAD A255         /LOAD ACTIVE-TAPE BIT.
0331 0464 7010      RAR              /ROTATE BIT 1 PLACE RIGHT.
0332 0465 7620      SNL CLA          /TEST FOR OTHER THAN TAPE 1.
0333 0466 5341      JMP B210         /IF SO, GO SET UP C-F TABLE.
0334 0467 1027 B185, TAD A070        /LOAD C-F IDENTIFIER WORD.
0335 0470 0172      AND A420         /MASK OFF SELECTED-TAPE BITS.
0336 0471 7650      SNA CLA          /TEST FOR ANY SELECTED TAPES.
0337 0472 5342      JMP B215         /IF NOT, GO SET UP C-F TABLE.
0338 0473 1027 B190, TAD A070        /LOAD C-F IDENTIFIER WORD.
0339 0474 7710      SPA CLA          /TEST FOR MODEL 20-40 C-F.
0340 0475 1174      TAD A427         /IF NOT, LOAD 4096-4196 TIMER.
0341 0476 1201      TAD B137         /IF SO, LOAD 20-40 TIMER.
0342 0477 3022      DCA A045         /SET UP 1-SECOND L-P TIMER.
0343 0500 3023      DCA A050
0344 0501 1027 B195, TAD A070        /LOAD C-F IDENTIFIER WORD.
0345 0502 7700      SMA CLA          /TEST FOR MODEL 20-40 C-F.
0346 0503 5310      JMP B200         /IF SO, GO TO 20-40 ROUTINE.
0347 0504 4556      JMS I A370       /GET 4096-4196 TAPES STATUS.
0348 0505 6004      OTSA1
0349 0506 4557      JMS I A375       /CONVERT L-P BITS TO NEW FORMAT.
0350 0507 5312      JMP B205         /GO COMPLEMENT L-P BITS.
0351 0510 4556 B200, JMS I A370      /GET 20-40 TAPES STATUS.
0352 0511 6014      OTSA
0353 0512 7040 B205, CMA             /GET NOT-AT-LOADPOINT BITS.
0354 0513 0027      AND A070         /MASK AGAINST SELECTED-TAPE BITS.
0355 0514 0172      AND A420         /CLEAR OUT GARBAGE.
0356 0515 7450      SNA              /TEST IF ALL TAPES ARE AT L-P.
0357 0516 5341      JMP B210         /IF SO, GO SET UP C-F TABLE.
0358 0517 2023      ISZ A050         /BUMP LOWER HALF OF 1-SECOND TIMER.
0359 0520 5301      JMP B195         /IF NON-ZERO, GO TEST AGAIN.
0360 0521 2022      ISZ A045         /BUMP UPPER HALF OF 1-SECOND TIMER.
0361 0522 5301      JMP B195         /IF NON-ZERO, GO TEST AGAIN.
0362 0523 2021      ISZ A040         /BUMP L-P SEARCH TIMER.
0363 0524 5273      JMP B190         /IF NON-ZERO, RESET 1-SEC. TIMER.
0364 0525 3130      DCA A255         /SAVE ERROR TAPE BITS.
0365 0526 7040      CMA              /SET L-P SEARCH TIMER TO -1.
0366 0527 3017      DCA A030
0367 0530 4550      JMS I A335       /TYPE FOUND-NO-LOADPOINT MESSAGE.
0368 0531 0310      D065+D065-D025
0369 0532 7124      STL RAL          /RESET ACTIVE-TAPE BIT.
0370 0533 3130      DCA A255
0371 0534 7404      OSR              /GET SWITCH 11.
0372 0535 7010      RAR
0373 0536 7620      SNL CLA          /TEST IF SWITCH 11 IS ON.
0374 0537 5267      JMP B185         /IF NOT, GO TEST REMAINING TAPES.
0375 0540 2132      ISZ A265         /SET ERROR FLAG ON.
0376 0541 2131 B210, ISZ A260        /SET ACTIVITY FLAG ON.
0377 0542 3034 B215, DCA A095        /CLEAR C-F CURRENT RECORD NUMBER.
0378 0543 3031      DCA A080         /CLEAR C-F ACTIVITY FLAG.
0379 0544 1027      TAD A070         /LOAD C-F IDENTIFIER WORD.
0380 0545 0130      AND A255         /MASK OFF CURRENT TAPE BIT.
0381 0546 7650      SNA CLA          /TEST IF THIS TAPE IS ACTIVE.
0382 0547 5363      JMP B220         /IF NOT, GO RESTORE C-F TABLE.
0383 0550 1140      TAD A295         /LOAD RECORD-ERROR LIMIT.
0384 0551 7450      SNA              /TEST FOR ZERO LIMIT.
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0275 0377 2501 B120, 2501            /4096-4196 FLAG-RESET MASK.
0276 0400 0616 B130, B270            /ADDRESS OF I-O SCAN LOOP.
0277 0401 7772 B137, 7772            /MODEL 20-40 1-SECOND TIMER.
0278          /
0279          /SUBROUTINE TO EXECUTE READ AND WRITE PASSES.
0280          /
0281 0402 5603 B140, JMP I B145      /SUBROUTINE EXIT INSTRUCTION.
0282 0403 0000 B145, 0               /RETURN ADDRESS HOLDER.
0283 0404 1127      TAD A250         /CONVERT PASS NUMBER TO OCTAL.
0284 0405 4547      JMS I A330
0285 0406 0427      D090+D090+11-D025
0286 0407 4546      JMS I A325       /TYPE PASS NUMBER MESSAGE.
0287 0410 0416      D090+D090-D025
0288 0411 7404      OSR              /GET SWITCH 9.
0289 0412 7012      RTR
0290 0413 7010      RAR
0291 0414 7630      SZL CLA          /TEST IF SWITCH 9 IS ON.
0292 0415 4544      JMS I A315       /IF SO, GO RING BELLS & HALT.
0293 0416 7124      STL RAL          /INITIALIZE ACTIVE-TAPE BIT.
0294 0417 3130      DCA A255
0295 0420 3131 B150, DCA A260        /RESET ACTIVITY FLAG.
0296 0421 4551 B155, JMS I A340      /ACCESS NEXT C-F TABLE.
0297 0422 5244      JMP B165         /AT END, GO TEST ACTIVITY FLAG.
0298 0423 1027      TAD A070         /LOAD C-F IDENTIFIER WORD.
0299 0424 7100      CLL              /CLEAR LINK BIT.
0300 0425 7510      SPA              /TEST FOR MODEL 4096-4196 C-F.
0301 0426 7020      CML              /IF SO, SET LINK BIT.
0302 0427 0172      AND A420         /MASK OFF SELECTED-TAPE BITS.
0303 0430 7450      SNA              /TEST FOR ANY SELECTED TAPES.
0304 0431 5221      JMP B155         /IF NOT, GO ACCESS NEXT TABLE.
0305 0432 7420      SNL              /TEST FOR MODEL 20-40 C-F.
0306 0433 5240      JMP B160         /IF SO, GO TO 20-40 ROUTINE.
0307 0434 4557      JMS I A375       /CONVERT BITS TO OLD FORMAT.
0308 0435 4556      JMS I A370       /ISSUE 4096-4196 L-P SEARCH.
0309 0436 6014      ACMD1
0310 0437 5220      JMP B150         /GO SET ACTIVITY FLAG.
0311 0440 1164 B160, TAD A397        /INSERT 20-40 L-P SEARCH BIT.
0312 0441 4556      JMS I A370       /ISSUE 20-40 L-P SEARCH.
0313 0442 6024      ACMD
0314 0443 5220      JMP B150         /GO SET ACTIVITY FLAG.
0315 0444 1131 B165, TAD A260        /END OF TABLES -- LOAD ACT. FLAG.
0316 0445 7650      SNA CLA          /TEST FOR ANY ACTIVE C-F.
0317 0446 5376      JMP B235         /IF NOT, TYPE NO C-F ACTIVE MSG.
0318 0447 1172      TAD A420         /LOAD -15.
0319 0450 7141      CLL CIA
0320 0451 1137      TAD A290         /ADD L-P SEARCH TIME LIMIT.
0321 0452 7420      SNL              /TEST FOR LIMIT UNDER 15 SEC.
0322 0453 7200      CLA              /IF SO, CLEAR A-C.
0323 0454 1172      TAD A420         /SET UP L-P SEARCH TIMER.
0324 0455 7041      CIA
0325 0456 3021      DCA A040
0326 0457 3131 B175, DCA A260        /RESET ACTIVITY FLAG.
0327 0460 3132      DCA A265         /RESET ERROR FLAG.
0328 0461 4551 B180, JMS I A340      /ACCESS NEXT C-F TABLE.
0329 0462 5365      JMP B225         /AT END, GO TEST ERROR FLAG.
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0385 0552 7001      IAC              /IF SO, SET LIMIT TO 1.
0386 0553 7510      SPA              /TEST FOR OVERSIZE LIMIT.
0387 0554 7240      STA              /IF SO, SET A-C TO -1.
0388 0555 7104      CLL RAL          /SHIFT LIMIT 1 PLACE LEFT.
0389 0556 7041      CIA              /NEGATE RECORD-ERROR LIMIT.
0390 0557 7110      CLL RAR          /GET ACTIVITY FLAG.
0391 0560 3031      DCA A080         /STORE ACTIVITY FLAG.
0392 0561 4545      JMS I A320       /TEST IF TAPE IS READY.
0393 0562 2132      ISZ A265         /IF NOT, SET ERROR FLAG.
0394 0563 4552 B220, JMS I A345      /RESTORE C-F TABLE.
0395 0564 5261      JMP B180         /GO ACCESS NEXT TABLE.
0396 0565 7100 B225, CLL             /CLEAR LINK BIT.
0397 0566 1132      TAD A265         /LOAD ERROR FLAG.
0398 0567 7640      SZA CLA          /TEST FOR ERROR-HALT REQUEST.
0399 0570 4544      JMS I A315       /IF SO, GO RING BELLS & HALT.
0400 0571 7430      SZL              /TEST IF HALT WAS TAKEN.
0401 0572 5220      JMP B150         /IF SO, GO RETRY L-P SEARCHES.
0402 0573 1131 B230, TAD A260        /LOAD ACTIVITY FLAG.
0403 0574 7640      SZA CLA          /TEST FOR ANY ACTIVE C-F.
0404 0575 5600      JMP I B130       /IF SO, GO CLEAR HALT FLAG.
0405 0576 4546 B235, JMS I A325      /TYPE NO C-F ACTIVE MESSAGE.
0406 0577 0075      D035+D035-1-D025
0407 0600 4546      JMS I A325       /TYPE END-OF-JOB MESSAGE.
0408 0601 0121      D040+D040-1-D025
0409 0602 7321      CLA STL IAC      /SET LINK BIT IF PASS 0 OR 1.
0410 0603 7040      CMA
0411 0604 1127      TAD A250
0412 0605 5606      JMP I B240       /GO TAKE CONDITIONAL HALT.
0413
0414 0606 0367 B240, B085            /CONDITIONAL HALT POINT.
0415 0607 1001 B242, B335            /MODEL 20-40 RERR TEST POINT.
0416 0610 1126 B245, B425            /INPUT L-P SEARCH POINT.
0417 0611 1143 B247, B440            /DEACTIVATION POINT.
0418 0612 1164 B250, B450            /OVERRUN TEST POINT.
0419 0613 1176 B255, B460            /HALT-FLAG TEST POINT.
0420 0614 1316 B260, B480            /ACTIVITY-FLAG SET POINT.
0421 0615 1321 B265, B485            /ACTIVITY-FLAG TEST POINT.
0422
0423 0616 3132 B270, DCA A265        /RESET HALT FLAG.
0424 0617 3131 B275, DCA A260        /RESET ACTIVITY FLAG.
0425 0620 4551 B280, JMS I A340      /ACCESS NEXT C-F TABLE.
0426 0621 5615      JMP I B265       /AT END, GO TEST ACTIVITY FLAG.
0427 0622 1031      TAD A080         /LOAD C-F ACTIVITY FLAG.
0428 0623 7450      SNA              /TEST IF THIS C-F IS ACTIVE.
0429 0624 5220      JMP B280         /IF NOT, GO ACCESS NEXT TABLE.
0430 0625 7700      SMA CLA          /TEST IF TAPE IS STOPPED.
0431 0626 5613      JMP I B255       /IF SO, GO TEST HALT FLAG.
0432 0627 1027      TAD A070         /LOAD C-F IDENTIFIER WORD.
0433 0630 7700      SMA CLA          /TEST FOR MODEL 20-40 C-F.
0434 0631 5250      JMP B290         /IF SO, GO TO 20-40 ROUTINE.
0435 0632 1127      TAD A250         /LOAD PASS NUMBER.
0436 0633 7640      SZA CLA          /TEST FOR WRITE PASS.
0437 0634 7001      IAC              /IF NOT, SET A-C TO 1.
0438 0635 7040      CMA              /STORE BIT-ROTATION COUNT.
0439 0636 3017      DCA A030
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0440 0637 4556        JMS I A370      /GET C-F TAPES STATUS.
0441 0640 6004        OTSA1
0442 0641 7040        CMA             /GET NOT-READY BITS.
0443 0642 7012 B285,  RTR             /ROTATE BITS 4 PLACES RIGHT.
0444 0643 7012        RTR
0445 0644 2017        ISZ A030        /BUMP BIT-ROTATION COUNT.
0446 0645 5242        JMP B285        /IF NON-ZERO, KEEP ROTATING.
0447 0646 4557        JMS I A375      /CONVERT BITS TO NEW FORMAT.
0448 0647 5255        JMP B295        /GO TEST IF TAPE IS STOPPED.
0449 0650 4556 B290,  JMS I A370      /GET C-F TAPES STATUS.
0450 0651 6014        OTSA
0451 0652 7006        RTL             /GET BUSY BITS IN LOW-ORDER A-C.
0452 0653 7006        RTL
0453 0654 7004        RAL
0454 0655 0130 B295,  AND A255        /MASK AGAINST ACTIVE-TAPE BIT.
0455 0656 7650        SNA CLA         /TEST IF TAPE IS STOPPED.
0456 0657 5270        JMP B300        /IF SO, GO TEST FOR FLASH L-P.
0457 0660 7126        STL RTL         /GET C-F TIMEOUT COUNTER PTR.
0458 0661 1133        TAD A270
0459 0662 3017        DCA A030
0460 0663 2417        ISZ I A030      /BUMP C-F TIMEOUT COUNTER.
0461 0664 5614        JMP I B260      /IF NON-ZERO, SET ACTIVITY FLAG.
0462 0665 4550        JMS I A335      /TYPE TIMEOUT MESSAGE.
0463 0666 4275        D060+D060+3777-D025
0464 0667 5220        JMP B280        /GO ACCESS NEXT TABLE.
0465 0670 1027 B300,  TAD A070        /LOAD C-F IDENTIFIER WORD.
0466 0671 7700        SMA CLA         /TEST FOR MODEL 20-40 C-F.
0467 0672 5302        JMP B305        /IF SO, GO TO 20-40 ROUTINE.
0468 0673 1033        TAD A090        /CONVERT L-P BITS TO NEW FORMAT.
0469 0674 4557        JMS I A375
0470 0675 3033        DCA A090
0471 0676 4556        JMS I A370      /GET C-F TAPES STATUS.
0472 0677 6004        OTSA1
0473 0700 4557        JMS I A375      /CONVERT L-P BITS TO NEW FORMAT.
0474 0701 5304        JMP B310        /GO TEST IF TAPE IS AT L-P.
0475 0702 4556 B305,  JMS I A370      /GET C-F TAPES STATUS.
0476 0703 6014        OTSA
0477 0704 0130 B310,  AND A255        /MASK OFF HARD-LOADPOINT BIT.
0478 0705 7640        SZA CLA         /TEST IF TAPE IS AT LOADPOINT.
0479 0706 5611        JMP I B247      /IF SO, GO DEACTIVATE C-F.
0480 0707 1033        TAD A090        /LOAD DETECTED L-P BIT.
0481 0710 0130        AND A255        /MASK OUT GARBAGE BITS.
0482 0711 7650        SNA CLA         /TEST IF TAPE FLASHED L-P.
0483 0712 5315        JMP B315        /IF NOT, GO TEST PASS NUMBER.
0484 0713 4550        JMS I A335      /TYPE FLASHED-LOADPOINT MESSAGE.
0485 0714 2326        D070+D070+2000-D025
0486 0715 1127 B315,  TAD A250        /LOAD PASS NUMBER.
0487 0716 7650        SNA CLA         /TEST FOR WRITE PASS.
0488 0717 5612        JMP I B250      /IF SO, GO TEST FOR OVERRUN.
0489 0720 7040        CMA             /SET A-C TO -1.
0490 0721 1034        TAD A095        /ADD C-F CURRENT RECORD NUMBER.
0491 0722 7650        SNA CLA         /TEST FOR FIRST INPUT RECORD.
0492 0723 5333        JMP B320        /IF SO, GO TEST FOR DATA ERROR.
0493 0724 7040        CMA             /SET A-C TO -1.
0494 0725 1430        TAD I A075      /ADD FIRST INPUT WORD.

0495 0726 7640        SZA CLA         /TEST FOR ANOTHER RECORD 1.
0496 0727 5333        JMP B320        /IF NOT, GO TEST FOR DATA ERROR.
0497 0730 4550        JMS I A335      /TYPE READ-OVER LOADPOINT MESSAGE.
0498 0731 2343        D075+D075+1777-D025
0499 0732 5610        JMP I B245      /GO ISSUE L-P SEARCH.
0500 0733 1034 B320,  TAD A095        /SET CONSTANT RECORD NUMBER.
0501 0734 3560        DCA I A380
0502 0735 1036        TAD A105        /LOAD C-F I-O WORD COUNT.
0503 0736 7040        CMA             /COMPLEMENT WORD COUNT.
0504 0737 7510        SPA             /TEST FOR INPUT OVERFLOW.
0505 0740 7200        CLA             /IF SO, SET A-C TO ZERO.
0506 0741 3023        DCA A050        /INITIALIZE COMPARE-ERROR COUNTER.
0507 0742 1160        TAD A380        /SET UP DATA COMPARISON.
0508 0743 3021        DCA A040
0509 0744 1030        TAD A075
0510 0745 3022        DCA A045
0511 0746 1141        TAD A300
0512 0747 7041        CIA
0513 0750 1023        TAD A050
0514 0751 3024        DCA A055
0515 0752 1024        TAD A055        /LOAD DATA COMPARISON COUNT.
0516 0753 7650        SNA CLA         /TEST FOR ANY DATA TO COMPARE.
0517 0754 5371        JMP B327        /IF NOT, GO TEST FOR RERR.
0518 0755 1421 B325,  TAD I A040      /LOAD NEXT CONSTANT WORD.
0519 0756 7041        CIA             /COMPLEMENT CONSTANT WORD.
0520 0757 1422        TAD I A045      /ADD NEXT INPUT WORD.
0521 0760 7640        SZA CLA         /TEST FOR COMPARE ERROR.
0522 0761 2023        ISZ A050        /IF SO, BUMP COMPARE-ERROR CTR.
0523 0762 2021        ISZ A040        /BUMP CONSTANT-DATA POINTER.
0524 0763 2022        ISZ A045        /BUMP INPUT-DATA POINTER.
0525 0764 2024        ISZ A055        /BUMP DATA COUNT.
0526 0765 5355        JMP B325        /IF NON-ZERO, LOOP BACK.
0527 0766 1036        TAD A105        /LOAD I-O BUFFER COUNT.
0528 0767 7650        SNA CLA         /TEST FOR INPUT OVERFLOW.
0529 0770 2023        ISZ A050        /IF SO, BUMP COMPARE-ERROR CTR.
0530 0771 1027 B327,  TAD A070        /LOAD C-F IDENTIFIER WORD.
0531 0772 7700        SMA CLA         /TEST FOR MODEL 20-40 C-F.
0532 0773 5377        JMP B330        /IF SO, GO TO 20-40 ROUTINE.
0533 0774 4556        JMS I A370      /GET C-F RECORD-ERROR BIT.
0534 0775 6002        OTSB1
0535 0776 5607        JMP I B242      /GO TEST FOR RECORD ERROR.
0536 0777 4556 B330,  JMS I A370      /GET C-F RECORD-ERROR BIT.
0537 1000 6012        OTSB
0538 1001 7710 B335,  SPA CLA         /TEST FOR RECORD ERROR.
0539 1002 2024        ISZ A055        /IF SO, SET RECORD-ERROR COUNTER.
0540 1003 1023        TAD A050        /ADD BOTH ERROR COUNTERS.
0541 1004 1024        TAD A055
0542 1005 7650        SNA CLA         /TEST FOR ERRORS ON THIS RECORD.
0543 1006 5364        JMP B450        /IF NOT, GO TEST FOR OVERRUN.
0544 1007 7404        OSR             /GET SWITCH 6.
0545 1010 0171        AND A415
0546 1011 7650        SNA CLA         /TEST FOR SPECIAL-MESSAGE REQ.
0547 1012 5226        JMP B380        /IF NOT, GO SET UP ERROR LINES.
0548 1013 7404        OSR             /GET SWITCH 7.
0549 1014 0225        AND B375

0550 1015 7640        SZA CLA         /TEST FOR BELL REQUEST.
0551 1016 5364        JMP B450        /IF NOT, GO TEST FOR OVERRUN.
0552 1017 4546        JMS I A325      /TYPE ONE BELL CODE.
0553 1020 0171        D045+D045+25-D025
0554 1021 5364        JMP B450        /GO TEST FOR OVERRUN.
0555
0556 1022 0620 B340,  B280            /TABLE-ACCESS POINT.
0557 1023 7765 B350,  7765            /CONSTANT -11.
0558 1024 3400 B355,  3400            /C-F LETTER CODE MASK.
0559 1025 0020 B375,  0020            /SWITCH 7 MASK.
0560
0561 1026 1034 B380,  TAD A095        /CONVERT RECORD NUMBER TO OCTAL.
0562 1027 4547        JMS I A330
0563 1030 0460        D105+D105-D025
0564 1031 1141        TAD A300        /LOAD I-O WORD COUNT.
0565 1032 1036        TAD A105        /ADD C-F I-O COUNT.
0566 1033 7710        SPA CLA         /TEST IF ANY DATA WAS READ.
0567 1034 5243        JMP B385        /IF NOT, USE ZERO AS LAST WORD.
0568 1035 1036        TAD A105        /IF SO, LOAD C-F I-O COUNT.
0569 1036 7640        SZA CLA         /TEST FOR INPUT OVERFLOW.
0570 1037 7040        CMA             /IF NOT, SET A-C TO -1.
0571 1040 1035        TAD A100        /SET UP LAST-WORD POINTER.
0572 1041 3035        DCA A100
0573 1042 1435        TAD I A100      /CONVERT LAST INPUT WORD TO OCTAL.
0574 1043 4547 B385,  JMS I A330
0575 1044 0472        D105+D105+12-D025
0576 1045 1023        TAD A050        /CONVERT C.E. COUNTER TO OCTAL.
0577 1046 4547        JMS I A330
0578 1047 0502        D105+D105+22-D025
0579 1050 1024        TAD A055        /CONVERT R.E. COUNTER TO OCTAL.
0580 1051 4547        JMS I A330
0581 1052 0512        D105+D105+32-D025
0582 1053 4550        JMS I A335      /TYPE 1ST LINE OF ERROR MESSAGE.
0583 1054 2457        D105+D105+1777-D025
0584 1055 7404        OSR             /GET SWITCH 7.
0585 1056 0225        AND B375
0586 1057 7640        SZA CLA         /TEST FOR SINGLE-LINE MESSAGE.
0587 1060 5322        JMP B420        /IF SO, GO BUMP RERR COUNTER.
0588 1061 1030        TAD A075        /SET UP TO FORMAT DATA LINES.
0589 1062 3021        DCA A040
0590 1063 1141        TAD A300
0591 1064 7040        CMA
0592 1065 3022        DCA A045
0593 1066 1036        TAD A105
0594 1067 7040        CMA
0595 1070 1022        TAD A045
0596 1071 3023        DCA A050
0597 1072 5277        JMP B395        /GO RESET LINE-SCAN COUNT.
0598 1073 2024 B390,  ISZ A055        /BUMP LINE-SCAN COUNT.
0599 1074 5301        JMP B400        /IF NON-ZERO, GO BUMP DATA CT.
0600 1075 4546        JMS I A325      /STORE C-R & L-F IN BUFFER.
0601 1076 0402        D080+D080+20-D025
0602 1077 1223 B395,  TAD B350        /RESET LINE-SCAN COUNT.
0603 1100 3024        DCA A055
0604 1101 2023 B400,  ISZ A050        /BUMP INPUT DATA COUNT.

0605 1102 5310        JMP B405        /IF NON-ZERO, GO STORE NEXT WORD.
0606 1103 7040        CMA             /RESET INPUT DATA COUNT TO -1.
0607 1104 3023        DCA A050
0608 1105 4546        JMS I A325      /STORE FOUR ASCII X'S IN BUFFER.
0609 1106 0525        D115+D115-1-D025
0610 1107 5316        JMP B415        /GO BUMP MESSAGE COUNT.
0611 1110 1421 B405,  TAD I A040      /CONVERT NEXT INPUT WORD TO OCTAL.
0612 1111 2021        ISZ A040
0613 1112 4547        JMS I A330
0614 1113 0520        D110+D110-D025
0615 1114 4546        JMS I A325      /STORE NEXT WORD IN BUFFER.
0616 1115 0517        D110+D110-1-D025
0617 1116 2022 B415,  ISZ A045        /BUMP MESSAGE COUNT.
0618 1117 5273        JMP B390        /IF NON-ZERO, LOOP BACK.
0619 1120 4546        JMS I A325      /STORE C-R & L-F IN BUFFER.
0620 1121 0402        D080+D080+20-D025
0621 1122 2031 B420,  ISZ A080        /BUMP C-F RECORD-ERROR COUNT.
0622 1123 5364        JMP B450        /IF NON-ZERO, GO TEST FOR OVERRUN.
0623 1124 4550        JMS I A335      /TYPE TOO-MANY-ERRORS MESSAGE.
0624 1125 2243        D055+D055+1777-D025
0625 1126 1027 B425,  TAD A070        /LOAD C-F IDENTIFIER WORD.
0626 1127 7700        SMA CLA         /TEST FOR MODEL 20-40 C-F.
0627 1130 5336        JMP B430        /IF SO, GO TO 20-40 ROUTINE.
0628 1131 1130        TAD A255        /LOAD ACTIVE-TAPE BIT.
0629 1132 4557        JMS I A375      /CONVERT BIT TO OLD FORMAT.
0630 1133 4556        JMS I A370      /ISSUE L-P SEARCH COMMAND.
0631 1134 6014        ACMD1
0632 1135 5342        JMP B435        /GO CLEAR A-C.
0633 1136 1164 B430,  TAD A397        /GET L-P SEARCH COMMAND BITS.
0634 1137 1130        TAD A255
0635 1140 4556        JMS I A370      /ISSUE L-P SEARCH COMMAND.
0636 1141 6024        ACMD
0637 1142 7200 B435,  CLA             /CLEAR A-C.
0638 1143 3031 B440,  DCA A080        /DEACTIVATE C-F TABLE.
0639 1144 4552        JMS I A345      /RESTORE C-F TABLE.
0640 1145 1027        TAD A070        /GET RECORD COUNTERS POINTER.
0641 1146 0224        AND B355
0642 1147 7112        CLL RTR
0643 1150 7012        RTR
0644 1151 7012        RTR
0645 1152 1161        TAD A385
0646 1153 3021        DCA A040
0647 1154 1130        TAD A255        /LOAD ACTIVE-TAPE BIT.
0648 1155 2021 B445,  ISZ A040        /BUMP RECORD COUNTERS POINTER.
0649 1156 7110        CLL RAR         /ROTATE TAPE BIT 1 PLACE RIGHT.
0650 1157 7420        SNL             /TEST IF TAPE BIT IS IN LINK.
0651 1160 5355        JMP B445        /IF NOT, LOOP BACK.
0652 1161 1034        TAD A095        /STORE TAPE RECORD COUNTER.
0653 1162 3421        DCA I A040
0654 1163 5622        JMP I B340      /GO ACCESS NEXT TABLE.
0655 1164 1034 B450,  TAD A095        /LOAD C-F CURRENT RECORD NUMBER.
0656 1165 7040        CMA             /COMPLEMENT RECORD NUMBER.
0657 1166 7640        SZA CLA         /TEST FOR TAPE OVERRUN.
0658 1167 5373        JMP B455        /IF NOT, GO CLEAR RUNNING FLAG.
0659 1170 4550        JMS I A335      /TYPE FOUND-NO-LOADPOINT MESSAGE.
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0660 1171 4310          D065+D065+4000-D025
0661 1172 5622          JMP I B340      /GO ACCESS NEXT TABLE.
0662 1173 7130 B455,    STL RAR         /CLEAR C-F RUNNING FLAG.
0663 1174 1031          TAD A080
0664 1175 3031          DCA A080
0665 1176 1132 B460,    TAD A265        /LOAD HALT FLAG.
0666 1177 7650          SNA CLA         /TEST FOR HALT REQUEST.
0667 1200 5207          JMP B465        /IF NOT, GO TEST IF TAPE IS READY.
0668 1201 1131          TAD A260        /SET ACTIVITY FLAG.
0669 1202 7004          RAL
0670 1203 7130          STL RAR
0671 1204 3131          DCA A260
0672 1205 4552          JMS I A345      /RESTORE C-F TABLE.
0673 1206 5760          JMP I B520      /GO ACCESS NEXT TABLE.
0674 1207 7120 B465,    STL             /SET LINK BIT ON.
0675 1210 4545          JMS I A320      /TEST IF TAPE IS READY.
0676 1211 5760          JMP I B520      /IF NOT, GO ACCESS NEXT TABLE.
0677 1212 7130          STL RAR         /SET C-F RUNNING FLAG.
0678 1213 1031          TAD A080
0679 1214 3031          DCA A080
0680 1215 3032          DCA A085        /CLEAR C-F TIMEOUT COUNTER.
0681 1216 3033          DCA A090        /CLEAR C-F DETECTED L-P BITS.
0682 1217 2034          ISZ A095        /BUMP C-F CURRENT RECORD NUMBER.
0683 1220 1030          TAD A075        /SET UP C-F I-O POINTER.
0684 1221 3035          DCA A100
0685 1222 1141          TAD A300        /SET UP C-F I-O COUNT.
0686 1223 7040          CMA
0687 1224 3036          DCA A105
0688 1225 1034          TAD A095        /SET C-F RECORD NO. IN I-O AREA.
0689 1226 3430          DCA I A075
0690 1227 1034          TAD A095        /LOAD C-F RECORD NUMBER.
0691 1230 7110          CLL RAR         /ROTATE 1 PLACE RIGHT.
0692 1231 7450          SNA             /TEST FOR 1ST I-O RECORD.
0693 1232 1127          TAD A250        /IF SO, LOAD PASS NUMBER.
0694 1233 7640          SZA CLA         /TEST FOR WRITE PASS.
0695 1234 5247          JMP B467        /IF NOT, GO RESTORE C-F TABLE.
0696 1235 1034          TAD A095        /STORE C-F RECORD NO. IN DATA.
0697 1236 3560          DCA I A380
0698 1237 1160          TAD A380        /SET UP DATA MOVE.
0699 1240 3024          DCA A055
0700 1241 1030          TAD A075
0701 1242 3025          DCA A060
0702 1243 1141          TAD A300
0703 1244 7041          CIA
0704 1245 3026          DCA A065
0705 1246 4553          JMS I A350      /EXECUTE I-O DATA MOVE.
0706 1247 4552 B467,    JMS I A345      /RESTORE C-F TABLE.
0707 1250 1027          TAD A070        /LOAD C-F IDENTIFIER WORD.
0708 1251 7700          SMA CLA         /TEST FOR MODEL 20-40 C-F.
0709 1252 5276          JMP B475        /IF SO, GO TO 20-40 ROUTINE.
0710 1253 1127          TAD A250        /LOAD PASS NUMBER.
0711 1254 7640          SZA CLA         /TEST FOR READ PASS.
0712 1255 7001          IAC             /IF SO, SET A-C TO 1.
0713 1256 7040          CMA             /STORE BIT-ROTATION COUNT.
0714 1257 3017          DCA A030
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0715 1260 1130          TAD A255        /LOAD ACTIVE-TAPE BIT.
0716 1261 4557          JMS I A375      /CONVERT BIT TO OLD FORMAT.
0717 1262 7106 B470,    CLL RTL         /ROTATE BIT 4 PLACES LEFT.
0718 1263 7006          RTL
0719 1264 2017          ISZ A030        /BUMP BIT-ROTATION COUNT.
0720 1265 5262          JMP B470        /IF NON-ZERO, GO ROTATE AGAIN.
0721 1266 4556          JMS I A370      /ROLL 'EM, BABY!
0722 1267 6014          ACMD1
0723 1270 3017          DCA A030        /STORE ACTIVE-TAPE BITS.
0724 1271 4556          JMS I A370      /GET C-F TAPES STATUS.
0725 1272 6004          OTSA1
0726 1273 0017          AND A030        /MASK AGAINST ACTIVE-TAPE BITS.
0727 1274 5311          JMP B477        /GO TEST IF TAPE IS RUNNING.
0728 1275 5316          JMP B480        /GO SET ACTIVITY FLAG.
0729 1276 1127 B475,    TAD A250        /LOAD PASS NUMBER.
0730 1277 7650          SNA CLA         /TEST FOR WRITE PASS.
0731 1300 1361          TAD B525        /IF SO, GET WRITE-START BIT.
0732 1301 1361          TAD B525        /IF NOT, GET READ-START BIT.
0733 1302 1130          TAD A255        /ADD ACTIVE-TAPE BIT.
0734 1303 4556          JMS I A370      /ROLL 'EM, BABY!
0735 1304 6024          ACMD
0736 1305 4556          JMS I A370      /LOAD C-F TAPES STATUS.
0737 1306 6013          OTSB+1
0738 1307 7006          RTL             /ISOLATE I-O MODE BIT.
0739 1310 7230          CLA CML RAR
0740 1311 7650 B477,    SNA CLA         /TEST IF TAPE IS RUNNING.
0741 1312 5316          JMP B480        /IF SO, GO SET ACTIVITY FLAG.
0742 1313 4550          JMS I A335      /TYPE FAILED-TO-START MESSAGE.
0743 1314 4533          D117+D117+3777-D025
0744 1315 5760          JMP I B520      /GO ACCESS NEXT TABLE.
0745 1316 7240 B480,    STA             /SET ACTIVITY & RUNNING FLAGS.
0746 1317 3131          DCA A260
0747 1320 5760          JMP I B520      /GO ACCESS NEXT TABLE.
0748 1321 1131 B485,    TAD A260        /END OF TABLES -- LOAD ACT. FLAG.
0749 1322 7450          SNA             /TEST IF ANY C-F IS ACTIVE.
0750 1323 5341          JMP B500        /IF NOT, GO TEST FOR END OF PASS.
0751 1324 7040          CMA             /GET NOT-RUNNING FLAG.
0752 1325 0132          AND A265        /MASK WITH HALT FLAG.
0753 1326 7654          SNA LAS         /TEST IF HALT IS REQUIRED.
0754 1327 5336          JMP B495        /IF NOT, GO SET HALT FLAG.
0755 1330 7200          CLA             /CLEAR A-C.
0756 1331 1135 B490,    TAD A280        /LOAD TELEPRINTER BUFFER POINTER.
0757 1332 7640          SZA CLA         /TEST IF TELEPRINTER IS RUNNING.
0758 1333 5331          JMP B490        /IF SO, WAIT.
0759 1334 7602          CLA HLT         /SCREACHING HALT.
0760 1335 6001          ION             /RE-ION IN CASE START WAS PRESSED.
0761 1336 7012 B495,    RTR             /SET OR CLEAR HALT FLAG.
0762 1337 7204          CLA RAL
0763 1340 5757          JMP I B515      /GO ACCESS NEXT TABLE.
0764 1341 1130 B500,    TAD A255        /LOAD ACTIVE-TAPE BIT.
0765 1342 7104          CLL RAL         /SHIFT BIT 1 PLACE LEFT.
0766 1343 0172          AND A420        /MASK OFF VALID TAPE BITS.
0767 1344 7450          SNA             /TEST FOR END OF PASS.
0768 1345 5755          JMP I B505      /IF SO, GO EXIT.
0769 1346 3130          DCA A255        /RESTORE ACTIVE-TAPE BIT.
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0770 1347 7404          OSR             /GET SWITCH 8 IN LINK.
0771 1350 7012          RTR
0772 1351 7012          RTR
0773 1352 7630          SZL CLA         /TEST IF SWITCH 8 IS ON.
0774 1353 4544          JMS I A315      /IF SO, GO RING BELLS & HALT.
0775 1354 5756          JMP I B510      /GO PROCESS NEXT TAPE.
0776
0777 1355 0402 B505,    B140            /SUBROUTINE EXIT POINT.
0778 1356 0420 B510,    B150            /NEXT-TAPE LOOP POINT.
0779 1357 0616 B515,    B270            /NEXT-RECORD LOOP POINT.
0780 1360 0620 B520,    B280            /NEXT-ACCESS LOOP POINT.
0781 1361 1000 B525,    1000            /MODEL 20-40 READ-START BIT.
0782
0783            /
0784            /SUBROUTINE TO RING BELLS AND HALT.  THE HALT IS
0785            /TAKEN IF EITHER THE LINK BIT OR SWITCH 11 IS ON.
0786            /
0787 1362 0000 B530,    0
0788 1363 7604          LAS             /GET SENSE SWITCHES.
0789 1364 7010          RAR             /PUT SWITCH 11 IN LINK.
0790 1365 7720          SMA SNL CLA     /TEST IF HALT IS REQUIRED.
0791 1366 5762          JMP I B530      /IF NOT, EXIT.
0792 1367 4546          JMS I A325      /RING-A-DING-DING!
0793 1370 0143          D045+D045-1-D025
0794 1371 1135 B535,    TAD A280        /LOAD TELEPRINTER BUFFER POINTER.
0795 1372 7640          SZA CLA         /TEST IF TELEPRINTER IS RUNNING.
0796 1373 5371          JMP B535        /IF SO, WAIT.
0797 1374 7602          CLA HLT         /SCREACHING HALT.
0798 1375 6001          ION             /RE-ION IN CASE START WAS PRESSED.
0799 1376 7120          STL             /SET LINK BIT ON.
0800 1377 5762          JMP I B530      /EXIT.
0801                    *1400
0802            /
0803            /SUBROUTINE TO TEST IF ACTIVE TAPES ARE READY.  IF THE
0804            /LINK BIT IS ON AND ANY TAPE IS NOT READY, THE TAPE
0805            /WILL ALWAYS BE DISABLED.  IF THE LINK BIT IS OFF AND
0806            /ANY TAPE IS NOT READY, THE TAPE WILL BE DISABLED ONLY
0807            /IF SWITCH 11 IS OFF.
0808            /
0809 1400 0000 B540,    0
0810 1401 7010          RAR             /SAVE LINK BIT.
0811 1402 3017          DCA A030
0812 1403 1027          TAD A070        /LOAD C-F IDENTIFIER WORD.
0813 1404 7700          SMA CLA         /TEST FOR MODEL 20-40 C-F.
0814 1405 5225          JMP B545        /IF SO, GO TO 20-40 ROUTINE.
0815 1406 4556          JMS I A370      /STORE C-F FILE-PROTECT BITS.
0816 1407 6004          OTSA1
0817 1410 7012          RTR
0818 1411 7012          RTR
0819 1412 7040          CMA
0820 1413 4557          JMS I A375
0821 1414 3020          DCA A035
0822 1415 4556          JMS I A370      /GET C-F BUSY BITS.
0823 1416 6004          OTSA1
0824 1417 7006          RTL
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0825 1420 7006          RTL
0826 1421 7004          RAL
0827 1422 7040          CMA
0828 1423 4557          JMS I A375
0829 1424 5245          JMP B550        /GO TEST IF TAPE IS BUSY.
0830 1425 4556 B545,    JMS I A370      /GET C-F NOT-ON-LINE BITS.
0831 1426 6012          OTSB
0832 1427 7040          CMA
0833 1430 0130          AND A255        /MASK AGAINST ACTIVE-TAPE BIT.
0834 1431 7640          SZA CLA         /TEST IF TAPE IS NOT ON LINE.
0835 1432 5260          JMP B555        /IF SO, GO TYPE NOT-ON-LINE MSG.
0836 1433 4556          JMS I A370      /STORE C-F FILE-PROTECT BITS.
0837 1434 6014          OTSA
0838 1435 7012          RTR
0839 1436 7012          RTR
0840 1437 3020          DCA A035
0841 1440 4556          JMS I A370      /GET C-F BUSY BITS.
0842 1441 6014          OTSA
0843 1442 7006          RTL
0844 1443 7006          RTL
0845 1444 7004          RAL
0846 1445 0130 B550,    AND A255        /MASK AGAINST ACTIVE-TAPE BIT.
0847 1446 7640          SZA CLA         /TEST IF TAPE IS BUSY.
0848 1447 5262          JMP B565        /IF SO, GO TYPE NOT-READY MESSAGE.
0849 1450 1127          TAD A250        /LOAD PASS NUMBER.
0850 1451 7650          SNA CLA         /TEST FOR WRITE PASS.
0851 1452 1020          TAD A035        /IF SO, LOAD FILE-PROTECT BITS.
0852 1453 0130          AND A255        /MASK AGAINST ACTIVE-TAPE BIT.
0853 1454 7640          SZA CLA         /TEST IF TAPE IS FILE-PROTECTED.
0854 1455 5261          JMP B560        /IF SO, GO TYPE FILE-PROTECT MSG.
0855 1456 2200          ISZ B540        /BUMP RETURN ADDRESS.
0856 1457 5600          JMP I B540      /EXIT.
0857 1460 1376 B555,    TAD B630        /GET NOT-ON-LINE MESSAGE ADDRESS.
0858 1461 1375 B560,    TAD B625        /GET FILE-PROTECT MESSAGE ADDRESS.
0859 1462 1374 B565,    TAD B620        /GET NOT-READY MESSAGE ADDRESS.
0860 1463 1017          TAD A030        /ADD IN DISABLE BIT.
0861 1464 3266          DCA B570        /STORE MESSAGE ADDRESS BELOW.
0862 1465 4550          JMS I A335      /TYPE APPROPRIATE ERROR MESSAGE.
0863 1466 0000 B570,    0
0864 1467 5600          JMP I B540      /EXIT.
0865            /
0866            /SUBROUTINE TO BUFFER AND INITIATE PRINTED MESSAGES.
0867            /
0868 1470 0000 B575,    0
0869 1471 1670          TAD I B575      /SET MESSAGE SOURCE ADDRESS.
0870 1472 3017          DCA A030
0871 1473 4555          JMS I A365      /GET 1ST MESSAGE CHARACTER.
0872 1474 1377          TAD B635        /ADD RUBOUT COMPLEMENT.
0873 1475 7640          SZA CLA         /TEST IF MESSAGE HAS RUBOUTS.
0874 1476 5305          JMP B580        /IF NOT, GO STORE BUFFER ADDRESS.
0875 1477 1135          TAD A280        /LOAD TELEPRINTER BUFFER ADDRESS.
0876 1500 7650          SNA CLA         /TEST IF TELEPRINTER IS RUNNING.
0877 1501 5305          JMP B580        /IF NOT, GO STORE BUFFER ADDRESS.
0878 1502 2017          ISZ A030        /BUMP MESSAGE ADDRESS BY 3.
0879 1503 2017          ISZ A030
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0880 1504 2017        ISZ A030
0881 1505 1134 B580,  TAD A275        /SAVE MESSAGE BUFFER ADDRESS.
0882 1506 3552        DCA I A345
0883 1507 1134        TAD A275        /SET BUFFER DESTINATION ADDRESS.
0884 1510 3020 B585,  DCA A035
0885 1511 1020 B590,  TAD A035        /LOAD DESTINATION ADDRESS.
0886 1512 7041        CIA             /COMPLEMENT ADDRESS.
0887 1513 1135        TAD A280        /ADD TELEPRINTER BUFFER ADDRESS.
0888 1514 7650        SNA CLA         /TEST FOR BUFFER WRAPAROUND.
0889 1515 5311        JMP B590        /IF SO, WAIT.
0890 1516 1020        TAD A035        /LOAD DESTINATION ADDRESS.
0891 1517 7040        CMA             /COMPLEMENT DESTINATION ADDRESS.
0892 1520 7640        SZA CLA         /TEST FOR END OF BUFFER.
0893 1521 5324        JMP B595        /IF NOT, GO STORE CHARACTER.
0894 1522 1163        TAD A395        /LOAD STARTING BUFFER ADDRESS.
0895 1523 5310        JMP B585        /GO RESET BUFFER ADDRESS.
0896 1524 4555 B595,  JMS I A365      /STORE NEXT MESSAGE CHARACTER.
0897 1525 4554        JMS I A360
0898 1526 4555        JMS I A365      /RELOAD CHARACTER.
0899 1527 7650        SNA CLA         /TEST FOR END OF MESSAGE.
0900 1530 5334        JMP B600        /IF SO, GO RESET BUFFER ADDRESS.
0901 1531 2017        ISZ A030        /BUMP MESSAGE SOURCE ADDRESS.
0902 1532 2020        ISZ A035        /BUMP BUFFER DESTINATION ADDR.
0903 1533 5311        JMP B590        /GO STORE NEXT CHARACTER.
0904 1534 1020 B600,  TAD A035        /RESET MESSAGE BUFFER ADDRESS.
0905 1535 3134        DCA A275
0906 1536 1135        TAD A280        /LOAD TELEPRINTER BUFFER ADDR.
0907 1537 7640        SZA CLA         /TEST IF TELEPRINTER IS RUNNING.
0908 1540 5345        JMP B605        /IF SO, GO EXIT.
0909 1541 1552        TAD I A345      /SET TELEPRINTER BUFFER ADDRESS.
0910 1542 3135        DCA A280
0911 1543 7040        CMA             /LOAD A RUBOUT.
0912 1544 6046        TLS             /SOCK IT TO THE TELEPRINTER.
0913 1545 7300 B605,  CLA CLL         /CLEAR A-C AND LINK.
0914 1546 2270        ISZ B575        /BUMP RETURN ADDRESS.
0915 1547 5670        JMP I B575      /EXIT.
0916          /
0917          /SUBROUTINE TO CONVERT 12-BIT WORDS TO FOUR PRINTABLE
0918          /OCTAL DIGITS AND STORE THE OCTAL DIGITS IN OUTPUT
0919          /MESSAGES.  AT ENTRY, THE WORD TO BE CONVERTED IS IN
0920          /THE A-C, AND THE CALLING SEQUENCE CONTAINS THE
0921          /DESTINATION CHARACTER POINTER.
0922          /
0923 1550 0000 B610,  0
0924 1551 3552        DCA I A345      /SAVE DATA WORD.
0925 1552 1750        TAD I B610      /SET DESTINATION CHARACTER POINTER.
0926 1553 3020        DCA A035
0927 1554 2350        ISZ B610        /BUMP RETURN ADDRESS.
0928 1555 1175        TAD A430        /SET LOOP COUNT OF -4.
0929 1556 3553        DCA I A350
0930 1557 1552 B615,  TAD I A345      /LOAD DATA WORD.
0931 1560 7006        RTL             /ROTATE WORD 3 BITS LEFT.
0932 1561 7004        RAL
0933 1562 3552        DCA I A345      /RESTORE DATA WORD.
0934 1563 1552        TAD I A345      /ISOLATE NEXT OCTAL DIGIT.
0935 1564 7004        RAL
0936 1565 0173        AND A425
0937 1566 1170        TAD A410        /ADD 6-BIT ASCII ZERO.
0938 1567 4554        JMS I A360      /STORE DIGIT IN MESSAGE.
0939 1570 2020        ISZ A035        /BUMP DESTINATION CHARACTER PTR.
0940 1571 2553        ISZ I A350      /BUMP LOOP COUNT.
0941 1572 5357        JMP B615        /IF NON-ZERO, LOOP BACK.
0942 1573 5750        JMP I B610      /EXIT.
0943
0944 1574 0173 B620,  D050+D050-1-D025 /NOT-READY MESSAGE ADDRESS.
0945 1575 0013 B625,  0013            /FILE-PROTECT MESSAGE OFFSET.
0946 1576 0020 B630,  0020            /NOT-ON-LINE MESSAGE OFFSET.
0947 1577 7741 B635,  7741            /6-BIT ASCII RUBOUT COMPLEMENT.
0948          /
0949          /SUBROUTINE TO SET UP TAPE ERROR MESSAGES.  THE CALLING
0950          /SEQUENCE SPECIFIES A SKELETON-MESSAGE CHARACTER POINTER
0951          /WHOSE HIGH-ORDER TWO BITS ARE USED AS FLAGS.  IF BIT 0
0952          /IS SET, THE TAPE WILL BE DISABLED; IF BIT 1 IS SET, THE
0953          /TAPE WILL NOT BE DISABLED.  IF NEITHER BIT IS SET, THE
0954          /TAPE WILL BE DISABLED ONLY IF SWITCH 11 IS OFF.
0955          /
0956 1600 0000 B640,  0
0957 1601 1600        TAD I B640      /LOAD MESSAGE ADDRESS.
0958 1602 7004        RAL             /ROTATE BITS 1 PLACE LEFT.
0959 1603 7710        SPA CLA         /TEST FOR NO DISABLE.
0960 1604 5222        JMP B650        /IF SO, GO SET C-R/L-F SUFFIX.
0961 1605 7430        SZL             /TEST FOR FORCED DISABLE.
0962 1606 5213        JMP B645        /IF SO, GO DEACTIVATE C-F TABLE.
0963 1607 7404        OSR             /GET SWITCH 11 IN LINK.
0964 1610 7010        RAR
0965 1611 7630        SZL CLA         /TEST IF SWITCH 11 IS ON.
0966 1612 5222        JMP B650        /IF SO, GO SET C-R/L-F SUFFIX.
0967 1613 3031 B645,  DCA A080        /DEACTIVATE C-F TABLE.
0968 1614 1130        TAD A255        /DISABLE THIS TAPE.
0969 1615 7040        CMA
0970 1616 0027        AND A070
0971 1617 3027        DCA A070
0972 1620 4552        JMS I A345      /RESTORE C-F TABLE.
0973 1621 1370        TAD B725        /LOAD DISABLE MESSAGE ADDRESS.
0974 1622 1367 B650,  TAD B720        /LOAD C-R L-F MESSAGE ADDRESS.
0975 1623 3271        DCA B670        /STORE SUFFIX ADDRESS BELOW.
0976 1624 1600        TAD I B640      /STORE MESSAGE ADDRESS BELOW.
0977 1625 0374        AND B745
0978 1626 3267        DCA B665
0979 1627 2200        ISZ B640        /BUMP RETURN ADDRESS.
0980 1630 1371        TAD B730        /INITIALIZE PREFIX ADDRESS.
0981 1631 3020        DCA A035
0982 1632 1170        TAD A410        /INITIALIZE ASCII TAPE NUMBER.
0983 1633 3552        DCA I A345
0984 1634 1130        TAD A255        /LOAD TAPE BITS.
0985 1635 2552 B655,  ISZ I A345      /BUMP ASCII TAPE NUMBER.
0986 1636 7110        CLL RAR         /ROTATE TAPE BITS 1 PLACE LEFT.
0987 1637 7420        SNL             /TEST IF THIS BIT IS SET.
0988 1640 5246        JMP B660        /IF NOT, GO TEST FOR MORE BITS.
0989 1641 3553        DCA I A350      /SAVE REMAINING TAPE BITS.
0990 1642 1552        TAD I A345      /STORE ASCII TAPE NO. IN PREFIX.
0991 1643 4554        JMS I A360
0992 1644 2020        ISZ A035        /BUMP PREFIX MESSAGE ADDRESS.
0993 1645 1553        TAD I A350      /LOAD REMAINING TAPE BITS.
0994 1646 7440 B660,  SZA             /TEST FOR ANY REMAINING BITS.
0995 1647 5235        JMP B655        /IF SO, LOOP BACK.
0996 1650 1027        TAD A070        /GET C-F LETTER CODE.
0997 1651 7006        RTL
0998 1652 7006        RTL
0999 1653 7004        RAL
1000 1654 0173        AND A425
1001 1655 7001        IAC
1002 1656 4554        JMS I A360      /STORE C-F LETTER CODE IN PREFIX.
1003 1657 2020        ISZ A035        /BUMP PREFIX MESSAGE ADDRESS.
1004 1660 1171        TAD A415        /LOAD ASCII SPACE.
1005 1661 4554        JMS I A360      /STORE ASCII SPACE IN PREFIX.
1006 1662 2020        ISZ A035        /BUMP PREFIX MESSAGE ADDRESS.
1007 1663 4554        JMS I A360      /SUFFIX TERMINATOR TO PREFIX.
1008 1664 4546        JMS I A325      /TYPE OUT PREFIX MESSAGE.
1009 1665 0437        D095+D095-1-D025
1010 1666 4546        JMS I A325      /TYPE OUT TAPE ERROR MESSAGE.
1011 1667 0000 B665,  0
1012 1670 4546        JMS I A325      /TYPE OUT SUFFIX MESSAGE.
1013 1671 0000 B670,  0
1014 1672 5600        JMP I B640      /EXIT.
1015          /
1016          /SUBROUTINE TO ACCESS NEXT CARTRIFILE TABLE.
1017          /
1018 1673 0000 B675,  0
1019 1674 1133        TAD A270        /LOAD C-F TABLE POINTER.
1020 1675 1366        TAD B715        /ADD END-OF-TABLE CONSTANT.
1021 1676 7710        SPA CLA         /TEST FOR END OF TABLES.
1022 1677 5303        JMP B680        /IF NOT, GO BUMP TABLE PTR.
1023 1700 1142        TAD A305        /RESET C-F TABLE POINTER.
1024 1701 3133        DCA A270
1025 1702 5673        JMP I B675      /EXIT.
1026 1703 1133 B680,  TAD A270        /BUMP C-F TABLE POINTER.
1027 1704 1375        TAD B750
1028 1705 3133        DCA A270
1029 1706 1133        TAD A270        /SET UP TABLE-TO-WORKAREA MOVE.
1030 1707 3024        DCA A055
1031 1710 1142        TAD A305
1032 1711 3025        DCA A060
1033 1712 1372        TAD B735
1034 1713 3026        DCA A065
1035 1714 4553        JMS I A350      /MOVE C-F TABLE TO WORKAREA.
1036 1715 2273        ISZ B675        /BUMP RETURN ADDRESS.
1037 1716 5673        JMP I B675      /EXIT.
1038          /
1039          /SUBROUTINE TO RESTORE CURRENT CARTRIFILE TABLE.
1040          /
1041 1717 0000 B685,  0
1042 1720 1142        TAD A305        /SET UP WORKAREA-TO-TABLE MOVE.
1043 1721 3024        DCA A055
1044 1722 1133        TAD A270
1045 1723 3025        DCA A060
1046 1724 1372        TAD B735
1047 1725 3026        DCA A065
1048 1726 4553        JMS I A350      /MOVE WORKAREA TO C-F TABLE.
1049 1727 5717        JMP I B685      /EXIT.
1050          /
1051          /SUBROUTINE TO MOVE WORD STRINGS.  AT ENTRY, THE SOURCE
1052          /WORD ADDRESS IS IN WR6, THE DESTINATION WORD ADDRESS
1053          /IS IN WR7, AND THE NEGATED WORD COUNT IS IN WR8.
1054          /
1055 1730 0000 B690,  0
1056 1731 1424 B695,  TAD I A055      /MOVE NEXT DATA WORD.
1057 1732 3425        DCA I A060
1058 1733 2024        ISZ A055        /BUMP SOURCE WORD ADDRESS.
1059 1734 2025        ISZ A060        /BUMP DESTINATION WORD ADDRESS.
1060 1735 2026        ISZ A065        /BUMP WORD COUNT.
1061 1736 5331        JMP B695        /IF NON-ZERO, LOOP BACK.
1062 1737 5730        JMP I B690      /EXIT.
1063          /
1064          /SUBROUTINE TO STORE 6-BIT CHARACTERS RIGHT-JUSTIFIED
1065          /FROM THE A-C.  AT ENTRY, THE DESTINATION CHARACTER
1066          /POINTER IS IN WR2.
1067          /
1068 1740 0000 B700,  0
1069 1741 3551        DCA I A340      /SAVE 6-BIT CHARACTER.
1070 1742 7100        CLL             /CLEAR LINK BIT.
1071 1743 1020        TAD A035        /SET UP DESTINATION WORD ADDRESS.
1072 1744 1162        TAD A390
1073 1745 7010        RAR
1074 1746 3026        DCA A065
1075 1747 7430        SZL             /TEST FOR ODD CHARACTER.
1076 1750 5361        JMP B705        /IF SO, GO STORE CHARACTER.
1077 1751 1551        TAD I A340      /SHIFT CHARACTER 6 BITS LEFT.
1078 1752 7006        RTL
1079 1753 7006        RTL
1080 1754 7006        RTL
1081 1755 3551        DCA I A340
1082 1756 1426        TAD I A065      /LOAD DESTINATION WORD.
1083 1757 0166        AND A405        /MASK OUT UPPER 6 BITS.
1084 1760 5363        JMP B710        /GO INSERT NEW CHARACTER.
1085 1761 1426 B705,  TAD I A065      /LOAD DESTINATION WORD.
1086 1762 0373        AND B740        /MASK OUT LOWER 6 BITS.
1087 1763 1551 B710,  TAD I A340      /INSERT NEW CHARACTER.
1088 1764 3426        DCA I A065      /RESTORE DESTINATION WORD.
1089 1765 5740        JMP I B700      /EXIT.
1090
1091 1766 7661 B715,  -A225-1         /C-F TABLE-END CONSTANT.
1092 1767 0402 B720,  D080+D080+20-D025 /C-R L-F SUFFIX ADDRESS.
1093 1770 7760 B725,  7760            /DISABLE SUFFIX OFFSET.
1094 1771 0443 B730,  D095+D095+3-D025 /PREFIX DATA ADDRESS.
1095 1772 7770 B735,  7770            /CONSTANT -8.
1096 1773 7700 B740,  7700            /UPPER 6-BIT CHARACTER MASK.
1097 1774 1777 B745,  1777            /MESSAGE ADDRESS MASK.
1098 1775 0010 B750,  0010            /CONSTANT +8.
1099          *2000
```

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1100                    /
1101                    /ROUTINE TO LOADPOINT-SEARCH ANY AND ALL ACTIVE TAPES.
1102                    /
1103 2000 6002                  IOF             /TURN OFF INTERRUPTS.
1104 2001 7200                  CLA             /CLEAR A-C.
1105 2002 1142                  TAD A305        /RESET C-F TABLE POINTER.
1106 2003 3133                  DCA A270
1107 2004 4551 B755,    JMS I A340      /ACCESS NEXT C-F TABLE.
1108 2005 5222                  JMP B760        /AT END, GO HALT.
1109 2006 1027                  TAD A070        /LOAD C-F IDENTIFIER WORD.
1110 2007 0165                  AND A400        /MASK OFF C-F HARDWARE ADDRESS.
1111 2010 7650                  SNA CLA         /TEST IF THIS TABLE IS ACTIVE.
1112 2011 5204                  JMP B755        /IF NOT, GO ACCESS NEXT TABLE.
1113 2012 1274                  TAD B800        /LOAD MODEL 20-40 L-P SEARCH BITS.
1114 2013 4556                  JMS I A370      /ISSUE MODEL 20-40 L-P SEARCH.
1115 2014 6024                  ACMD
1116 2015 0172                  AND A420        /MASK OUT HIGH-ORDER BIT.
1117 2016 4556                  JMS I A370      /ISSUE 4096-4196 L-P SEARCH.
1118 2017 6014                  ACMD1
1119 2020 7200                  CLA             /CLEAR A-C.
1120 2021 5204                  JMP B755        /GO ACCESS NEXT TABLE.
1121 2022 7602 B760,    CLA HLT         /DEAD-END HALT.
1122 2023 5222                  JMP B760
1123                    /
1124                    /SUBROUTINE TO LOAD 6-BIT CHARACTERS RIGHT-JUSTIFIED
1125                    /INTO THE A-C.  AT ENTRY, THE SOURCE CHARACTER POINTER
1126                    /IS IN XR1.
1127                    /
1128 2024 0000 B765,    0
1129 2025 7100                  CLL             /CLEAR LINK BIT.
1130 2026 1017                  TAD A030        /SET UP SOURCE WORD ADDRESS.
1131 2027 1162                  TAD A390
1132 2030 7010                  RAR
1133 2031 3026                  DCA A065
1134 2032 1426                  TAD I A065      /LOAD SOURCE WORD.
1135 2033 7430                  SZL             /TEST FOR ODD CHARACTER.
1136 2034 5240                  JMP B770        /IF SO, GO MASK OFF CHARACTER.
1137 2035 7012                  RTR             /SWAP SOURCE WORD.
1138 2036 7012                  RTR
1139 2037 7012                  RTR
1140 2040 0166 B770,    AND A405        /MASK OFF 6-BIT CHARACTER.
1141 2041 5624                  JMP I B765      /EXIT.
1142                    /
1143                    /SUBROUTINE TO SET UP AND EXECUTE CARTRIFILE OPCODES.
1144                    /
1145 2042 0000 B775,    0
1146 2043 3551                  DCA I A340      /SAVE A-C.
1147 2044 1027                  TAD A070        /ISOLATE C-F HARDWARE ADDRESS.
1148 2045 0165                  AND A400
1149 2046 7104                  CLL RAL
1150 2047 1642                  TAD I B775      /ADD C-F OPCODE.
1151 2050 3252                  DCA B780        /STORE OPCODE BELOW.
1152 2051 1551                  TAD I A340      /RELOAD A-C.
1153 2052 0000 B780,    0               /EXECUTE C-F OPCODE.
1154 2053 2242                  ISZ B775        /BUMP RETURN ADDRESS.
1155 2054 5642                  JMP I B775      /EXIT.
1156                    /
1157                    /SUBROUTINE TO CHANGE TAPE COMMAND BITS FROM 4096-4196
1158                    /FORMAT TO MODEL 20-40 FORMAT AND VICE-VERSA.  THE
1159                    /BITS TO BE CONVERTED ARE IN A-C BITS 8-11 AT ENTRY;
1160                    /THE CONVERTED BITS WILL BE IN A-C BITS 8-11 ON EXIT.
1161                    /
1162 2055 0000 B785,    0
1163 2056 0172                  AND A420        /MASK OFF TAPE COMMAND BITS.
1164 2057 3551                  DCA I A340      /STORE TAPE COMMAND BITS.
1165 2060 1175                  TAD A430        /SET LOOP COUNT OF -4.
1166 2061 3552                  DCA I A345
1167 2062 3553 B790,    DCA I A350      /STORE NEW COMMAND BITS.
1168 2063 1551                  TAD I A340      /LOAD OLD COMMAND BITS.
1169 2064 7110                  CLL RAR         /ROTATE BITS 1 PLACE RIGHT.
1170 2065 3551                  DCA I A340      /STORE OLD COMMAND BITS.
1171 2066 1553                  TAD I A350      /LOAD NEW COMMAND BITS.
1172 2067 7004                  RAL             /ROTATE IN NEW BIT.
1173 2070 2552                  ISZ I A345      /BUMP LOOP COUNT.
1174 2071 5262                  JMP B790        /IF NON-ZERO, LOOP BACK.
1175 2072 5655                  JMP I B785      /EXIT.
1176
1177 2073 7400 B795,    D025            /6-BIT DATA BASE ADDRESS.
1178 2074 0417 B800,    0417            /MODEL 20-40 L-P SEARCH BITS.
1179                    /
1180                    /WRITE INTERRUPT ROUTINES.
1181                    /
1182 2075 6332 C005,    SDCL A          /TEST FOR WRITE-CALL ON C-F A.
1183 2076 5310                  JMP C030        /IF NOT, GO TEST C-F B.
1184 2077 2046                  ISZ A125        /BUMP I-O COUNT.
1185 2100 5304                  JMP C015        /IF NON-ZERO, WRITE NEXT WORD.
1186 2101 7130                  STL RAR         /ISSUE WRITE-STOP COMMAND.
1187 2102 6324 C010,    ACMD A
1188 2103 5307                  JMP C025        /GO SET LINK BIT.
1189 2104 1445 C015,    TAD I A120      /WRITE NEXT WORD.
1190 2105 2045                  ISZ A120
1191 2106 6334 C020,    OTB A
1192 2107 7320 C025,    CLA STL         /SET LINK BIT ON.
1193
1194 2110 6432 C030,    SDCL B          /TEST FOR WRITE-CALL ON C-F B.
1195 2111 5323                  JMP C055        /IF NOT, GO TEST C-F C.
1196 2112 2056                  ISZ A145        /BUMP I-O COUNT.
1197 2113 5317                  JMP C040        /IF NON-ZERO, WRITE NEXT WORD.
1198 2114 7130                  STL RAR         /ISSUE WRITE-STOP COMMAND.
1199 2115 6424 C035,    ACMD B
1200 2116 5322                  JMP C050        /GO SET LINK BIT.
1201 2117 1455 C040,    TAD I A140      /WRITE NEXT WORD.
1202 2120 2055                  ISZ A140
1203 2121 6434 C045,    OTB B
1204 2122 7320 C050,    CLA STL         /SET LINK BIT ON.
1205
1206 2123 6532 C055,    SDCL C          /TEST FOR WRITE-CALL ON C-F C.
1207 2124 5336                  JMP C080        /IF NOT, GO TEST C-F D.
1208 2125 2066                  ISZ A165        /BUMP I-O COUNT.
1209 2126 5332                  JMP C065        /IF NON-ZERO, WRITE NEXT WORD.
1210 2127 7130                  STL RAR         /ISSUE WRITE-STOP COMMAND.
1211 2130 6524 C060,    ACMD C
1212 2131 5335                  JMP C075        /GO SET LINK BIT.
1213 2132 1465 C065,    TAD I A160      /WRITE NEXT WORD.
1214 2133 2065                  ISZ A160
1215 2134 6534 C070,    OTB C
1216 2135 7320 C075,    CLA STL         /SET LINK BIT ON.
1217
1218 2136 6632 C080,    SDCL D          /TEST FOR WRITE-CALL ON C-F D.
1219 2137 5351                  JMP C105        /IF NOT, GO TEST C-F E.
1220 2140 2076                  ISZ A185        /BUMP I-O COUNT.
1221 2141 5345                  JMP C090        /IF NON-ZERO, WRITE NEXT WORD.
1222 2142 7130                  STL RAR         /SET LINK BIT ON.
1223 2143 6624 C085,    ACMD D
1224 2144 5350                  JMP C100        /GO SET LINK BIT.
1225 2145 1475 C090,    TAD I A180      /WRITE NEXT WORD.
1226 2146 2075                  ISZ A180
1227 2147 6634 C095,    OTB D
1228 2150 7320 C100,    CLA STL         /SET LINK BIT ON.
1229
1230 2151 6672 C105,    SDCL E          /TEST FOR WRITE-CALL ON C-F E.
1231 2152 5364                  JMP C130        /IF NOT, GO TEST C-F F.
1232 2153 2106                  ISZ A205        /BUMP I-O COUNT.
1233 2154 5360                  JMP C115        /IF NON-ZERO, WRITE NEXT WORD.
1234 2155 7130                  STL RAR         /ISSUE WRITE-STOP COMMAND.
1235 2156 6664 C110,    ACMD E
1236 2157 5363                  JMP C125        /GO SET LINK BIT.
1237 2160 1505 C115,    TAD I A200      /WRITE NEXT WORD.
1238 2161 2105                  ISZ A200
1239 2162 6674 C120,    OTB E
1240 2163 7320 C125,    CLA STL         /SET LINK BIT ON.
1241
1242 2164 6732 C130,    SDCL F          /TEST FOR WRITE-CALL ON C-F F.
1243 2165 5377                  JMP C155        /IF NOT, GO TEST C-F G.
1244 2166 2116                  ISZ A225        /BUMP I-O COUNT.
1245 2167 5373                  JMP C140        /IF NON-ZERO, WRITE NEXT WORD.
1246 2170 7130                  STL RAR         /ISSUE WRITE-STOP COMMAND.
1247 2171 6724 C135,    ACMD F
1248 2172 5376                  JMP C150        /GO SET LINK BIT.
1249 2173 1515 C140,    TAD I A220      /WRITE NEXT WORD.
1250 2174 2115                  ISZ A220
1251 2175 6734 C145,    OTB F
1252 2176 7320 C150,    CLA STL         /SET LINK BIT ON.
1253
1254 2177 6772 C155,    SDCL G          /TEST FOR WRITE-CALL ON C-F G.
1255 2200 5347                  JMP C325        /IF NOT, GO TEST FOR ANY I-O.
1256 2201 2126                  ISZ A245        /BUMP I-O COUNT.
1257 2202 5206                  JMP C165        /IF NON-ZERO, WRITE NEXT WORD.
1258 2203 7130                  STL RAR         /ISSUE WRITE-STOP COMMAND.
1259 2204 6764 C160,    ACMD G
1260 2205 5011                  JMP A020        /GO EXIT.
1261 2206 1525 C165,    TAD I A240      /WRITE NEXT WORD.
1262 2207 2125                  ISZ A240
1263 2210 6774 C170,    OTB G
1264 2211 5011                  JMP A020        /GO EXIT.
1265                    /
1266                    /READ INTERRUPT ROUTINES.
1267                    /
1268 2212 6332 C175,    SDCL A          /TEST FOR READ-CALL ON C-F A.
1269 2213 5227                  JMP C195        /IF NOT, GO TEST C-F B.
1270 2214 6334 C180,    OTB A           /READ & STORE NEXT WORD.
1271 2215 3445                  DCA I A120
1272 2216 6324 C185,    ACMD A          /GET C-F TAPES STATUS.
1273 2217 0346                  AND C320        /MASK OFF READ-READY BITS.
1274 2220 7650                  SNA CLA         /TEST FOR RRCC INTERRUPT.
1275 2221 1046                  TAD A125        /IF NOT, LOAD I-O COUNT.
1276 2222 7650                  SNA CLA         /TEST FOR INPUT OVERFLOW.
1277 2223 5226                  JMP C190        /IF SO, GO SET LINK BIT.
1278 2224 2046                  ISZ A125        /BUMP I-O COUNT.
1279 2225 2045                  ISZ A120        /BUMP I-O POINTER.
1280 2226 7120 C190,    STL             /SET LINK BIT ON.
1281
1282 2227 6432 C195,    SDCL B          /TEST FOR READ-CALL ON C-F B.
1283 2230 5244                  JMP C215        /IF NOT, GO TEST C-F C.
1284 2231 6434 C200,    OTB B           /READ & STORE NEXT WORD.
1285 2232 3455                  DCA I A140
1286 2233 6424 C205,    ACMD B          /GET C-F TAPES STATUS.
1287 2234 0346                  AND C320        /MASK OFF READ-READY BITS.
1288 2235 7650                  SNA CLA         /TEST FOR RRCC INTERRUPT.
1289 2236 1056                  TAD A145        /IF NOT, LOAD I-O COUNT.
1290 2237 7650                  SNA CLA         /TEST FOR INPUT OVERFLOW.
1291 2240 5243                  JMP C210        /IF SO, GO SET LINK BIT.
1292 2241 2056                  ISZ A145        /BUMP I-O COUNT.
1293 2242 2055                  ISZ A140        /BUMP I-O POINTER.
1294 2243 7120 C210,    STL             /SET LINK BIT ON.
1295
1296 2244 6532 C215,    SDCL C          /TEST FOR READ-CALL ON C-F C.
1297 2245 5261                  JMP C235        /IF NOT, GO TEST C-F D.
1298 2246 6534 C220,    OTB C           /READ & STORE NEXT WORD.
1299 2247 3465                  DCA I A160
1300 2250 6524 C225,    ACMD C          /GET C-F TAPES STATUS.
1301 2251 0346                  AND C320        /MASK OFF READ-READY BITS.
1302 2252 7650                  SNA CLA         /TEST FOR RRCC INTERRUPT.
1303 2253 1066                  TAD A165        /IF NOT, LOAD I-O COUNT.
1304 2254 7650                  SNA CLA         /TEST FOR INPUT OVERFLOW.
1305 2255 5260                  JMP C230        /IF SO, GO SET LINK BIT.
1306 2256 2066                  ISZ A165        /BUMP I-O COUNT.
1307 2257 2065                  ISZ A160        /BUMP I-O POINTER.
1308 2260 7120 C230,    STL             /SET LINK BIT ON.
1309
1310 2261 6632 C235,    SDCL D          /TEST FOR READ-CALL ON C-F D.
1311 2262 5276                  JMP C255        /IF NOT, GO TEST C-F E.
1312 2263 6634 C240,    OTB D           /READ & STORE NEXT WORD.
1313 2264 3475                  DCA I A180
1314 2265 6624 C245,    ACMD D          /GET C-F TAPES STATUS.
1315 2266 0346                  AND C320        /MASK OFF READ-READY BITS.
1316 2267 7650                  SNA CLA         /TEST FOR RRCC INTERRUPT.
1317 2270 1076                  TAD A185        /IF NOT, LOAD I-O COUNT.
1318 2271 7650                  SNA CLA         /TEST FOR INPUT OVERFLOW.
1319 2272 5275                  JMP C250        /IF SO, GO SET LINK BIT.
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1320 2273 2076        ISZ A185          /BUMP I-O COUNT.
1321 2274 2075        ISZ A180          /BUMP I-O POINTER.
1322 2275 7120 C250,  STL               /SET LINK BIT ON.
1323
1324 2276 6672 C255,  SDCL E            /TEST FOR READ-CALL ON C-F E.
1325 2277 5313        JMP C275          /IF NOT, GO TEST C-F F.
1326 2300 6674 C260,  OTB E             /READ & STORE NEXT WORD.
1327 2301 3505        DCA I A200
1328 2302 6664 C265,  ACMD E            /GET C-F TAPES STATUS.
1329 2303 0346        AND C320          /MASK OFF READ-READY BITS.
1330 2304 7650        SNA CLA           /TEST FOR RRCC INTERRUPT.
1331 2305 1106        TAD A205          /IF NOT, LOAD I-O COUNT.
1332 2306 7650        SNA CLA           /TEST FOR INPUT OVERFLOW.
1333 2307 5312        JMP C270          /IF SO, GO SET LINK BIT.
1334 2310 2106        ISZ A205          /BUMP I-O COUNT.
1335 2311 2105        ISZ A200          /BUMP I-O POINTER.
1336 2312 7120 C270,  STL               /SET LINK BIT ON.
1337
1338 2313 6732 C275,  SDCL F            /TEST FOR READ-CALL ON C-F F.
1339 2314 5330        JMP C295          /IF NOT, GO TEST C-F G.
1340 2315 6734 C280,  OTB F             /READ & STORE NEXT WORD.
1341 2316 3515        DCA I A220
1342 2317 6724 C285,  ACMD F            /GET C-F TAPES STATUS.
1343 2320 0346        AND C320          /MASK OFF READ-READY BITS.
1344 2321 7650        SNA CLA           /TEST FOR RRCC INTERRUPT.
1345 2322 1116        TAD A225          /IF NOT, LOAD I-O COUNT.
1346 2323 7650        SNA CLA           /TEST FOR INPUT OVERFLOW.
1347 2324 5327        JMP C290          /IF SO, GO SET LINK BIT.
1348 2325 2116        ISZ A225          /BUMP I-O COUNT.
1349 2326 2115        ISZ A220          /BUMP I-O POINTER.
1350 2327 7120 C290,  STL               /SET LINK BIT ON.
1351
1352 2330 6772 C295,  SDCL G            /TEST FOR READ-CALL ON C-F G.
1353 2331 5347        JMP C325          /IF NOT, GO TEST FOR ANY I-O.
1354 2332 6774 C300,  OTB G             /READ & STORE NEXT WORD.
1355 2333 3525        DCA I A240
1356 2334 6764 C305,  ACMD G            /GET C-F TAPES STATUS.
1357 2335 0346        AND C320          /MASK OFF READ-READY BITS.
1358 2336 7650        SNA CLA           /TEST FOR RRCC INTERRUPT.
1359 2337 1126        TAD A245          /IF NOT, LOAD I-O COUNT.
1360 2340 7650        SNA CLA           /TEST FOR INPUT OVERFLOW.
1361 2341 5012        JMP A025          /IF SO, GO EXIT.
1362 2342 2126        ISZ A245          /BUMP I-O COUNT.
1363 2343 2125        ISZ A240          /BUMP I-O POINTER.
1364 2344 5012        JMP A025          /GO EXIT.
1365
1366 2345 2431 C315,  C400              /LOADPOINT ROUTINES ADDRESS.
1367 2346 7400 C320,  7400              /READ-READY BIT MASK.
1368                   /
1369                  /TELEPRINTER INTERRUPT ROUTINE.
1370                   /
1371 2347 7430 C325,  SZL               /TEST FOR ANY I-O INTERRUPTS.
1372 2350 5012        JMP A025          /IF SO, GO EXIT.
1373 2351 6041        TSF               /TEST FOR TELEPRINTER INTERRUPT.
1374 2352 5745        JMP I C315        /IF NOT, GO TEST FOR LOADPOINT.
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1375 2353 6042        TCF               /CLEAR TELEPRINTER FLAG.
1376 2354 1135 C330,  TAD A280          /LOAD TELEPRINTER BUFFER PTR.
1377 2355 7040        CMA               /COMPLEMENT BUFFER POINTER.
1378 2356 7440        SZA               /TEST FOR END OF BUFFER.
1379 2357 5363        JMP C335          /IF NOT, GO GET WORD ADDRESS.
1380 2360 1163        TAD A395          /RESET TELEPRINTER BUFFER PTR.
1381 2361 3135        DCA A280
1382 2362 5354        JMP C330          /GO GET 1ST CHARACTER.
1383 2363 2135 C335,  ISZ A280          /BUMP TELEPRINTER BUFFER PTR.
1384 2364 7040        CMA               /GET TELEPRINTER WORD ADDRESS.
1385 2365 1162        TAD A390
1386 2366 7010        RAR
1387 2367 3006        DCA A007
1388 2370 1406        TAD I A007        /LOAD NEXT TELEPRINTER WORD.
1389 2371 7430        SZL               /TEST FOR ODD CHARACTER.
1390 2372 5376        JMP C340          /IF SO, GO MASK OFF CHARACTER.
1391 2373 7012        RTR               /SWAP TELEPRINTER WORD.
1392 2374 7012        RTR
1393 2375 7012        RTR
1394 2376 0166 C340,  AND A405          /MASK OFF 6-BIT CHARACTER.
1395 2377 7440        SZA               /TEST FOR END OF MESSAGES.
1396 2400 5203        JMP C345          /IF NOT, GO ADD -40.
1397 2401 3135        DCA A280          /CLEAR TELEPRINTER BUFFER POINTER.
1398 2402 5012        JMP A025          /GO EXIT.
1399 2403 1223 C345,  TAD C380          /ADD -40 OCTAL.
1400 2404 7500        SMA               /TEST FOR CODES 40-77.
1401 2405 5216        JMP C355          /IF SO, GO RECREATE CHARACTER.
1402 2406 1174        TAD A427          /ADD +4.
1403 2407 7510        SPA               /TEST FOR CODES 1-33.
1404 2410 5215        JMP C350          /IF SO, GO RECREATE CHARACTER.
1405 2411 1221        TAD C365          /GET SPECIAL-CHARACTER ADDRESS.
1406 2412 3006        DCA A007
1407 2413 1406        TAD I A007        /LOAD SPECIAL CHARACTER.
1408 2414 5217        JMP C360          /GO PRINT SPECIAL CHARACTER.
1409 2415 1222 C350,  TAD C370          /RECREATE CODES 101-133.
1410 2416 1171 C355,  TAD A415          /RECREATE CODES 040-077.
1411 2417 6046 C360,  TLS               /PRINT NEXT CHARACTER.
1412 2420 5011        JMP A020          /GO EXIT.
1413
1414 2421 2425 C365,  C390              /ADDRESS OF SPECIAL CHARACTERS.
1415 2422 0074 C370,  0074              /CODES 101-133 RESET WORD.
1416 2423 7740 C380,  7740              /CONSTANT -40 OCTAL.
1417 2424 0100 C385,  0100              /4096-4196 LPA RESET BIT.
1418 2425 0007 C390,  0007              /BELL CODE (CODE 34).
1419 2426 0012        0012              /LINE-FEED (CODE 35).
1420 2427 0015        0015              /CARRIAGE-RETURN (CODE 36).
1421 2430 0377        0377              /RUBOUT (CODE 37).
1422                   /
1423                  /LOADPOINT INTERRUPT ROUTINES.
1424                   /
1425 2431 6322 C400,  SCSC A            /TEST FOR LOADPOINT ON C-F A.
1426 2432 5241        JMP C415          /IF NOT, GO TEST C-F B.
1427 2433 1224        TAD C385          /LOAD LPA RESET BIT.
1428 2434 6324 C405,  ACMD A            /RESET LPA FLAG.
1429 2435 1043        TAD A115          /UPDATE DETECTED L-P BITS.
1430 2436 6314 C410,  OTSA A
1431 2437 3043        DCA A115
1432 2440 5012        JMP A025          /GO EXIT.
1433
1434 2441 6422 C415,  SCSC B            /TEST FOR LOADPOINT ON C-F B.
1435 2442 5251        JMP C430          /IF NOT, GO TEST C-F C.
1436 2443 1224        TAD C385          /LOAD LPA RESET BIT.
1437 2444 6424 C420,  ACMD B            /RESET LPA FLAG.
1438 2445 1053        TAD A135          /UPDATE DETECTED L-P BITS.
1439 2446 6414 C425,  OTSA B
1440 2447 3053        DCA A135
1441 2450 5012        JMP A025          /GO EXIT.
1442
1443 2451 6522 C430,  SCSC C            /TEST FOR LOADPOINT ON C-F C.
1444 2452 5261        JMP C445          /IF NOT, GO TEST C-F D.
1445 2453 1224        TAD C385          /LOAD LPA RESET BIT.
1446 2454 6524 C435,  ACMD C            /RESET LPA FLAG.
1447 2455 1063        TAD A155          /UPDATE DETECTED L-P BITS.
1448 2456 6514 C440,  OTSA C
1449 2457 3063        DCA A155
1450 2460 5012        JMP A025          /GO EXIT.
1451
1452 2461 6622 C445,  SCSC D            /TEST FOR LOADPOINT ON C-F D.
1453 2462 5271        JMP C460          /IF NOT, GO TEST C-F E.
1454 2463 1224        TAD C385          /LOAD LPA RESET BIT.
1455 2464 6624 C450,  ACMD D            /RESET LPA FLAG.
1456 2465 1073        TAD A175          /UPDATE DETECTED L-P BITS.
1457 2466 6614 C455,  OTSA D
1458 2467 3073        DCA A175
1459 2470 5012        JMP A025          /GO EXIT.
1460
1461 2471 6662 C460,  SCSC E            /TEST FOR LOADPOINT ON C-F E.
1462 2472 5301        JMP C475          /IF NOT, GO TEST C-F F.
1463 2473 1224        TAD C385          /LOAD LPA RESET BIT.
1464 2474 6664 C465,  ACMD E            /RESET LPA FLAG.
1465 2475 1103        TAD A195          /UPDATE DETECTED L-P BITS.
1466 2476 6654 C470,  OTSA E
1467 2477 3103        DCA A195
1468 2500 5012        JMP A025          /GO EXIT.
1469
1470 2501 6722 C475,  SCSC F            /TEST FOR LOADPOINT ON C-F F.
1471 2502 5311        JMP C490          /IF NOT, GO TEST C-F G.
1472 2503 1224        TAD C385          /LOAD LPA RESET BIT.
1473 2504 6724 C480,  ACMD F            /RESET LPA FLAG.
1474 2505 1113        TAD A215          /UPDATE DETECTED L-P BITS.
1475 2506 6714 C485,  OTSA F
1476 2507 3113        DCA A215
1477 2510 5012        JMP A025          /GO EXIT.
1478
1479 2511 6762 C490,  SCSC G            /TEST FOR LOADPOINT ON C-F G.
1480 2512 5321        JMP C505          /IF NOT, GO TEST KEYBOARD.
1481 2513 1224        TAD C385          /LOAD LPA RESET BIT.
1482 2514 6764 C495,  ACMD G            /RESET LPA FLAG.
1483 2515 1123        TAD A235          /UPDATE DETECTED L-P BITS.
1484 2516 6754 C500,  OTSA G
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1485 2517 3123        DCA A235
1486 2520 5012        JMP A025          /GO EXIT.
1487                   /
1488                  /KEYBOARD- AND UNKNOWN-INTERRUPT ROUTINES.
1489                   /
1490 2521 6033 C505,  KSF KCC           /TEST FOR KLOWN ON THE KEYBOARD.
1491 2522 5324        JMP C510          /IF NOT, BAD NEWS!
1492 2523 5012        JMP A025          /IGNORE KEYBOARD KLOWN; EXIT.
1493 2524 7602 C510,  CLA HLT           /UNKNOWN INTERRUPT!  WE'VE BEEN
1494 2525 5324        JMP C510          /        SCREWED BY GRANNY!!!!!
1495                   /
1496                  /MODEL 20-40 SKELETON C-F OPCODE TABLE.
1497                   /
1498 2526 6032 D005,  SDCL
1499 2527 6024        ACMD
1500 2530 6034        OTB
1501 2531 6032        SDCL
1502 2532 6034        OTB
1503 2533 6024        ACMD
1504 2534 6022        SCSC
1505 2535 6024        ACMD
1506 2536 6014        OTSA
1507 2537 0000        0
1508                   /
1509                  /4096-4196 SKELETON C-F OPCODE TABLE.
1510                   /
1511 2540 6021        SWWC
1512 2541 6012        WSPC
1513 2542 6024        LTB
1514 2543 6032        SRWC
1515 2544 6034        OTB
1516 2545 6004        OTSA1
1517 2546 6011        SLPA
1518 2547 6022        RSFF
1519 2550 6004        OTSA1
1520 2551 0000        0
1521                   /
1522                  /INTERRUPT ROUTINES OPCODE ADDRESS TABLE.
1523                   /
1524 2552 2075 D010,  C005              /C-F A OPCODE ADDRESSES.
1525 2553 2102        C010
1526 2554 2106        C020
1527 2555 2212        C175
1528 2556 2214        C180
1529 2557 2216        C185
1530 2560 2431        C400
1531 2561 2434        C405
1532 2562 2436        C410
1533 2563 2110        C030              /C-F B OPCODE ADDRESSES.
1534 2564 2115        C035
1535 2565 2121        C045
1536 2566 2227        C195
1537 2567 2231        C200
1538 2570 2233        C205
1539 2571 2441        C415
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1540 2572 2444        C420
1541 2573 2446        C425
1542 2574 2123        C055            /C-F C OPCODE ADDRESSES.
1543 2575 2130        C060
1544 2576 2134        C070
1545 2577 2244        C215
1546 2600 2246        C220
1547 2601 2250        C225
1548 2602 2451        C430
1549 2603 2454        C435
1550 2604 2456        C440
1551 2605 2136        C080            /C-F D OPCODE ADDRESSES.
1552 2606 2143        C085
1553 2607 2147        C095
1554 2610 2261        C235
1555 2611 2263        C240
1556 2612 2265        C245
1557 2613 2461        C445
1558 2614 2464        C450
1559 2615 2466        C455
1560 2616 2151        C105            /C-F E OPCODE ADDRESSES.
1561 2617 2156        C110
1562 2620 2162        C120
1563 2621 2276        C255
1564 2622 2300        C260
1565 2623 2302        C265
1566 2624 2471        C460
1567 2625 2474        C465
1568 2626 2476        C470
1569 2627 2164        C130            /C-F F OPCODE ADDRESSES.
1570 2630 2171        C135
1571 2631 2175        C145
1572 2632 2313        C275
1573 2633 2315        C280
1574 2634 2317        C285
1575 2635 2501        C475
1576 2636 2504        C480
1577 2637 2506        C485
1578 2640 2177        C155            /C-F G OPCODE ADDRESSES.
1579 2641 2204        C160
1580 2642 2210        C170
1581 2643 2330        C295
1582 2644 2332        C300
1583 2645 2334        C305
1584 2646 2511        C490
1585 2647 2514        C495
1586 2650 2516        C500
1587          /
1588          /CONSTANT INPUT-OUTPUT DATA PATTERN.  THE FIRST WORD IS
1589          /FILLED DURING INPUT-OUTPUT WITH THE C-F RECORD NUMBER.
1590          /
     2651 0000
     2652 0000
     2653 0003
     2654 0014
     2655 0060
     2656 0077
     2657 0140
1591 2660 0220 D015, 0000; 0000; 0003; 0014; 0060; 0077; 0140; 0220
     2661 0300
     2662 0360
     2663 0410
     2664 1004
     2665 1400
     2666 1463
     2667 1777
1592 2670 2002        0300; 0360; 0410; 1004; 1400; 1463; 1777; 2002
     2671 2525
     2672 2526
     2673 2531
     2674 2545
     2675 2552
     2676 2625
     2677 2645
1593 2700 3125        2525; 2526; 2531; 2545; 2552; 2625; 2645; 3125
     2701 3146
     2702 3252
     2703 3637
     2704 3776
     2705 4001
     2706 4525
     2707 4631
1594 2710 4652        3146; 3252; 3637; 3776; 4001; 4525; 4631; 4652
     2711 5132
     2712 5152
     2713 5225
     2714 5232
     2715 5246
     2716 5251
     2717 5252
1595 2720 5775        5132; 5152; 5225; 5232; 5246; 5251; 5252; 5775
     2721 6000
     2722 6314
     2723 6337
     2724 6773
     2725 7367
     2726 7417
     2727 7477
1596 2730 7557        6000; 6314; 6337; 6773; 7367; 7417; 7477; 7557
     2731 7700
     2732 7717
     2733 7763
     2734 7774
     2735 7777
1597 2736 7763        7700; 7717; 7763; 7774; 7777; 7763
1598          D020, *3600             /I-O BUFFERS START HERE.
1599          D025=.+.                /MESSAGE DATA BASE ADDRESS.
1600          /
1601          /TITLE MESSAGE.
1602          /
     3600 3737
     3601 3736
     3602 3535
     3603 2422
     3604 1155
     3605 0401
     3606 2401
1603 3607 4070 D030, 3737; 3736; 3535; 2422; 1155; 0401; 2401; 4070
     3610 5560
     3611 6066
     3612 0255
     3613 0211
     3614 1640
     3615 0301
     3616 2224
1604 3617 2211        5560; 6066; 0255; 0211; 1640; 0301; 2224; 2211
     3620 0611
     3621 1405
     3622 4004
     3623 1101
     3624 0716
     3625 1723
     3626 2411
1605 3627 0373        0611; 1405; 4004; 1101; 0716; 1723; 2411; 0373
     3630 4061
     3631 6157
     3632 6061
     3633 5767
     3634 6156
     3635 3635
1606 3636 0037        4061; 6157; 6061; 5767; 6156; 3635; 0037
1607          /
1608          /NO C-F ACTIVE MESSAGE (1ST CHARACTER ABOVE).
1609          /
     3637 3737
     3640 1617
     3641 4003
     3642 5706
     3643 4001
     3644 0324
     3645 1126
1610 3646 0556 D035, 3737; 1617; 4003; 5706; 4001; 0324; 1126; 0556
     3647 3635
1611 3650 0037        3635; 0037
1612          /
1613          /END-OF-JOB MESSAGE (1ST CHARACTER ABOVE).
1614          /
     3651 3737
     3652 3505
     3653 1604
     3654 4017
     3655 0640
     3656 1217
     3657 0256
1615 3660 3635 D040, 3737; 3505; 1604; 4017; 0640; 1217; 0256; 3635
1616 3661 0037        0037
1617          /
1618          /BELL MESSAGE (1ST CHARACTER ABOVE).
1619          /
     3662 3737
     3663 3434
     3664 3434
     3665 3434
     3666 3434
     3667 3434
     3670 3434
1620 3671 3434 D045, 3737; 3434; 3434; 3434; 3434; 3434; 3434; 3434
     3672 3434
     3673 3434
     3674 3434
1621 3675 0016        3434; 3434; 3434; 0016
1622          /
1623          /NOT-READY MESSAGE (1ST CHARACTER ABOVE).
1624          /
     3676 1724
     3677 4022
     3700 0501
     3701 0431
1625 3702 5600 D050, 1724; 4022; 0501; 0431; 5600
1626          /
1627          /FILE-PROTECTED MESSAGE.
1628          /
     3703 0611
     3704 1405
     3705 5520
     3706 2217
     3707 2405
     3710 0324
     3711 0504
1629 3712 5600        0611; 1405; 5520; 2217; 2405; 0324; 0504; 5600
1630          /
1631          /NOT-ON-LINE MESSAGE.
1632          /
     3713 1617
     3714 2440
     3715 1716
     3716 4014
     3717 1116
     3720 0556
1633 3721 0023        1617; 2440; 1716; 4014; 1116; 0556; 0023
1634          /
1635          /TOO-MANY-ERRORS MESSAGE (1ST CHARACTER ABOVE).
1636          /
     3722 2417
     3723 2020
     3724 0504
     3725 7340
     3726 2417
     3727 1740
     3730 1501
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1637 3731 1631 D055, 2417; 2020; 0504; 7340; 2417; 1740; 1501; 1631
     3732 4005
     3733 2222
     3734 1722
     3735 2356
1638 3736 0024       4005; 2222; 1722; 2356; 0024
1639           /
1640           /TIMED-OUT MESSAGE.
1641           /
     3737 1115
     3740 0504
     3741 4017
     3742 2524
1642 3743 5600 D060, 1115; 0504; 4017; 2524; 5600
1643           /
1644           /FOUND-NO-LOADPOINT MESSAGE.
1645           /
     3744 0617
     3745 2516
     3746 0440
     3747 1617
     3750 4014
     3751 5720
1646 3752 5600 D065, 0617; 2516; 0440; 1617; 4014; 5720; 5600
1647           /
1648           /FLASHED-LOADPOINT MESSAGE.
1649           /
     3753 0614
     3754 0123
     3755 1005
     3756 0440
     3757 1457
     3760 2056
1650 3761 0022 D070, 0614; 0123; 1005; 0440; 1457; 2056; 0022
1651           /
1652           /READ-OVER-LOADPOINT MESSAGE (1ST CHARACTER ABOVE).
1653           /
     3762 0501
     3763 0440
     3764 1726
     3765 0522
     3766 4014
     3767 5720
1654 3770 5600 D075, 0501; 0440; 1726; 0522; 4014; 5720; 5600
1655           /
1656           /TAPE-DISABLED MESSAGE.
1657           /
     3771 4040
     3772 2401
     3773 2005
     3774 4004
     3775 1123
     3776 0102
     3777 1405
1658 4000 0456 D080, 4040; 2401; 2005; 4004; 1123; 0102; 1405; 0456
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     4001 3635
1659 4002 0014       3635; 0014
1660           /
1661           /LAST-RECORD MESSAGE (1ST CHARACTER ABOVE).
1662           /
     4003 2275
     4004 0000
     4005 0000
1663 4006 5600 D085, 2275; 0000; 0000; 5600
1664           /
1665           /PASS NUMBER MESSAGE.
1666           /
     4007 3737
     4010 3735
     4011 2001
     4012 2323
     4013 4000
     4014 0000
     4015 0056
1667 4016 3635 D090, 3737; 3735; 2001; 2323; 4000; 0000; 0056; 3635
1668 4017 0037       0037
1669           /
1670           /RUBOUT-T MESSAGE PREFIX (1ST CHARACTER ABOVE).
1671           /
     4020 3737
     4021 2400
     4022 0000
     4023 0000
1672 4024 0000 D095, 3737; 2400; 0000; 0000; 0000
1673           /
1674           /LINE-FEED MESSAGE.
1675           /
     4025 3737
     4026 3735
1676 4027 0022 D100, 3737; 3735; 0022
1677           /
1678           /READ-ERROR LOGOUT AREA (1ST CHARACTER ABOVE).
1679           /
     4030 0000
     4031 0000
     4032 7240
     4033 4014
     4034 2775
     4035 0000
     4036 0000
1680 4037 4003 D105, 0000; 0000; 7240; 4014; 2775; 0000; 0000; 4003
     4040 0575
     4041 0000
     4042 0000
     4043 4022
     4044 0575
     4045 0000
     4046 0000
1681 4047 0040       0575; 0000; 0000; 4022; 0575; 0000; 0000; 0040
1682           /
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1683           /ERROR-WORD MESSAGE (1ST CHARACTER ABOVE).
1684           /
     4050 0000
     4051 0000
1685 4052 0040 D110, 0000; 0000; 0040
1686           /
1687           /ASCII X'S MESSAGE (1ST CHARACTER ABOVE).
1688           /
     4053 3030
     4054 3030
1689 4055 0006 D115, 3030; 3030; 0006
1690           /
1691           /FAILED-TO-START MESSAGE (1ST CHARACTER ABOVE).
1692           /
     4056 0111
     4057 1405
     4060 0440
     4061 2417
     4062 4023
     4063 2401
     4064 2224
1693 4065 4011 D117, 0111; 1405; 0440; 2417; 4023; 2401; 2224; 4011
     4066 5517
1694 4067 5600       5517; 5600
1695           D120=.+.-D025         /STARTING TELEPRINTER BUFFER ADDR.
```