TM11

DRIVE FUNCTION TIMER
MD-11-DZTMD-E

EP-DZTMD-E-DL

FICHE 1 OF 1

APR 1978
digital
MADE IN USA

```
                        .REPT   0
```

IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZTMD-E-D

PRODUCT NAME: TM11 DRIVE FUNCTION TIMER

PROGRAM DATE: MARCH 1976

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHOR: JOHN RODENHISER/JIM LACEY/B. BURGESS/RON PLATUKIS

```
                                1.      ABSTRACT

                                        THE TM11 DRIVE FUNCTION TIMER ASSISTS IN THE TESTING OF
                                        THE TM11 CONTROL UNIT AND TU10 TAPE UNIT.  SELECTED
                                        OPERATIONS ARE EXECUTED, TIMED, AND THE TIMES ARE THEN
                                        PRINTED (IN MILLISECONDS).  THERE IS NO LIMIT OR ERROR
                                        TESTING FACILITIES IN THE PROGRAM, THE DECISION ON THE
                                        VALIDITY OF TIMES MEASURED MUST BE MADE BY THE OPERATOR.
                                        ANY CONFIGURATION OF UP TO 8 TU10 TAPE UNITS (7 AND 9
                                        CHANNEL) MAY BE SELECTED.

                                2.      REQUIREMENTS

                                2.1     EQUIPMENT

                                        PDP-11 WITH TM11 CONTROL UNIT AND 1 TO 8 TU10 TAPE
                                        UNITS (ANY COMBINATION OF 7 AND 9 CHANNEL UNITS).

                                2.2     STORAGE

                                2.2.1   PROGRAM STORAGE

                                        THE PROGRAM REQUIRES 4K OF MEMORY.

                                3.      LOADING PROCEDURE

                                3.1     METHOD

                                        PROCEDURE FOR NORMAL BINARY TAPES SHOULD BE FOLLOWED

                                        1.  ABSOLUTE LOADER MUST BE IN MEMORY.
                                        2.  PLACE BINARY TAPE IN READER.
                                        3.  LOAD ADDRESS 07500 (0 DETERMINED BY LOCATION OF LOADER).
                                        4.  PRESS "START" (PROGRAM WILL LOAD).

                                4.      STARTING PROCEDURE

                                4.1     BEFORE STARTING PROGRAM SET LOC. 176 WITH THE

                                        DESIRED CONTROL SETTINGS.

                                        BITS 15-0 ARE USED TO INDICATE THE TU10 TAPE UNIT CONFIGURATION.

                                         15=1          HAVE UNIT 0     SELECTED,       7 TRACK
                                           14=1              "    1          "              "
                                           13=1              "    2          "              "
                                           12=1              "    3          "              "
                                           11=1              "    4          "              "
                                           10=1              "    5          "              "
                                            9=1              "    6          "              "
                                            8=1              "    7          "              "
                                            7=1          HAVE UNIT 0     SELECTED,       9 TRACK
                                            6=1              "    1          "              "
                                            5=1              "    2          "              "
                                            4=1              "    3          "              "
```

```
                105                             3=1             "       4       "               "
                106                             2=1             "       5       "               "
                107                             1=1             "       6       "               "
                108                             0=1             "       7       "               "
```

```
                                4.2     STARTING ADDRESS

                                        200

                                4.3     PROGRAM AND/OR OPERATOR ACTION

                                        LOAD PROGRAM INTO MEMORY,
                                        SET DESIRED TU10 TAPE UNITS ON-LINE,
                                        LOAD LOC. 176 WITH CONTROL SETTINGS  (SEE 4.1)
                                        LOAD STARTING ADDRESS
                                        PRESS START,
                                        THE PROGRAM WILL BEGIN TIMING FUNCTIONS,
                                        ON COMPLETION OF ALL TESTS "END OF TIMING" WILL BE PRINTED AND
                                        THE PROCESSOR WILL HALT,
                                        TO REPEAT TEST1 IF SAME CONTROL SETTINGS ARE DESIRED SIMPLY PRESS CONTINUE,
                                        IF DIFFERENT SETTINGS ARE NECESSARY RELOAD LOC. 176 AND LOAD ADDRESS 200-START,

                                5.      OPERATING PROCEDURE

                                5.1     OPERATIONAL SWITCH SETTINGS

                                        NONE

                                6.      ERRORS

                                        THE PROGRAM HAS NO INTERNAL ERROR DETECTION FACILITIES AND,
                                        THEREFORE, NO ACTUAL ERROR TYPEOUTS.  THE VALIDITY OF THE
                                        TIMES MEASURED MUST BE DETERMINED BY THE OPERATOR,

                        6.1     TIME RELATIONSHIPS

                                A.  "WRITE NONSTOP GAP" SHOULD APPROXIMATELY EQUAL THE SUM OF
                                    "WRITE SHUTDOWN" & "WRITE START".
                                B.  "BACKSPACE SHUTDOWN" MUST BE = "WRITE START".
                                C.  "READ SHUTDOWN" MUST BE < "WRITE SHUTDOWN".
                                D.  GAPS MUST = 8>7>6>5>4>1, 1-2 < 1.7, 2=3(+1.1, -0.2).
                                E.  "WRITE EOF" SHOULD BE SLIGHTLY > "WRITE XIRG",
```

6.2 TIME LIMITS AND PRINTOUT FORMAT

TIMES INDICATED UNDER "UNIT A" ARE STANDARD FOR A 9 CHANNEL UNIT
AND "UNIT B" FOR A 7 CHANNEL UNIT. TIMES ARE IN MILLISECONDS.
TOLERANCES INDICATED WITHIN "()" ARE PLUS OR MINUS

FUNCTION	UNIT A	(9 CHANNEL)	UNIT B	(7 CHANNEL)
WRITE FROM BOT DELAY	185.0	(15.0)	SAME	
WRITE SHUTDOWN	2.3	(0.8)	SAME	
WRITE START	8.9	(0.4)	12.0	(0.5)
SETTLE DOWN DELAY	12.0	(4.0)	SAME	
WRITE TO ERASE HEAD	11.0	(4.0)	SAME	
WRITE NONSTOP GAP	11.5	(2.0)	14.9	(2.0)
BACKSPACE SHUTDOWN	1.8	(0.3)	6.2	(0.5)
READ SHUTDOWN	1.8	(0.3)	SAME	
GAPS SHOULD = 8>7>6>5>4>1, 1=2 < 1.7, 2=3 (=1.1, -0.2),				
GAP 1	14.5	SEE	20.8	
GAP 2	13.6	NOTE	19.8	
GAP 3	13.6	ABOVE	19.8	
GAP 4	18.1		27.8	
GAP 5	21.6		35.1	
GAP 6	25.1		42.3	
GAP 7	28.8		48.9	
GAP 8	32.4		56.3	
WRITE START	8.9	(0.4)	12.0	(0.5)
WRITE XIRG	95.0	(10.0)	SAME	
READ FROM BOT DELAY	98.0	(10.0)	SAME	
LAST CHAR TO CU RDY	.4	(0.1)	.4	(0.1)
WRITE EOF	100.0	(10.0)	SAME	
EOR TO EOF SP TIME	100.0	(10.0)	SAME	
SPACE SHUTDOWN	1.8	(0.3)	SAME	
ONE INCH DATA TIME	22.3	(1.0)	SAME	
*FUNCTIONS AT 556 BPI				
WRITE FROM BOT	.0		185.0	(15.0)
ONE INCH DATA TIME	.0		22.0	(0.8)
WRITE SHUTDOWN	.0		1.8	(1.0)
BACKSPACE SHUTDOWN	.0		6.2	(0.5)
LAST CHAR TO CU RDY	.0		.5	(0.1)
READ SHUTDOWN	.0		1.8	(0.3)
*FUNCTIONS AT 200 BPI				
WRITE FROM BOT	.0		185.0	(15.0)
ONE INCH DATA TIME	.0		22.0	(1.0)
WRITE SHUTDOWN	.0		2.3	(0.8)
BACKSPACE SHUTDOWN	.0		6.2	(0.5)
LAST CHAR TO CU RDY	.0		1.3 TO 1.6	(0.1)
READ SHUTDOWN	.0		1.8	(0.3)
END OF TIMING				

* NOTE: THESE TIMES ONLY PRINTED WHEN ONE OR MORE 7 CHANNEL TAPE UNITS ARE SELECTED.

```
                                7.      RESTRICTIONS

                                7.1     STARTING RESTRICTIONS

                                        AT LEAST ONE TU10 TAPE UNIT MUST BE "ON-LINE" AND SELECTED
                                        BY SWITCHES PER 4.1.  ALSO MAKE CERTAIN THAT EACH TM10
                                        THAT IS "ON-LINE" HAS A UNIQUE UNIT NUMBER SELECTED.

                                7.2     OPERATING RESTRICTIONS

                                        TM11 INSTRUCTION TEST MUST RUN WITHOUT ERRORS BEFORE ATTEMPTING
                                        TO OPERATE THIS PROGRAM.

                                8.      MISCELLANEOUS

                                8.1     EXECUTION TIME

                                        NOT APPLICABLE

                                9.0     PROGRAM DESCRIPTION

                                9.1     WRITE FROM BOT DELAY

                                        WRITE FROM BOT DELAY IS THE TIME NECESSARY TO MOVE THE BEGINNING
                                        OF TAPE (BOT) MARKER APPROXIMATELY 6 INCHES PAST THE WRITE HEAD.
                                        THE FIRST RECORD ON TAPE MUST BE WRITTEN AT  LEAST 3 INCHES AWAY
                                        FROM THE BOT MARKER.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  IF TU10 IS NOT AT BOT IT IS REWOUND TO BOT.
                                        B.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                            REGISTER.
                                        C.  ISSUE WRITE FUNCTION, 800 BPI, SET "GO".
                                        D.  MONITOR CURRENT MEMORY ADDRESS REGISTER TO DETERMINE WHEN
                                            2ND BYTE IS OUTPUT.
                                        E.  THE TIME FROM "GO" UNTIL 2ND BYTE IS OUTPUT IS
                                            APPROXIMATELY EQUAL TO "WRITE FROM BOT DELAY".


                                9.2     WRITE SHUTDOWN

                                        WRITE SHUTDOWN IS THE AMOUNT OF TIME NECESSARY TO CONTINUE
                                        MOVING TAPE AFTER A RECORD IS WRITTEN SO THAT THE PROPER
                                        INTERRECORD GAP WILL EXIST BETWEEN RECORDS.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  THE PROGRAM USES THE SAME RECORD THAT WAS WRITTEN TO TIME
                                            "WRITE FROM BOT DELAY".
                                        B.  AFTER "CU READY" BECOMES A 1, INDICATING THE END OF THE
                                            RECORD, MONITOR "SETTLEDOWN" UNTIL IT BECOMES A 1.
                                        C.  THE TIME FROM "CU READY" UNTIL "SETTLEDOWN" IS "WRITE
                                            SHUTDOWN".
```

```
256
257
258                          9.3     WRITE START
259
260                                  WRITE START IS THE TIME NECESSARY FOR TAPE TO ACCELERATE TO
261                                  FULL SPEED AND GUARANTEE A 1/2 INCH INTERRECORD GAP.
262
263                                  PROCEDURE TO MEASURE TIME:
264
265                                  SAME AS "WRITE FROM BOT" EXCEPT NOW WE ARE NOT AT BOT,
266                                  A.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
267                                      REGISTER.
268                                  B.  ISSUE WRITE FUNCTION, 800 BPI, SET "GO",
269                                  C.  MONITOR CURRENT MEMORY ADDRESS REGISTER TO DETERMINE WHEN
270                                      2ND BYTE IS OUTPUT,
271                                  D.  THE TIME FROM "GO" UNTIL 2ND BYTE IS OUTPUT IS APPROXIMATELY
272                                      EQUAL TO "WRITE START",
273
274                          9.4     SETTLEDOWN DELAY
275
276                                  TAPE DOES NOT ACTUALLY COME TO A COMPLETE STOP UNTIL SOME
277                                  PERIOD OF TIME AFTER SHUTDOWN HAS ENDED.  ALSO, AFTER TAPE HAS
278                                  FULLY STOPPED, AN ADDITIONAL PERIOD OF TIME IS NECESSARY FOR THE
279                                  TAPE AND HARDWARE TO "SETTLEDOWN" AND BECOME STABLE.  THE
280                                  "SETTLEDOWN DELAY" IS THE PERIOD OF TIME NECESSARY FOR THE TAPE
281                                  AND MECHANICAL CHARACTERISTICS OF THE TU10 TO BECOME STABLE, SO
282                                  THAT THE UNIT CANNOT BE OPERATED, START/STOP, AT A FREQUENCY WHERE
283                                  IT IS MECHANICALLY RESONANT.
284
285                                  PROCEDURE TO MEASURE TIME:
286
287                                  A.  THE PROGRAM USES THE SAME RECORD THAT WAS WRITTEN TO TIME
288                                      "WRITE START"
289                                  B.  AFTER "SETTLEDOWN" BECOMES A 1, INDICATING THE START OF
290                                      SETTLEDOWN, MONITOR "TU READY" UNTIL IT BECOMES A 1.
291                                  C.  THE TIME FROM "SETTLEDOWN" UNTIL "TU READY" IS "SETTLEDOWN".
292
293
294                          9.5     WRITE TO ERASE HEAD
295
296                                  THE PURPOSE OF THE ERASE HEAD IS TO INSURE THAT THE TAPE IS IN
297                                  THE SAME FLUX STATE AS THE WRITE HEADS.  THIS IS NECESSARY FOR
298                                  SEVERAL REASONS.
299
300                                  1.  START/STOP CHARACTERISTICS VARY AMONG TAPE UNITS AND IT
301                                      WOULD BE POSSIBLE TO LEAVE OLD DATA IN THE INTERRECORD GAPS
302                                      WHEN USING A TAPE ON MORE THAN ONE UNIT.
303                                  2.  A TAPE PREVIOUSLY USED AT ONE RECORDING DENSITY COULD NOT BE
304                                      USED LATER AT ANOTHER DENSITY.
305                                  3.  TRACK ALIGNMENT AND HEAD WIDTH VARY FROM TAPE UNIT TO
306                                      TAPE UNIT AND IT WOULD BE POSSIBLE FOR DATA TO BE LEFT ON
307                                      THE TRACK EDGES FROM OLD RECORDS.
```

```
                                        THE "WRITE TO ERASE HEAD" TEST INSURES THAT THE TAPE IN FRONT OF
                                        THE WRITE HEAD IS ERASED DURING A WRITE OPERATION.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  A LONG RECORD HAS BEEN WRITTEN FROM BOT.  SAME RECORD THAT
                                            WAS USED TO TIME "WRITE FROM BOT DELAY".
                                        B.  TAPE IS REWOUND TO BOT.
                                        C.  BYTE RECORD COUNTER IS INITIALIZED FOR A 3 BYTE RECORD
                                            AND CURRENT MEMORY ADDRESS REGISTER IS INITIALIZED.
                                        D.  ISSUE WRITE FUNCTION, 800 BPI, SET "GO".
                                        E.  MONITOR BYTE RECORD COUNTER UNTIL IT = 0 INDICATING THAT 2
                                            BYTES ARE WRITTEN IMMEDIATELY ISSUE A POWER CLEAR WHICH
                                            STOPS ALL DATA TRANSFERS AND CAUSES THE DRIVE TO SHUTDOWN.
                                        F.  TAPE IS REWOUND TO BOT
                                        G.  INITIALIZE BYTE RECORD COUNTER (3 BYTES) AND CURRENT
                                            MEMORY ADDRESS REGISTER.
                                        H.  ISSUE READ FUNCTION, 800 BPI, SET GO
                                        I.  MONITOR BYTE RECORD COUNTER UNTIL IT = -1 AND THEN TIME
                                            UNIT IT = 0.  THIS TIME WILL INDICATE THE DISTANCE BETWEEN THE
                                            2ND BYTE AND THE 3RD BYTE WHICH IS ALSO THE AMOUNT OF TAPE
                                            THAT WAS ERASED BY THE ERASE HEAD DURING THE WRITE OPERATION
                                            OR "WRITE TO ERASE HEAD".

                                9.6     WRITE NONSTOP GAP

                                        WRITE NONSTOP GAP IS EQUIVALENT TO THE SUM OF "WRITE SHUTDOWN"
                                        AND "WRITE START" AND IS THE TIME NECESSARY TO INSURE THAT THE
                                        INTERRECORD GAP WILL BE AT LEAST 1/2 OF AN INCH WHEN WRITING
                                        NON-STOP.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  TAPE IS REWOUND TO BOT.
                                        B.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                            REGISTER.
                                        C.  ISSUE WRITE FUNCTION, 800 BPI, SET "GO".
                                        D.  WAIT FOR "CU READY" TO BECOME A 1 AND THEN REPEAT STEPS B
                                            AND C.
                                        E.  MONITOR CURRENT MEMORY ADDRESS REGISTER TO DETERMINE WHEN
                                            2ND BYTE IS OUTPUT.
                                        F.  TIME FROM THE 2ND "GO" COMMAND UNTIL 2ND BYTE OF 2ND
                                            RECORD IS OUTPUT IS "WRITE NONSTOP GAP".
```

```
                        9.7     BACKSPACE SHUTDOWN

                                "BACKSPACE SHUTDOWN" IS THE LENGTH OF TIME NECESSARY TO GUARANTEE
                                THAT IF A WRITE OPERATION FOLLOWS A BACKSPACE THE TAPE WILL BE
                                POSITIONED SUCH THAT ALL PREVIOUS DATA IS IN FRONT OF THE WRITE
                                AND ERASE HEADS AND WILL BE ERASED.  "BACKSPACE SHUTDOWN" MUST
                                BE LESS THAN "WRITE START" SO THAT INTERRECORD GAPS WILL INCREASE
                                IF A BACKSPACE/REWRITE OPERATION IS INITIATED.

                                PROCEDURE TO MEASURE TIME:

                                A.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                    REGISTER.
                                B.  ISSUE WRITE FUNCTION, 800 BPI, SET "GO"
                                C.  AFTER RECORD IS WRITTEN WAIT FOR "TU READY",
                                D.  SET BYTE RECORD COUNTER TO BACKSPACE 1 RECORD,
                                E.  ISSUE BACKSPACE FUNCTION, SET "GO",
                                F.  AFTER "CU READY" BECOMES A 1, INDICATING THE BEGINNING OF
                                    THE RECORD, MONITOR "SETTLEDOWN" UNTIL IT BECOMES A 1,
                                G.  THE TIME FROM "CU READY" UNTIL "SETTLEDOWN" IS "BACKSPACE
                                    SHUTDOWN".

                        9.8     READ SHUTDOWN

                                READ SHUTDOWN IS THE AMOUNT OF TIME NECESSARY TO CONTINUE MOVING
                                TAPE AFTER A RECORD IS READ SO THAT THERE IS ENOUGH GAP FOR TAPE
                                TO BE FULLY ACCELERATED IF A READ IS FOLLOWED BY A BACKSPACE.
                                "READ SHUTDOWN" MUST ALSO BE LESS THAN "WRITE SHUTDOWN" TO
                                GUARANTEE THAT THE WRITE AND ERASE HEADS WILL BE POSITIONED
                                SUCH THAT ALL PREVIOUS DATA IS IN FRONT OF THE HEADS AND
                                WILL BE ERASED IF A WRITE FOLLOWS A READ.  IN ADDITION, WHEN A
                                WRITE FOLLOWS A READ THE INTERRECORD GAP MUST STILL BE AT LEAST
                                1/2 OF AN INCH.

                                PROCEDURE TO MEASURE TIME:

                                A.  RECORD PREVIOUSLY USED IN "BACKSPACE SHUTDOWN" IS READ.
                                B.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                    REGISTER
                                C.  ISSUE READ FUNCTION, 800 BPI, SET "GO".
                                D.  AFTER "CU READY" BECOMES A 1, INDICATING THE END OF THE
                                    RECORD, MONITOR "SETTLEDOWN" UNTIL IT BECOMES A 1,
                                E.  THE TIME FROM "CU READY" UNTIL "SETTLEDOWN" IS "READ
                                    SHUTDOWN"
```

9.9 GAP CONSISTENCY

FOR PROPER OPERATION, THE INTERRECORD GAPS ON TAPE MUST ALWAYS BE AT LEAST 1/2 OF AN INCH. THIS WILL ALLOW DATA WRITTEN USING ONE TAPE UNIT TO BE READ ON ANOTHER TAPE UNIT WHEN THE START/STOP CHARACTERISTICS OF EACH UNIT ARE DIFFERENT. THE MINIMUM GAP SIZE OF 1/2 INCH IS GENERATED WHEN A WRITE FOLLOWS A READ. ALL OTHER GAPS SHOULD BE LARGER DEPENDING ON HOW THEY WERE WRITTEN.

PROCEDURE TO MEASURE TIME:

A. A TOTAL OF NINE RECORDS ARE WRITTEN ON TAPE (FROM BOT) UTILIZING DIFFERENT SEQUENCES TO GENERATE THE INTERRECORD GAPS.
B. THE TAPE IS REWOUND TO BOT.
C. INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS REGISTER.
D. ISSUE READ FUNCTION, 800 BPI, SET "GO".
E. WAIT FOR "CU READY" TO BECOME A 1, THEN REPEAT STEP C AND RESET "GO" TO CONTINUE NONSTOP.
F. MONITOR CURRENT MEMORY ADDRESS TO DETERMINE WHEN 2ND BYTE IS INPUT.
G. THE TIME FROM WHEN "GO" IS RESET UNTIL THE 2ND BYTE IS INPUT WILL REFLECT THE SIZE OF THE GAP.
H. STEPS E, F ARE REPEATED UNTIL ALL 8 GAPS ARE MEASURED.

PROGRAM SEQUENCE FOR EACH GAP:

GAP 1 — WRITE FOLLOWED BY A WRITE (NONSTOP).

GAP 2 — WRITE FOLLOWED BY A WRITE (START/STOP).

GAP 3 — READ FOLLOWED BY A WRITE (START/STOP).

GAP 4 — WRITE-BACKSPACE FOLLOWED BY A WRITE (START/STOP).

GAP 5 — SAME AS GAP 4 EXCEPT WRITE-BACKSPACE REPEATED 2 TIMES.

GAP 6 — SAME AS GAP 4 EXCEPT WRITE-BACKSPACE REPEATED 3 TIMES.

GAP 7 — SAME AS GAP 4 EXCEPT WRITE-BACKSPACE REPEATED 4 TIMES.

GAP 8 — SAME AS GAP 4 EXCEPT WRITE-BACKSPACE REPEATED 5 TIMES.

GAP LENGTHS SHOULD REFLECT THE FOLLOWING RELATIONSHIP:

8>7>6>5>4>1, 1-2<1.7, 2=3(+1.1, -0.2).

```
                                9.10    WRITE START

                                        THIS IS A REPEAT OF THE "WRITE START" TEST PREVIOUSLY COMPLETED
                                        (REFERENCE 9.3).  IT'S PURPOSE IS TO DETERMINE IF TAPE WILL
                                        DRIFT BACKWARDS TO BOT IF A "POWER CLEAR" IS ISSUED AS SOON
                                        AS BOT DISAPPEARS WHEN MOVING FORWARD FROM BOT.  TIME SHOULD
                                        EQUAL "WRITE START" AS MEASURED IN 9.3.

                                9.11    WRITE XIRG

                                        WRITE WITH AN EXTENDED INTERRECORD GAP IS A FUNCTION THAT CAUSES
                                        THE GENERATION OF AN INTERRECORD GAP THAT IS AT LEAST 3 INCH LONG
                                        AS COMPARED WITH THE NORMAL 3/4 INCH GAP.  THE PURPOSE IS TO
                                        ELIMINATE WRITE ERRORS THAT MAY BE CAUSED BY A DEFECTIVE AREA
                                        ON TAPE.  NORMALLY ONE REWRITE WITH XIRG WOULD BE SUFFICIENT TO
                                        MOVE PAST THE BAD SPOT, HOWEVER IF IT ISN'T, THE PROCEDURE
                                        WOULD BE TO REPEAT THE "BACKSPACE-REWRITE WITH XIRG" SEQUENCE UNTIL
                                        A RECORD IS WRITTEN WITHOUT ERRORS.  EACH SUCCESSIVE REWRITE WOULD
                                        ADD 3 INCHES TO THE INTERRECORD GAP UNTIL "GOOD" TAPE WAS REACHED.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  TAPE IS NOT AT BOT
                                        B.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                            REGISTER.
                                        C.  ISSUE WRITE WITH XIRG FUNCTION, 800 BPI, SET "GO".
                                        D.  MONITOR CURRENT MEMORY ADDRESS REGISTER TO DETERMINE WHEN
                                            2ND BYTE IS OUTPUT.
                                        E.  THE TIME FROM "GO" UNIT 2ND BYTE IS OUTPUT IS "WRITE WITH
                                            XIRG".

                                9.12    READ FROM BOT

                                        THE FIRST RECORD WRITTEN ON TAPE IS SUPPOSED TO BE AT LEAST 6
                                        INCHES FROM THE BOT MARKER,  IN THE EVENT THAT THIS CONDITION
                                        WASN'T MET IT IS STILL DESIREABLE TO READ THE RECORD.  READ FROM
                                        BOT IS THE TIME FROM WHEN A READ FUNCTION IS ISSUED UNTIL THE
                                        2ND BYTE IS INPUT.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  THE RECORD THAT WAS WRITTEN JUST OFF BOT DURING "WRITE
                                            START"  (REFERENCE 9.10) IS USED.
                                        B.  TAPE IS REWOUND TO BOT
                                        C.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                            REGISTER.
                                        D.  ISSUE READ FUNCTION, 800 BPI, SET "GO".
                                        E.  MONITOR CURRENT MEMORY ADDRESS REGISTER TO DETERMINE WHEN
                                            2ND BYTE IS INPUT.
                                        F.  THE TIME FROM "GO" UNTIL 2ND BYTE IS INPUT IS "READ FROM
                                            BOT".
```

```
                                9.13    LAST CHARACTER TO CU READY

                                        LAST CHARACTER TO CU READY IS THE AMOUNT OF TIME IT TAKES FOR
                                        THE CONTROL TO SENSE 3 MISSING BYTES ON TAPE (END OF RECORD)
                                        UNTIL "CU READY" BECOMES A 1.

                                        PROCEDURE TO MEASURE TIME:

                                        A.  PROGRAM READS SAME RECORD THAT WAS WRITTEN DURING "WRITE
                                            XIRG".
                                        B.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS
                                            REGISTER.
                                        C.  ISSUE READ FUNCTION, 800 BPI, SET "GO".
                                        D.  WAIT UNTIL BYTE RECORD COUNTER EQUALS 0 AND THEN MONITOR "CU
                                            READY" UNTIL IT BECOMES A 1.
                                        E.  THE TIME FROM BYTE RECORD COUNTER = 0 UNTIL "CU READY" = 1
                                            IS "LAST CHARACTER INPUT UNTIL CU READY".

                                9.14    WRITE EOF.

                                        TO WRITE AN END OF FILE MARK IT IS NECESSARY FOR TAPE TO
                                        MOVE 3 INCHES BEFORE WRITING.  IN THAT RESPECT IT IS SIMILAR
                                        TO WRITING A RECORD WITH EXTENDED INTERRECORD GAP, HOWEVER, AN
                                        EOF MARK CORRESPONDS TO A 1 BYTE RECORD.  THE TIME SHOULD BE
                                        SLIGHTLY LARGER THAN "WRITE XIRG".

                                        PROCEDURE TO MEASURE TIME:

                                        A.  TAPE UNIT IS REWOUND TO BOT,
                                        B.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS REGISTER,
                                        C.  ISSUE WRITE FUNCTION, 800 BPI, SET "GO",
                                        D.  WAIT FOR "CU READY" AND THEN "TU READY" TO BECOME A 1,
                                        E.  ISSUE WRITE EOF FUNCTION, 800 BPI, SET "GO",
                                        F.  WAIT FOR "CU READY" TO BECOME A 1,
                                        G.  THE TIME FROM "GO" UNTIL "CU READY" IS "WRITE EOF",
```

546
547
548
549 9.15 EOR TO EOF SPACE TIME
550
551 EOR TO EOF SPACE TIME IS THE TIME NEEDED TO MOVE TAPE FROM THE
552 END OF A RECORD TO AN END OF FILE MARK WRITTEN AFTER IT. THE
553 PROCEDURE USED TURNS OUT TO BE A TEST OF THE WRITE AND ERASE HEAD
554 POLARITIES. IF THE TIME PRINTED IS EQUAL TO ZERO IT IS AN INDICA-
555 TION THAT THE EOF WAS NOT FOUND WHEN "CU READY" BECAME A 1.
556
557 THIS COULD INDICATE ONE OR MORE OF THE FOLLOWING PROBLEMS:
558
559 1. ERASE HEAD POLARITY REVERSED.
560 2. ERASE HEAD CURRENT NOT SUFFICIENT TO FULLY SATURATE TAPE.
561 3. ONE OR MORE OF WRITE HEAD TRACKS POLARITY REVERSED.
562 4. ONE OR MORE SENSITIVE READ AMPLIFIERS.
563 5. WRITE EOF FUNCTION DIDN'T REALLY WRITE AN EOF MARK,
564   OTHERWISE "EOR TO EOF SPACE TIME" SHOULD BE SLIGHTLY LARGER
565   THAN "WRITE EOF".
566
567 PROCEDURE TO MEASURE TIME:
568
569 A. A RECORD AND EOF WAS PREVIOUSLY WRITTEN FROM BOT FOR "WRITE
570   EOF" (REFERENCE 9.14).
571 B. TAPE IS REWOUND TO BOT.
572 C. REWRITE RECORD OVER PREVIOUSLY WRITTEN RECORD.
573 D. BACKSPACE OVER RECORD JUST WRITTEN.
574 E. SET BYTE RECORD COUNTER TO SPACE 2 RECORDS.
575 F. ISSUE SPACE FORWARD FUNCTION, SET "GO".
576 G. WAIT FOR BYTE RECORD COUNTER TO INDICATE THAT 1ST RECORD
577   WAS BEEN SPACED OVER THEN MONITOR "CU READY" UNTIL IT BECOMES
578   A 1. AFTER "CU READY" CHECK TO SEE IF "EOF" IS A 1
579   IN STATUS REGISTER. IF "EOF" NOT SET THEN ZERO TIME COUNTER.
580 H. TIME FROM BYTE RECORD COUNTER 0-1 UNTIL "CU READY" IS "EOR
581   TO EOF SPACE TIME".
582
583 9.16 SPACE SHUTDOWN
584
585 SPACE SHUTDOWN IS THE AMOUNT OF TIME NECESSARY TO
586 CONTINUE MOVING TAPE AFTER A RECORD IS SPACED OVER IN THE
587 FORWARD DIRECTION FOR THE SAME REASONS AS "READ SHUTDOWN"
588 (REFERENCE 9.8).
589
590 PROCEDURE TO MEASURE TIME:
591
592 A. SPACE FORWARD FUNCTION USED TO TIME "EOR TO EOF SPACE TIME"
593   IS USED.
594 B. AFTER "CU READY" BECOMES A 1, INDICATING THE END OF THE
595   RECORD (EOF), MONITOR "SETTLEDOWN" UNTIL IT BECOMES A 1.
596 C. THE TIME FROM "CU READY" UNTIL "SETTLEDOWN" IS "SPACE
597   SHUTDOWN".

```
                        9.17    ONE INCH DATA TIME

                                ONE INCH OF DATA, 800 BYTES (ALSO 556 AND 200 IF 7 CHANNEL
                                UNIT), IS WRITTEN AND TIMED TO DETERMINE IF TAPE IS MOVING AT
                                PROPER SPEED.

                                PROCEDURE TO MEASURE TIME:

                                A.  INITIALIZE BYTE RECORD COUNTER AND CURRENT MEMORY ADDRESS.

                                B.  ISSUE WRITE FUNCTION, 800 BPI (OR 556, OR 200), SET "GO".

                                C.  WAIT FOR CURRENT MEMORY ADDRESS REGISTER TO INDICATE 2ND
                                    BYTE IS OUTPUT AND THEN MONITOR BYTE RECORD COUNTER UNTIL
                                    EQUAL TO ZERO.

                                D.  TIME FROM 2ND BYTE OUTPUT UNTIL BYTE RECORD COUNTER = 0
                                    IS "ONE INCH DATA TIME"

                        9.18    FUNCTIONS AT 556 BPI

                                ALL OF THE PREVIOUS TESTS USED THE DENSITY OF 800 BPI.  IF A 7
                                CHANNEL DRIVE IS SELECTED IT IS USEFUL TO RUN SEVERAL OF THE TESTS
                                AGAIN USING DENSITY OF 556 BPI.  REFERENCE THE PROPER PARAGRAPHS
                                FOR A DESCRIPTION OF EACH TEST.

                        9.19    FUNCTIONS AT 200 BPI

                                SAME AS ABOVE.
                                REFERENCE 9.18, "FUNCTIONS AT 556 BPI".
```

```
                                STATUS AND COMMAND REGISTER BIT ASSIGNMENTS

                                                COMMAND REGISTER

                        15      ERROR

                        14      DEN 8           00 = 200 BPI 7 TRACK    10 = 800 BPI 7 TRACK
                        13      DEN 5           01 = 556 BPI 7 TRACK    11 = 800 BPI 9 TRACK
                        12      POWER CLEAR

                        11      PARITY          0 = ODD     1 = EVEN
                        10      UNIT SEL. BIT 2
                        9       UNIT SEL. BIT 1

                        8       UNIT SEL. BIT 0
                        7       CONTROL UNIT READY
                        6       INTERRUPT ENABLE

                        5       ADDRESS BIT 17
                        4       ADDRESS BIT 16
                        3       FUNCTION BIT 2  000 = OFF LINE          100 = SPACE FORWARD
                                                001 = READ              101 = SPACE REVERSE
                        2       FUNCTION BIT 1  010 = WRITE             110 = WRITE XIRG
                        1       FUNCTION BIT 0  011 = WRITE EOF         111 = REWIND
                        0       GO

                                                STATUS REGISTER

                        15      ILLEGAL COMMAND (ILC)

                        14      END OF FILE (EOF)
                        13      CYCLICAL REDUNDANCY ERROR (CRE)
                        12      PARITY ERROR (PAE)

                        11      BUS GRANT LATE (BGL)
                        10      END OF TAPE (EOT)
                        9       RECORD LENGTH ERROR (RLE)

                        8       BAD TAPE ERROR (BTE)
                        7       NON EXISTENT MEMORY (NXM)
                        6       SELECT REMOTE (SELR)

                        5       BEGINNING OF TAPE (BOT)
                        4       7 CHANNEL (7CH)
                        3       SETTLE DOWN (SDWN)

                        2       WRITE LOCK (WRL)
                        1       REWIND STATUS (RWS)
                        0       TAPE UNIT READY (TUR)
                                .ENDR
```

```
                                ;TITLE  MAINDEC-11-DZTMD-E      TM-11 DRIVE FUNCTION TIMER
                                ;COPYRIGHT 1971, 1976 DIGITAL EQUIPMENT CORP., MAYNARD, MASS, 01754
                                ;REVISED MARCH 1973
                                ;REVISED TO REV,C AUG., 1973 BY BRUCE BURGESS - DIAGNOSTIC ENGINEERING
                                ;                THE FOLLOWING CHANGES MAKE UP REV,C !
                                ;       (A) BECAUSE CONTROL UNIT READY NOW OCCURS AFTER SETTLEDOWN
                                ;           THE "WAIT FOR CU READY" LOOPS IN SECTIONS 'T1C', 'T2C',
                                ;           'T4B', 'T4D', AND 'T10C' WERE DELETED,
                                ;       (B)  ALSO, IN SECTION
                                ;           'T10F', INSTRUCTIONS WERE ADDED FOR THE PROGRAM TO WAIT
                                ;           FOR CU READY BEFORE ISSUING THE NEW COMMAND! OTHERWISE,
                                ;           AN ILLEGAL COMMAND ERROR (ILC) WILL RESULT
                                ;REVISED TO REV, D MARCH, 1974
                                ;       (A) ALL OF "A" ABOVE WAS REPLACED,
                                ;

                                ;REVISED FEB 1976 REV E
                                ;       (A) MADE TO WORK WITHOUT HARDWARE SWITCH REGISTER

                                ;LOAD PAPERTAPE BINARY USING ABS LOADER
                                ;SET LCC. 176 TO REFLECT TAPE UNIT CONFIGURATION
                                ;LOAD ADDRESS 200, PRESS START
                                ;
001000                          STACK=1000
005670                          $LENTH=3000,
                                        .ENABL  ABS
000000                                  .=0
                                ;TRAP CATCHER FROM 0 TO 1000



                                ;CONTROL SETTING LOCATION-MUST BE SET TO RUN PROPERLY
000176                                  .=176
002176  000000                  SWREG:  0

000200                                  .=200
002200  000167  002642                  JMP     START
001000                                  .=1000
001000  172520                  MTS:    172520
001002  172522                  MTC:    172522
001004  172524                  BC:     172524
001006  172526                  CA:     172526
001010  172530                  MTD:    172530
001012  172532                  MTRD:   172532
001014  177570                  SR:     177570
001016  177560                  TKS:    177560
001020  177562                  TKB:    177562
001022  177564                  TPS:    177564
001024  177566                  TPB:    177566
001026  000224                  MTV:    224
001030  177776                  CC:     177776
001032  000000                  R10:    0
001034  000000                  R11:    0
001036  000000                  R12:    0
001040  000000                  R13:    0
001042  000000                  TSCRV:  0
```

```
001044  000000                          T11T:   0
001046  012706  001000                  START:  MOV     #STACK,%6       ;INITIALIZE STACK
001052  012777  000340  177750                  MOV     #340,@CC                ;SET PRIORITY LEVEL 7
001062  012767  010052  006762                  MOV     #MSG1,MESAGE
001066  004767  006636                          JSR     %7,TOP          ;PRINT PROGRAM TITLE
001072  016767  177100  005662          ST0:    MOV     SWREG,DRIVES    ;SAVE DRIVES SELECTED
001100  001006                                  BNE     1$
001102  012767  011223  006740                  MOV     #MSG29,MESAGE
001110  004767  006614                          JSR     %7,TOP          ;ERROR-NO CONFIGURATION SELECTED
001114  000000                                  HALT
001116  004767  005524                  1$:     JSR     %7,RSFDRV       ;RESET DRIVES
001122  004767  005736                  ST1:    JSR     %7,STRREW       ;START REWIND
001126  004767  005560                          JSR     %7,CHGDRV       ;DONE ALL DRIVES?
001132  000773                                  BR      ST1             ;NO
001134  004767  005764                  ST2:    JSR     %7,WATREW       ;WAIT FOR BOT
001140  004767  005546                          JSR     %7,CHGDRV       ;DONE ALL DRIVES?
001144  000773                                  BR      ST2             ;NO
                                        ;PRINT HEADER
001146  012767  010137  006674                  MOV     #MSG2,MESAGE
001154  004767  006550                          JSR     %7,TOP          ;PRINT "FUNCTION"
001160  012767  010163  006662          ST3:    MOV     #MSG2A,MESAGE
001166  004767  006536                          JSR     %7,TOP          ;PRINT "UNIT"
001172  016767  005566  006512                  MOV     FDRIVE,DIGIT
001200  000367  006506                          SWAB    DIGIT
001204  042767  177770  006500                  BIC     #177770,DIGIT
001212  052767  000060  006472                  BIS     #60,DIGIT
001220  105777  177576                          TSTB    @TPS
001224  100375                                  BPL     .-4
001226  016777  006460  177570                  MOV     DIGIT,@TPB      ;PRINT DRIVE "NUMBER"
001234  004767  005452                          JSR     %7,CHGDRV       ;DONE ALL DRIVES?
001240  000747                                  BR      ST3             ;NO
001242  004767  005576                          JSR     %7,ST1S         ;STORE ONES IN WRITE BUFFER
                                        ;TIME WRITE FROM BOT DELAY, AND WRITE SHUTDOWN
001246  012700  007212                  T1:     MOV     #TM1,%0         ;INITIALIZE TIME BUFFERS
001252  012701  007236                          MOV     #TM2,%1
001256  004767  005544                  T1A:    JSR     %7,WRINT
001262  016777  005476  177512                  MOV     FDRIVE,@MTC     ;SELECT DRIVE
001270  052777  040005  177504                  BIS     #40005,@MTC     ;800 BPI, WRITE, GO
001276  005067  005706                          CLR     TIME
001302  022777  011344  177476          T1B:    CMP     #WBUF+2,@CA     ;IS 2ND WORD OUTPUT?
001310  003403                                  BLE     T1C             ;YES
001312  004767  005650                          JSR     %7,TIMER        ;NO, COUNT TIME
001316  000771                                  BR      T1B
001320  016720  005664                  T1C:    MOV     TIME,(0)+       ;SAVE "WRITE FROM BOT DELAY" TIME
001324  005067  005660                          CLR     TIME
001330  105777  177446                          TSTB    @MTC
001334  100375                                  BPL     .-4
001336  032777  000010  177434          T1D:    BIT     #10,@MTS        ;HAS SETTLEDOWN SET?
001344  001003                                  BNE     T1E             ;YES
001346  004767  005614                          JSR     %7,TIMER        ;NO, COUNT TIME
001352  000771                                  BR      T1D
001354  016721  005630                  T1E:    MOV     TIME,(1)+       ;SAVE "WRITE SHUTDOWN" TIME
001360  004767  005326                          JSR     %7,CHGDRV       ;DONE ALL DRIVES
001364  000734                                  BR      T1A             ;NO
001366  012720  177777                          MOV     #-1,(0)+        ;TERMINATE TIMES
001372  012721  177777                          MOV     #-1,(1)+        ;TERMINATE TIMES
```

D2

```
 796  001376  012767  010177  006444          MOV     #MSG3,MESAGE
 797  001404  012700  007212                  MOV     #TM1,%0
 798  001410  004767  006036                  JSR     %7,TYPTIM       ;PRINT "WRITE FROM BOT DELAY" TIMES
 799  001414  012767  010225  006426          MOV     #MSG4,MESAGE
 800  001422  012700  007236                  MOV     #TM2,%0
 801  001426  004767  006020                  JSR     %7,TYPTIM       ;PRINT "WRITE SHUTDOWN" TIMES
 802                          ;TIME WRITE START AND SETTLEDOWN DELAY
 803  001432  004767  005210          T2:     JSR     %7,RSFDRV       ;RESET DRIVE SELECTION
 804  001436  012700  007212                  MOV     #TM1,%0
 805  001442  012701  007236                  MOV     #TM2,%1
 806  001446  004767  005354          T2A:    JSR     %7,WRINT
 807  001452  016777  005326  177322          MOV     FDRIVE,@MTC     ;SELECT DRIVE
 808  001460  052777  040005  177314          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
 809  001466  005007  005516                  CLR     TIME
 810  001472  022777  011344  177306  T2B:    CMP     #WBUF+2,@CA     ;IS 2ND WORD OUTPUT
 811  001500  003403                          BLE     T2C             ;YES
 812  001502  004767  005460                  JSR     %7,TIMER        ;NO, COUNT TIME
 813  001506  000771                          BR      T2B
 814  001510  016720  005474          T2C:    MOV     TIME,(0)+       ;SAVE "WRITE START" TIME
 815  001514  005007  005470                  CLR     TIME
 816  001520  105777  177256                  TSTB    @MTC
 817  001524  100375                          BPL     .-4
 818  001526  032777  000010  177244          BIT     #10,@MTS
 819  001534  001774                          BEQ     .-6             ;WAIT FOR SETTLEDOWN TO SET
 820  001536  006077  177236          T2D:    ROR     @MTS
 821  001542  103403                          BCS     T2E             ;WAIT FOR TU READY
 822  001544  004767  005416                  JSR     %7,TIMER
 823  001550  000772                          BR      T2D
 824  001552  016721  005432          T2E:    MOV     TIME,(1)+       ;SAVE "SETTLEDOWN" TIME
 825  001556  004767  005130                  JSR     %7,CHGDRV
 826  001562  000731                          BR      T2A
 827  001564  012720  177777                  MOV     #-1,(0)+        ;TERMINATE TIMES
 828  001570  012721  177777                  MOV     #-1,(1)+        ;TERMINATE TIMES
 829  001574  012767  010253  006246          MOV     #MSG5,MESAGE
 830  001602  012700  007212                  MOV     #TM1,%0
 831  001606  004767  005640                  JSR     %7,TYPTIM       ;PRINT "WRITE START" TIMES
 832  001612  012767  010301  006230          MOV     #MSG6,MESAGE
 833  001620  012700  007236                  MOV     #TM2,%0
 834  001624  004767  005622                  JSR     %7,TYPTIM       ;PRINT "SETTLEDOWN" TIMES
 835                          ;TIME WRITE TO ERASE HEAD
 836                          ;LONG RECORD WAS PREVIOUSLY WRITTEN
 837                          ;WRITE A 3 BYTE RECORD AND POWER CLEAR
 838                          ;DISTANCE FROM NEW DATA TO OLD IS
 839                          ;ERASE HEAD DISTANCE
 840  001630  004767  005230          T3:     JSR     %7,STRREW       ;START REWIND
 841  001634  004767  005052                  JSR     %7,CHGDRV       ;DONE ALL DRIVES?
 842  001640  000773                          BR      T3              ;NO
 843  001642  004767  005256          T3A:    JSR     %7,WATREW       ;IS DRIVE AT BOT?
 844  001646  004767  005040                  JSR     %7,CHGDRV       ;DONE ALL DRIVES
 845  001652  000773                          BR      T3A             ;NO
 846  001654  012777  177775  177122  T3B:    MOV     #-3,@BC         ;3 BYTE RECORD
 847  001662  012777  011342  177116          MOV     #WBUF,@CA       ;INITIALIZE CURRENT ADDRESS
 848  001670  016777  005070  177104          MOV     FDRIVE,@MTC     ;SELECT DRIVE
 849  001676  052777  040005  177076          BIS     #40005,@MTC     ;800BPI, WRITE, GO
 850  001704  005777  177074                  TST     @BC
 851  001710  001375                          BNE     .-4
```

```
852  001712  052777  010000  177062          BIS     #10000,@MTC     ;POWER CLEAR
853  001720  004767  005140                  JSR     %7,STRREW       ;START REWIND
854  001724  004767  004762                  JSR     %7,CHGDRV       ;DONE ALL DRIVES
855  001730  000751                          BR      T3B             ;NO
856  001732  004767  005166          T3C:    JSR     %7,WATREW       ;DRIVE AT BOT
857  001736  004767  004750                  JSR     %7,CHGDRV       ;DONE ALL DRIVES
858  001742  000773                          BR      T3C             ;NO
859                                  ;NOW THAT ALL DRIVES ARE AT BOT AGAIN
860                                  ;READ OVER PARTIAL RECORD
861  001744  012700  007212                  MOV     #TM1,%0
862  001750  012777  177775  177026  T3D:    MOV     #-3,@BC
863  001756  012777  011342  177022          MOV     #WBUF,@CA
864  001764  016777  004774  177010          MOV     FDRIVE,@MTC     ;SELECT DRIVE
865  001772  052777  040003  177002          BIS     #40003,@MTC     ;800BPI, READ, GO
866  002000  005067  005224                  CLR     TIME            ;CLEAR TIME
867  002004  022777  177777  176772          CMP     #-1,@BC
868  002012  001374                          BNE     .-6
869  002014  005777  176764          T3E:    TST     @BC             ;WAIT FOR NEXT WORD IN
870  002020  001403                          BEQ     T3F             ;HAVE IT
871  002022  004767  005140                  JSR     %7,TIMER        ;NO, COUNT TIME
872  002026  000772                          BR      T3E
873  002030  016720  005134          T3F:    MOV     TIME,(0)+       ;SAVE "WRITE TO ERASE HEAD TIME"
874  002034  004767  004652                  JSR     %7,CHGDRV       ;DONE ALL DRIVES
875  002040  000743                          BR      T3D             ;NO
876  002042  012720  177777                  MOV     #-1,(0)+        ;TERMINATE TIMES
877  002046  012767  010327  005774          MOV     #MSG7,MESAGE
878  002054  012700  007212                  MOV     #TM1,%0
879  002060  004767  005366                  JSR     %7,TYPTIM       ;PRINT "WRITE TO ERASE HEAD TIMES"
880  002064  004767  004774          T3G:    JSR     %7,STRREW       ;START REWIND
881  002070  004767  004616                  JSR     %7,CHGDRV       ;DONE ALL DRIVES
882  002074  000773                          BR      T3G             ;NO
883  002076  004767  005022          T3H:    JSR     %7,WATREW       ;DRIVE AT BOT
884  002102  004767  004624                  JSR     %7,CHGDRV       ;DONE ALL DRIVES
885  002106  000773                          BR      T3H             ;NO
886                                  ;TIME WRITE NONSTOP GAP, BACKSPACE SHUTDOWN AND READ SHUTDOWN
887                                  ;WRITE ONE RECORD, FOLLOW WITH ONE RECORD NONSTOP
888                                  ;FOLLOWED BY ONE RECORD START-STOP
889                                  ;FOLLOWED BY WRITE-BACKSPACE-READ-WRITE
890                                  ;FOLLOWED BY WRITE-BACKSPACE-WRITE
891  002110  004767  004730          T4:     JSR     %7,ST1S
892  002114  012700  007212                  MOV     #TM1,%0         ;INITIALIZE TIME BUFFERS
893  002120  012701  007236                  MOV     #TM2,%1
894  002124  012702  007262                  MOV     #TM3,%2
895  002130  005067  005054          T4AA:   CLR     TIME
896  002134  004767  004666                  JSR     %7,WRINT
897  002140  016777  004620  176634          MOV     FDRIVE,@MTC     ;TRACK AND DRIVE NUMBERS
898  002146  052777  040005  176626          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
899  002154  105777  176622                  TSTB    @MTC
900  002160  100375                          BPL     .-4             ;WAIT FOR CU READY
901                                  ;HAVE FIRST RECORD WRITTEN, GO NONSTOP
902  002162  004767  004640                  JSR     %7,WRINT
903  002166  005277  176610                  INC     @MTC            ;GO
904  002172  022777  011344  176606  T4A:    CMP     #WBUF+2,@CA     ;IS 2ND WORD OUTPUT?
905  002200  003403                          BLE     T4B             ;YES
906  002202  004767  004760                  JSR     %7,TIMER        ;NO, COUNT TIME
907  002206  000771                          BR      T4A
```

```
002210  016720  004774           T4B:   MOV     TIME,(0)+       ;SAVE "WRITE NONSTOP GAP" TIME
002214  005067  004770                  CLR     TIME
002220  105777  176556                  TSTB    @MTC
002224  100375                          BPL     .-4             ;WAIT FOR CU READY
002226  006077  176546                  ROR     @MTS
002232  103375                          BCC     .-4             ;WAIT FOR TU READY
                                 ;WRITE-BACKSPACE-READ-WRITE
002234  004767  004566                  JSR     %7,WRINT
002240  016777  004520  176534          MOV     FDRIVE,@MTC     ;DRIVE SELECT
002246  052777  040005  176526          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
002254  105777  176522                  TSTB    @MTC
002260  100375                          BPL     .-4             ;WAIT FOR CU READY
002262  012777  177777  176514          MOV     #-1,@BC         ;BACKSPACE 1 RECORD
002270  042777  000016  176504          BIC     #16,@MTC
002276  052777  000013  176476          BIS     #13,@MTC        ;SPACE REVERSE, GO
002304  105777  176472                  TSTB    @MTC
002310  100375                          BPL     .-4
002312  032777  000010  176460   T4C:   BIT     #10,@MTS        ;HAS SETTLEDOWN SET?
002320  001003                          BNE     T4D             ;YES
002322  004767  004640                  JSR     %7,TIMER        ;NO, COUNT TIME
002326  000771                          BR      T4C
002330  006077  176444           T4D:   ROR     @MTS
002334  103375                          BCC     .-4             ;WAIT FOR TU READY
002336  016721  004646                  MOV     TIME,(1)+       ;SAVE "BACKSPACE SHUTDOWN" TIME
002342  004767  004460                  JSR     %7,WRINT
002346  005067  004636                  CLR     TIME
002352  016777  004406  176422          MOV     FDRIVE,@MTC     ;SELECT DRIVE
002360  052777  040003  176414          BIS     #40003,@MTC     ;800 BPI, READ, GO
002366  105777  176410                  TSTB    @MTC
002372  100375                          BPL     .-4
002374  032777  000010  176376   T4E:   BIT     #10,@MTS        ;HAS SETTLEDOWN SET?
002402  001003                          BNE     T4F             ;YES
002404  004767  004556                  JSR     %7,TIMER        ;NO, COUNT TIME
002410  000771                          BR      T4E
002412  006077  176362           T4F:   ROR     @MTS
002416  103375                          BCC     .-4             ;WAIT FOR TU READY
002420  016722  004564                  MOV     TIME,(2)+       ;SAVE "READ SHUTDOWN" TIME
002424  004767  004262                  JSR     %7,CHGDRV
002430  000637                          BR      T4AA
002432  012720  177777                  MOV     #-1,(0)+        ;TERMINATE TIMES
002436  012721  177777                  MOV     #-1,(1)+        ;TERMINATE TIMES
002442  012722  177777                  MOV     #-1,(2)+        ;TERMINATE TIMES
002446  012767  010355  005374          MOV     #MSG8,MESAGE
002454  012700  007212                  MOV     #TM1,%0
002460  004767  004766                  JSR     %7,TYPTIM       ;PRINT "WRITE NONSTOP GAP" TIMES
002464  012767  010423  005356          MOV     #MSG9,MESAGE
002472  012700  007236                  MOV     #TM2,%0
002476  004767  004750                  JSR     %7,TYPTIM       ;PRINT "BACKSPACE SHUTDOWN" TIMES
002502  012767  010431  005340          MOV     #MSG10,MESAGE
002510  012700  007262                  MOV     #TM3,%0
002514  004767  004732                  JSR     %7,TYPTIM       ;PRINT "READ SHUTDOWN" TIMES
002520  004767  004320                  JSR     %7,ST1S
                                 ;WRITE RECORDS TO BE USED IN GAP TEST
002524  004767  004276           T4G:   JSR     %7,WRINT
002530  016777  004230  176244          MOV     FDRIVE,@MTC     ;SELECT DRIVE
002536  052777  040005  176236          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
```

G2

```
 964  002544  105777  176232          TSTB    @MTC
 965  002550  100375                  BPL     .-4             ;WAIT FOR CU READY
 966  002552  004767  004250          JSR     %7,WRINT
 967  002556  005277  176220          INC     @MTC            ;GO NONSTOP
 968  002562  105777  176214          TSTB    @MTC
 969  002566  100375                  BPL     .-4             ;WAIT FOR CU READY
 970  002570  012777  177777  176206  MOV     #-1,@BC
 971  002576  016777  004162  176176  MOV     FDRIVE,@MTC     ;SELECT DRIVE
 972  002604  052777  046013  176170  BIS     #46013,@MTC     ;800 BPI, BACKSPACE, GO
 973  002612  105777  176164          TSTB    @MTC
 974  002616  100375                  BPL     .-4             ;WAIT FOR CU READY
 975  002620  004767  004262          JSR     %7,WRINT
 976  002624  016777  004134  176150  MOV     FDRIVE,@MTC
 977  002632  052777  046005  176142  BIS     #46005,@MTC     ;800 BPI, WRITE, GO
 978  002640  105777  176136          TSTB    @MTC
 979  002644  100375                  BPL     .-4
 980  002646  012767  177777  176160  MOV     #-1,R11         ;INDICATES BACK 3 COMPLETE
 981  002654  012767  177777  176154  MOV     #-1,R12         ;INDICATES BACK 4 COMPLETE
 982  002662  012767  177777  176150  MOV     #-1,R13         ;INDICATES BACK 5 COMPLETE
 983  002670  012767  177776  176134  MOV     #-2,R10         ;FIRST SEQUENCE BACK 2 TIMES
 984                          ;NOW WRITE, BACKSPACE, WRITE, BACKSPACE, WRITE
 985                          ;GAP SHOULD GET LARGER
 986  002676  004767  004124  MULWRT: JSR     %7,WRINT
 987  002702  005277  176074          INC     @MTC            ;GO NONSTOP
 988  002706  105777  176070          TSTB    @MTC
 989  002712  100375                  BPL     .-4             ;WAIT FOR DONE
 990  002714  012777  177777  176062  MULBAK: MOV     #-1,@BC         ;BACKSPACE 1 RECORD
 991  002722  042777  000016  176052          BIC     #16,@MTC
 992  002730  052777  000013  176044          BIS     #13,@MTC        ;SET BACKSPACE, GO
 993  002736  105777  176040          TSTB    @MTC
 994  002742  100375                  BPL     .-4             ;WAIT FOR BACKSPACE DONE
 995  002744  004767  004056          JSR     %7,WRINT
 996  002750  042777  000016  176024  BIC     #16,@MTC
 997  002756  052777  000005  176016  BIS     #5,@MTC         ;SET WRITE, GO
 998  002764  105777  176012          TSTB    @MTC
 999  002770  100375                  BPL     .-4             ;WAIT FOR WRITE DONE
1000  002772  005267  176034          INC     R10             ;BACKSPACED ENOUGH TIMES?
1001  002776  001346                  BNE     MULBAK          ;NO BACKSPACE AND WRITE AGAIN
1002  003000  005267  176030          INC     R11             ;DONE 3 BACKSPACE SEQUENCES?
1003  003004  001004                  BNE     MUL1            ;YES
1004  003006  012767  177775  176016  MOV     #-3,R10
1005  003014  000730                  BR      MULWRT
1006  003016  005267  176014  MUL1:   INC     R12             ;DONE 4 BACKSPACE SEQUENCES?
1007  003022  001004                  BNE     MUL2            ;YES
1008  003024  012767  177774  176000  MOV     #-4,R10
1009  003032  000721                  BR      MULWRT
1010  003034  005267  175770  MUL2:   INC     R13             ;DONE 5 BACKSPACE SEQUENCES?
1011  003040  001004                  BNE     MUL3            ;YES
1012  003042  012767  177773  175762  MOV     #-5,R10
1013  003050  000712                  BR      MULWRT
1014  003052  006077  175722  MUL3:   ROR     @MTS
1015  003056  103375                  BCC     .-4             ;WAIT FOR TU READY
1016  003060  004767  004000          JSR     %7,STRREW       ;START REWIND
1017  003064  004767  003622          JSR     %7,CHGDRV
1018  003070  000615                  BR      T4G
1019                          ;NOW READ NONSTOP
```

```
1020                                    ;ACCUMULATE GAP TIMES ON READ
1021                                    ;TYPE ACCUMULATED TIMES AT END OF READ
1022                                    ;GAP1 SHOULD = GAP2, GAP3 <GAP1 AND GAP2
1023                                    ;GAP4 THRU GAP8 SHOULD GET INCREASINGLY LONGER
1024  003072  005067  175744           CLR     TSDRV
1025  003076  004767  004022           T5:     JSR     %7,WATREW
1026  003102  004767  003720                   JSR     %7,WRINT
1027  003106  012700  007212                   MOV     #TM1,%0
1028  003112  066700  175724                   ADD     TSDRV,%0
1029  003116  016777  003642  175656           MOV     FDRIVE,@MTC     ;SELECT DRIVE
1030  003124  052777  040003  175650           BIS     #40003,@MTC     ;800 BPI, READ, GO
1031  003132  012767  177778  175672           MOV     #-8.,R10        ;COUNT 8 GAPS
1032  003140  105777  175636           T5A:    TSTB    @MTC
1033  003144  100375                           BPL     .-4             ;WAIT FOR CU READY
1034  003146  004767  003654                   JSR     %7,WRINT
1035  003152  005067  004032                   CLR     TIME
1036  003156  005277  175620                   INC     @MTC            ;GO NONSTOP
1037  003162  022777  011344  175616   T5B:    CMP     #WBUF+2,@CA     ;IS 2ND WORD OUTPUT
1038  003170  003403                           BLE     T5C             ;YES
1039  003172  004767  003770                   JSR     %7,TIMER        ;NO, COUNT TIME
1040  003176  000771                           BR      T5B
1041  003200  016720  004004           T5C:    MOV     TIME,(0)+       ;SAVE GAP TIME
1042  003204  012710  177777                   MOV     #-1,(0)         ;TERMINATE, JUST IN CASE AT END
1043  003210  062700  000022                   ADD     #22,%0          ;STEP GAP POINTER
1044  003214  005267  175612                   INC     R10             ;DONE ALL 8 GAPS?
1045  003220  001347                           BNE     T5A             ;NO
1046  003222  006077  175552                   ROR     @MTS
1047  003226  103375                           BCC     .-4             ;WAIT FOR TU READY
1048  003230  004767  003630                   JSR     %7,STRREW       ;START REWIND
1049  003234  062767  000002  175600           ADD     #2,TSDRV        ;+2 TO DRIVE TIME POINTER
1050  003242  004767  003444                   JSR     %7,CHGDRV
1051  003246  000713                           BR      T5
1052  003250  112767  000061  005276           MOVB    #'1,MSG11A+6
1053  003256  012767  010457  004564           MOV     #MSG11,MESAGE
1054  003264  004767  004440                   JSR     %7,TOP
1055  003270  012767  010546  004552           MOV     #MSG11A,MESAGE
1056  003276  012700  007212                   MOV     #TM1,%0
1057  003302  004767  004144                   JSR     %7,TYPTIM       ;PRINT "GAP 1"
1058  003306  105267  005242                   INCB    MSG11A+6
1059  003312  012767  010546  004530           MOV     #MSG11A,MESAGE
1060  003320  012700  007236                   MOV     #TM2,%0
1061  003324  004767  004122                   JSR     %7,TYPTIM       ;PRINT "GAP 2"
1062  003330  105267  005220                   INCB    MSG11A+6
1063  003334  012767  010546  004506           MOV     #MSG11A,MESAGE
1064  003342  012700  007262                   MOV     #TM3,%0
1065  003346  004767  004100                   JSR     %7,TYPTIM       ;PRINT "GAP 3"
1066  003352  105267  005176                   INCB    MSG11A+6
1067  003356  012767  010546  004464           MOV     #MSG11A,MESAGE
1068  003364  012700  007306                   MOV     #TM4,%0
1069  003370  004767  004056                   JSR     %7,TYPTIM       ;PRINT "GAP 4"
1070  003374  105267  005154                   INCB    MSG11A+6
1071  003400  012767  010546  004442           MOV     #MSG11A,MESAGE
1072  003406  012700  007332                   MOV     #TM5,%0
1073  003412  004767  004034                   JSR     %7,TYPTIM       ;PRINT "GAP 5"
1074  003416  105267  005132                   INCB    MSG11A+6
1075  003422  012767  010546  004420           MOV     #MSG11A,MESAGE
```

```
1076  003430  012700  007356                MOV     #TM6,%0
1077  003434  004767  004012                JSR     %7,TYPTIM       ;PRINT "GAP 6"
1078  003440  105267  005110                INCB    MSG11A+6
1079  003444  012767  010546  004376        MOV     #MSG11A,MESAGE
1080  003452  012700  007402                MOV     #TM7,%0
1081  003456  004767  003770                JSR     %7,TYPTIM       ;PRINT "GAP 7"
1082  003462  105267  005066                INCB    MSG11A+6
1083  003466  012767  010546  004354        MOV     #MSG11A,MESAGE
1084  003474  012700  007426                MOV     #TM8,%0
1085  003500  004767  003746                JSR     %7,TYPTIM       ;PRINT "GAP 8"
1086  003504  004767  003334                JSR     %7,ST1S
1087                                ;TIME WRITE START NOT AT BOT
1088  003510  012700  007212        T61:    MOV     #TM1,%0
1089  003514  012701  007236                MOV     #TM2,%1
1090  003520  004767  003362        T6A:    JSR     %7,WRINT
1091  003524  016777  003234  175250        MOV     FDRIVE,@MTC     ;SELECT DRIVE
1092  003532  105777  175244                TSTB    @MTC
1093  003536  100375                        BPL     .-4
1094  003540  006077  175234                ROR     @MTS
1095  003544  103375                        BCC     .-4             ;WAIT FOR TU READY
1096  003546  052777  040005  175226        BIS     #40005,@MTC     ;800 BPI, WRITE, GO
1097  003554  032777  000040  175216        BIT     #40,@MTS
1098  003562  001374                        BNE     .-6             ;WAIT FOR BOT TO CLEAR
1099  003564  052777  010000  175210        BIS     #10000,@MTC     ;POWER CLEAR
1100  003572  016777  003166  175202        MOV     FDRIVE,@MTC
1101  003600  004767  003222                JSR     %7,WRINT
1102  003604  006777  175170                ROR     @MTS
1103  003610  103375                        BCC     .-4             ;WAIT FOR TU READY
1104  003612  005067  003372                CLR     TIME
1105  003616  016777  003142  175156        MOV     FDRIVE,@MTC     ;SELECT DRIVE
1106  003624  052777  040005  175150        BIS     #40005,@MTC     ;800 BPI, WRITE, GO
1107  003632  022777  011344  175146  T6B:  CMP     #WBUF+2,@CA     ;IS 2ND WORD OUTPUT?
1108  003640  003403                        BLE     T6C             ;YES
1109  003642  004767  003320                JSR     %7,TIMER        ;NO, COUNT TIME
1110  003646  000771                        BR      T6B
1111  003650  006077  175124        T6C:    ROR     @MTS
1112  003654  103375                        BCC     .-4             ;WAIT FOR TU READY
1113  003656  016720  003026                MOV     TIME,(0)+       ;SAVE "WRITE START" TIME
1114  003662  005067  003322                CLR     TIME
1115  003666  004767  003134                JSR     %7,WRINT
1116  003672  016777  003066  175102        MOV     FDRIVE,@MTC     ;SELECT DRIVE
1117  003700  052777  040015  175074        BIS     #40015,@MTC     ;800 BPI, WRITE XIRG, GO
1118  003706  022777  011344  175072  T6D:  CMP     #WBUF+2,@CA     ;IS 2ND WORD OUTPUT
1119  003714  003403                        BLE     T6E             ;YES
1120  003716  004767  003244                JSR     %7,TIMER        ;NO COUNT TIME
1121  003722  000771                        BR      T6D
1122  003724  006077  175050        T6E:    ROR     @MTS
1123  003730  103375                        BCC     .-4             ;WAIT FOR TU READY
1124  003732  016721  003252                MOV     TIME,(1)+       ;SAVE "WRITE XIRG" TIME
1125  003736  004767  003122                JSR     %7,STRREW
1126  003742  004767  002744                JSR     %7,CHGDRV
1127  003746  000664                        BR      T6A
1128  003750  012720  177777                MOV     #-1,(0)+        ;TERMINATE TIMES
1129  003754  012721  177777                MOV     #-1,(1)+        ;TERMINATE TIMES
1130  003760  012767  010253  004062        MOV     #MSG5,MESAGE
1131  003766  012700  007212                MOV     #TM1,%0
```

```
1132  003772  004767  003454                JSR     %7,TYPTIM       ;TYPE "WRITE START" TIME
1133  003776  012767  010574  004044        MOV     #MSG12,MESAGE
1134  004004  012700  007236                MOV     #TM2,%0
1135  004010  004767  003436                JSR     %7,TYPTIM       ;TYPE "WRITE XIRG" TIME
1136  004014  004767  003104        T6F:    JSR     %7,WATREW
1137  004020  004767  002666                JSR     %7,CHGDRV
1138  004024  000773                        BR      T6F             ;WAIT FOR ALL DRIVES AT BOT,
1139                                ;NOW TIME "READ FROM BOT DELAY
1140  004026  012700  007212        T7:     MOV     #TM1,%0
1141  004032  005067  003152        T7A:    CLR     TIME
1142  004036  004767  002764                JSR     %7,WRINT
1143  004042  016777  002716  174732        MOV     FDRIVE,@MTC     ;SELECT DRIVE
1144  004050  052777  040003  174724        BIS     #40003,@MTC     ;800 BPI, READ GO
1145  004056  022777  011344  174722  T7B:   CMP     #WBUF+2,@CA     ;IS 2ND WORD INPUT?
1146  004064  003403                        BLE     T7C             ;YES
1147  004066  004767  003074                JSR     %7,TIMER        ;NO COUNT TIME
1148  004072  000771                        BR      T7B
1149  004074  016720  003110        T7C:    MOV     TIME,(0)+       ;SAVE "READ FROM BOT" TIME
1150  004100  105777  174676                TSTB    @MTC
1151  004104  100375                        BPL     .-4             ;WAIT FOR CU READY,
1152  004106  004767  002680                JSR     %7,CHGDRV       ;DONE ALL DRIVES?
1153  004112  000747                        BR      T7A             ;NO
1154  004114  006077  174660                ROR     @MTS
1155  004120  103375                        BCC     .-4
1156  004122  012720  177777                MOV     #-1,(0)+        ;TERMINATE TIMES
1157  004126  012767  010622  003714        MOV     #MSG13,MESAGE
1158  004134  012700  007212                MOV     #TM1,%0
1159  004140  004767  003306                JSR     %7,TYPTIM       ;PRINT "READ FROM BOT" TIME
1160  004144  004767  002674                JSR     %7,ST1S
1161                                ;TIME "LAST CHARACTER INPUT TO CU READY"
1162  004150  012700  007212        T8:     MOV     #TM1,%0
1163  004154  004767  002646        T8A:    JSR     %7,WRINT
1164  004160  005067  003024                CLR     TIME
1165  004164  016777  002574  174610        MOV     FDRIVE,@MTC     ;SELECT DRIVE
1166  004172  052777  040003  174602        BIS     #40003,@MTC     ;800 BPI, READ, GO
1167  004200  005777  174600                TST     @BC
1168  004204  001375                        BNE     .-4             ;WAIT FOR LAST WORD IN
1169  004206  105777  174570        T8B:    TSTB    @MTC            ;IS CU READY?
1170  004212  100403                        BMI     T8C             ;YES
1171  004214  004767  002746                JSR     %7,TIMER        ;NO, COUNT TIME
1172  004220  000772                        BR      T8B
1173  004222  006077  174552        T8C:    ROR     @MTS
1174  004226  103375                        BCC     .-4             ;WAIT FOR TU READY
1175  004230  016720  002754                MOV     TIME,(0)+       ;SAVE "LAST CHAR TO CU READY" TIME
1176  004234  004767  002624                JSR     %7,STRREW       ;REWIND
1177  004240  004767  002446                JSR     %7,CHGDRV               ;ANYMORE DRIVES?
1178  004244  000743                        BR      T8A             ;NO
1179  004246  012720  177777                MOV     #-1,(0)+        ;TERMINATE TIMES
1180  004252  012767  010650  003570        MOV     #MSG14,MESAGE
1181  004260  012700  007212                MOV     #TM1,%0
1182  004264  004767  003162                JSR     %7,TYPTIM       ;PRINT "LAST CHAR TO CU READY" TIMES
1183  004270  004767  002630        T8D:    JSR     %7,WATREW
1184  004274  004767  002412                JSR     %7,CHGDRV
1185  004300  000773                        BR      T8D
1186                                ;TIME "WRITE EOF"
1187                                ;WRITE A 3 BYTE RECORD FROM BOT FOLLOWED BY AN EOF.
```

K2

```
1188  024302  012700  007212          T9:     MOV     #TM1,%0
1189  024306  005067  002676          T9A:    CLR     TIME
1190  024312  012777  177775  174464          MOV     #-3.,@BC                ;WRITE 3 BYTES
1191  024320  012777  011342  174460          MOV     #WBUF,@CA
1192  024326  016777  002432  174446          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1193  024334  052777  040005  174440          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
1194  024342  105777  174434                  TSTB    @MTC
1195  024346  100375                          BPL     .-4
1196  024350  006077  174424                  ROR     @MTS
1197  024354  103375                          BCC     .-4             ;WAIT FOR TU READY
1198  024356  042777  000016  174416          BIC     #16,@MTC
1199  024364  052777  000007  174410          BIS     #7,@MTC         ;WRITE EOF, GO
1200  024372  105777  174404          T9B:    TSTB    @MTC            ;IS CU READY SET?
1201  024376  100403                          BMI     T9C             ;YES
1202  024400  004767  002562                  JSR     %7,TIMER        ;NO, COUNT TIME
1203  024404  000772                          BR      T9B
1204  024406  016720  002576          T9C:    MOV     TIME,(0)+       ;SAVE "WRITE EOF" TIME
1205  024412  004767  002446                  JSR     %7,STRREW       ;REWIND
1206  024416  004767  002278                  JSR     %7,CHGDRV       ;ANYMORE DRIVES?
1207  024422  000731                          BR      T9A             ;YES
1208  024424  012720  177777                  MOV     #-1,(0)+        ;TERMINATE TIMES
1209  024430  012767  010676  003412          MOV     #MSG15,MESAGE
1210  024436  012700  007212                  MOV     #TM1,%0
1211  024442  004767  003004                  JSR     %7,TYPTIM       ;PRINT "WRITE EOF" TIMES
1212  024446  004767  002452          T9D:    JSR     %7,WATREW
1213  024452  004767  002234                  JSR     %7,CHGDRV
1214  024456  000773                          BR      T9D
1215                                  ;TIME "EOR TO EOF SPACE TIME", "SPACE SHUTDOWN" AND "ONE INCH DATA TIME",
1216                                  ;WRITE A 3 BYTE RECORD OVER ONE PREVIOUSLY WRITTEN
1217                                  ;BACKSPACE 1 RECORD AND THEN SPACE FORWARD 2 RECORDS
1218                                  ;TIME FROM THE END OF FIRST RECORD UNTIL EOF IS REACHED
1219  024460  012700  007212          T10:    MOV     #TM1,%0
1220  024464  012701  007236                  MOV     #TM2,%1
1221  024470  012702  007262                  MOV     #TM3,%2
1222  024474  005067  002518          T10A:   CLR     TIME
1223  024500  012777  177775  174276          MOV     #-3,@BC         ;3 BYTE RECORD
1224  024506  012777  011342  174272          MOV     #WBUF,@CA
1225  024514  016777  002244  174260          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1226  024522  052777  040005  174252          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
1227  024530  105777  174246                  TSTB    @MTC
1228  024534  100375                          BPL     .-4             ;WAIT FOR CU READY
1229  024536  012777  177777  174240          MOV     #-1,@BC         ;BACKSPACE 1 RECORD
1230  024544  042777  000016  174230          BIC     #16,@MTC        ;SELECT DRIVE
1231  024552  052777  000013  174222          BIS     #13,@MTC        ;BACKSPACE, GO
1232  024560  105777  174216                  TSTB    @MTC
1233  024564  100375                          BPL     .-4             ;WAIT FOR CU READY
1234  024566  012777  177776  174210          MOV     #-2,@BC         ;SPACE FORWARD 2 RECORDS
1235  024574  042777  000016  174200          BIC     #16,@MTC
1236  024602  052777  000011  174172          BIS     #11,@MTC        ;SPACE FORWARD, GO
1237  024610  022777  177777  174166  T10B:   CMP     #-1,@BC
1238  024616  001374                          BNE     T10B            ;WAIT FOR 1ST RECORD TO BE SPACED OVER
1239  024620  032777  040000  174152  T10C:   BIT     #40000,@MTS     ;IS EOF SET?
1240  024626  001014                          BNE     T10D            ;YES
1241  024630  105777  174146                  TSTB    @MTC            ;IS CU READY
1242  024634  100403                          BMI     T10CC           ;YES
1243  024636  004767  002324                  JSR     %7,TIMER        ;NO, COUNT TIME
```

L2

```
1244  004642  000766                          BR      T10C
1245  004644  032777  040000  174126  T10CC:  BIT     #40000,@MTS     ;HAVE CU READY
1246  004652  001002                          BNE     T10D            ;IS EOF SET?
1247  004654  005067  002330                  CLR     TIME            ;NO, SET ERROR
1248  004660  016720  002324          T10D:   MOV     TIME,(0)+       ;SAVE "EOR TO EOF SPACE TIME"
1249  004664  005067  002320                  CLR     TIME
1250  004670  105777  174106                  TSTB    @MTC
1251  004674  100375                          BPL     .-4
1252  004676  032777  000010  174074  T10E:   BIT     #10,@MTS        ;IS SETTLEDOWN SET?
1253  004704  001003                          BNE     T10F            ;YES
1254  004706  004767  002254                  JSR     %7,TIMER        ;NO, COUNT TIME
1255  004712  000771                          BR      T10E
1256  004714  016721  002270          T10F:   MOV     TIME,(1)+       ;SAVE "SPACE SHUTDOWN" TIME
1257  004720  012777  176340  174056          MOV     #-800.,@BC      ;1 INCH OF DATA
1258  004726  012777  011342  174052          MOV     #WBUF,@CA
1259  004734  005067  002250                  CLR     TIME
1260  004740  016777  002020  174034          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1261  004746  105777  174030                  TSTB    @MTC            ;WAIT FOR CU READY
1262  004752  100375                          BPL     .-4
1263  004754  052777  040005  174020          BIS     #40005,@MTC     ;800 BPI, WRITE, GO
1264  004762  022777  011344  174016          CMP     #WBUF+2,@CA     ;IS 2ND BYTE OUTPUT
1265  004770  003374                          BGT     .-6             ;NO
1266  004772  005777  174006          T10G:   TST     @BC             ;YES IS LAST BYTE OUT
1267  004776  001403                          BEQ     T10H            ;YES
1268  005000  004767  002162                  JSR     %7,TIMER        ;NO, COUNT TIME
1269  005004  000772                          BR      T10G
1270
1271  005006  016722  002176          T10H:   MOV     TIME,(2)+       ;SAVE "ONE INCH DATA TIME"
1272  005012  004767  002046                  JSR     %7,STRREW       ;REWIND
1273  005016  004767  001670                  JSR     %7,CHGDRV       ;ANYMORE DRIVES?
1274  005022  000624                          BR      T10A            ;YES
1275  005024  012720  177777                  MOV     #-1,(0)+        ;TERMINATE TIMES
1276  005030  012721  177777                  MOV     #-1,(1)+
1277  005034  012722  177777                  MOV     #-1,(2)+
1278  005040  012767  010724  003002          MOV     #MSG16,MESAGE
1279  005046  012708  007212                  MOV     #TM1,%0
1280  005052  004767  002374                  JSR     %7,TYPTIM       ;PRINT "EOR TO EOF SPACE TIME"
1281                          ;PRINT STATUS
1282  005056  012767  010752  002764          MOV     #MSG18,MESAGE
1283  005064  012708  007236                  MOV     #TM2,%0
1284  005070  004767  002356                  JSR     %7,TYPTIM       ;PRINT "SPACE SHUTDOWN" TIME
1285  005074  012767  011027  002746          MOV     #MSG20,MESAGE
1286  005102  012708  007262                  MOV     #TM3,%0
1287  005106  004767  002340                  JSR     %7,TYPTIM       ;PRINT "ONE INCH DATA TIME"
1288                          ;TIME SOME OF PREVIOUS OPERATIONS AT 200 BPI AND 556 BPI
1289  005112  012700  007212          T11:    MOV     #TM1,%0         ;INITIALIZE TIME BUFFERS
1290  005116  012701  007236                  MOV     #TM2,%1
1291  005122  012702  007262                  MOV     #TM3,%2
1292  005126  012703  007306                  MOV     #TM4,%3
1293  005132  012704  007332                  MOV     #TM5,%4
1294  005136  012705  007356                  MOV     #TM6,%5
1295  005142  005067  173676                  CLR     T11T
1296  005146  004767  001752          T11A:   JSR     %7,WAITREW      ;WAIT FOR REWIND
1297  005152  032767  020000  001604          BIT     #20000,FDRIVE   ;IS DRIVE 9 TRACK?
1298  005160  001161                          BNE     T11P            ;YES, GET NEXT DRIVE
1299  005162  012767  177777  173654          MOV     #-1,T11T        ;INDICATE 7 TRACK
```

M2

```
1300  025170  012777  176724  173606          MOV     #-556.,@BC      ;556 BYTES = ONE INCH
1301  025176  012777  011342  173602          MOV     #WBUF,@CA
1302  025204  005067  002080                  CLR     TIME
1303  025210  016777  001598  173564          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1304  025216  052777  020005  173556          BIS     #20005,@MTC     ;556 BPI, WRITE, GO
1305                                  ;TIME "WRITE FROM BOT DELAY" AT 556 BPI
1306  025224  022777  011344  173554  T11B:   CMP     #WBUF+2,@CA     ;IS 2ND WORD OUT?
1307  025232  003403                          BLE     T11C            ;YES
1308  025234  004767  001726                  JSR     %7,TIMER        ;NO, COUNT TIME
1309  025240  000771                          BR      T11B
1310  025242  016720  001742          T11C:   MOV     TIME,(0)+       ;SAVE "WRITE FROM BOT DELAY"
1311  025246  005067  001736                  CLR     TIME
1312                                  ;TIME "ONE INCH DATA" AT 556 BPI
1313  025252  005777  173526          T11D:   TST     @BC             ;IS BC=0
1314  025256  001403                          BEQ     T11E            ;YES
1315  025260  004767  001702                  JSR     %7,TIMER        ;NO, COUNT TIME
1316  025264  000772                          BR      T11D
1317  025266  016721  001716          T11E:   MOV     TIME,(1)+       ;SAVE "1 INCH DATA" TIME
1318  025272  005067  001712                  CLR     TIME
1319
1320                                  ;TIME "WRITE SHUTDOWN" AT 556 BPI
1321  025276  105777  173500                  TSTB    @MTC
1322  025302  100375                          BPL     .-4
1323  025304  032777  000010  173466  T11F:   BIT     #10,@MTS        ;IS SETTLEDOWN SET?
1324  025312  001003                          BNE     T11G            ;YES
1325  025314  004767  001646                  JSR     %7,TIMER        ;NO, COUNT TIME
1326  025320  000771                          BR      T11F
1327  025322  016722  001662          T11G:   MOV     TIME,(2)+       ;SAVE "WRITE SHUTDOWN"
1328  025326  005067  001656                  CLR     TIME
1329                                  ;TIME "BACKSPACE SHUTDOWN" AT 556 BPI
1330  025332  012777  177777  173444          MOV     #-1,@BC
1331  025340  042777  000010  173434          BIC     #10,@MTC
1332  025346  052777  000013  173426          BIS     #13,@MTC        ;BACKSPACE 1 RECORD, GO
1333  025354  105777  173422                  TSTB    @MTC
1334  025360  100375                          BPL     .-4             ;WAIT FOR CU READY
1335  025362  032777  000010  173410  T11H:   BIT     #10,@MTS        ;IS SETTLEDOWN SET?
1336  025370  001003                          BNE     T11J            ;YES
1337  025372  004767  001570                  JSR     %7,TIMER        ;NO COUNT TIME
1338  025376  000771                          BR      T11H
1339  025400  016723  001624          T11J:   MOV     TIME,(3)+       ;SAVE "BACKSPACE SHUTDOWN"
1340  025404  005067  001620                  CLR     TIME
1341                                  ;TIME "LAST CHAR IN TO MTF" AT 556 BPI
1342  025410  006077  173364                  ROR     @MTS
1343  025414  103375                          BCC     .-4             ;WAIT FOR CU READY
1344  025416  012777  176724  173360          MOV     #-556.,@BC      ;556 BYTES
1345  025424  012777  011342  173354          MOV     #WBUF,@CA
1346  025432  016777  001326  173342          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1347  025440  052777  020003  173334          BIS     #20003,@MTC     ;556 BPI, READ, GO
1348  025446  005777  173332                  TST     @BC
1349  025452  001375                          BNE     .-4             ;WAIT FOR LAST WORD OUT
1350  025454  105777  173322          T11K:   TSTB    @MTC            ;IS CU READY SET?
1351  025460  100403                          BMI     T11L            ;YES
1352  025462  004767  001520                  JSR     %7,TIMER        ;NO COUNT TIME
1353  025466  000772                          BR      T11K
1354  025470  016724  001514          T11L:   MOV     TIME,(4)+       ;SAVE "LAST CHAR IN TO MTF"
1355  025474  005067  001510                  CLR     TIME
```

```
1356  002500  032777  000010  173272  T11M:  BIT   #10,@MTS
1357  002506  001003                  BNE    T11N
1358  002510  004767  001492            JSR    %7,TIMER
1359  002514  000771                  BR     T11M
1360  002516  016725  001466  T11N:   MOV    TIME,(5)+       ;SAVE "READ SHUTDOWN"
1361  002522  000406                  BR     T11R
1362  002524  005020          T11P:   CLR    (0)+            ;CLEAR TIMES FOR 9 TRACK DRIVES
1363  002526  005021                  CLR    (1)+
1364  002530  005022                  CLR    (2)+
1365  002532  005023                  CLR    (3)+
1366  002534  005024                  CLR    (4)+
1367  002536  005025                  CLR    (5)+
1368  002540  004767  001320  T11R:   JSR    %7,$TRREW
1369  002544  004767  001142            JSR    %7,CHGDRV
1370  002550  000401                  BR     .+4
1371  002552  000402                  BR     .+6
1372  002554  000167  177366            JMP    T11A
1373
1374  002560  012720  177777            MOV    #-1,(0)+        ;TERMINATE DRIVES
1375  002564  012721  177777            MOV    #-1,(1)+
1376  002570  012722  177777            MOV    #-1,(2)+
1377  002574  012723  177777            MOV    #-1,(3)+
1378  002600  012724  177777            MOV    #-1,(4)+
1379  002604  012725  177777            MOV    #-1,(5)+
1380  002610  005767  173230            TST    T11T            ;HAVE TESTED ANY 7 TRACKS
1381  002614  001461                  BEQ    T12             ;NO
1382  002616  012767  011000  002224    MOV    #MSG19,MESAGE   ;PRINT "FUNCTIONS AT 556"
1383  002624  004767  002100            JSR    %7,TOP
1384  002630  012767  010177  002212    MOV    #MSG3,MESAGE
1385  002636  012708  007212            MOV    #TM1,%0
1386  002642  004767  001604            JSR    %7,TYPTIM       ;PRINT "WRITE FROM BOT DELAY"
1387  002646  012767  011027  002174    MOV    #MSG20,MESAGE
1388  002654  012708  007236            MOV    #TM2,%0
1389  002660  004767  001566            JSR    %7,TYPTIM       ;PRINT "ONE INCH DATA TIME"
1390  002664  012767  010225  002156    MOV    #MSG4,MESAGE
1391  002672  012708  007262            MOV    #TM3,%0
1392  002676  004767  001530            JSR    %7,TYPTIM       ;PRINT "WRITE SHUTDOWN"
1393  002702  012767  010403  002140    MOV    #MSG9,MESAGE
1394  002710  012708  007306            MOV    #TM4,%0
1395  002714  004767  001532            JSR    %7,TYPTIM       ;PRINT "BACKSPACE SHUTDOWN"
1396  002720  012767  010650  002122    MOV    #MSG14,MESAGE
1397  002726  012708  007332            MOV    #TM5,%0
1398  002732  004767  001514            JSR    %7,TYPTIM       ;PRINT "LAST CHAR IN TO MTP"
1399  002736  012767  010431  002104    MOV    #MSG10,MESAGE
1400  002744  012708  007356            MOV    #TM6,%0
1401  002750  004767  001476            JSR    %7,TYPTIM       ;PRINT "READ SHUTDOWN"
1402  002754  004767  001864            JSR    %7,$T10
1403                          ;TIME OPERATIONS AT 200 BPI
1404  002760  012708  007212  T12:     MOV    #TM1,%0         ;INITIALIZE TIME BUFFERS
1405  002764  012701  007236            MOV    #TM2,%1
1406  002770  012702  007262            MOV    #TM3,%2
1407  002774  012703  007306            MOV    #TM4,%3
1408  003000  012704  007332            MOV    #TM5,%4
1409  003004  012705  007356            MOV    #TM6,%5
1410  003010  005067  173030            CLR    T11T
1411  003014  004767  001124  T12A:    JSR    %7,WAITREW      ;WAIT FOR REWIND
```

```
1412  002020  032767  000000  000736          BIT     #20000,FDRIVE   ;IS DRIVE 9 TRACK?
1413  002026  001402                          BEQ     .+6             ;NO
1414  002030  000167  000342                  JMP     T12P            ;YES, GET NEXT DRIVE
1415  002034  012767  177777  173002          MOV     #-1,T11T
1416  002042  012777  177470  172734          MOV     #-200.,@BC      ;506 BYTES = ONE INCH
1417  002050  012777  011342  172730          MOV     #WBUF,@CA
1418  002056  005067  001126                  CLR     TIME
1419  002062  016777  000676  172712          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1420  002070  052777  000005  172704          BIS     #00005,@MTC     ;200 BPI, WRITE, GO
1421                                  ;TIME "WRITE FROM BOT DELAY" AT 556 BPI
1422  002076  022777  011344  172702  T12B:   CMP     #WBUF+2,@CA     ;IS 2ND WORD OUT?
1423  002104  001403                          BEQ     T12C            ;YES
1424  002106  004767  001054                  JSR     %7,TIMER        ;NO, COUNT TIME
1425  002112  000771                          BR      T12B
1426  002114  016720  001070          T12C:   MOV     TIME,(0)+       ;SAVE "WRITE FROM BOT DELAY"
1427  002120  005067  001064                  CLR     TIME
1428
1429                                  ;TIME "ONE INCH DATA" AT 200 BPI
1430  002124  005777  172654          T12D:   TST     @BC             ;IS BC=0
1431  002130  001403                          BEQ     T12E            ;YES
1432  002132  004767  001030                  JSR     %7,TIMER        ;NO, COUNT TIME
1433  002136  000772                          BR      T12D
1434  002140  016721  001044          T12E:   MOV     TIME,(1)+       ;SAVE "1 INCH DATA" TIME
1435  002144  005067  001040                  CLR     TIME
1436                                  ;TIME "WRITE SHUTDOWN" AT 200 BPI
1437  002150  105777  172626                  TSTB    @MTC
1438  002154  100375                          BPL     .-4
1439  002156  032777  000010  172614  T12F:   BIT     #10,@MTS        ;IS SETTLEDOWN SET?
1440  002164  001003                          BNE     T12G            ;YES
1441  002166  004767  000774                  JSR     %7,TIMER        ;NO, COUNT TIME
1442  002172  000771                          BR      T12F
1443  002174  016722  001010          T12G:   MOV     TIME,(2)+       ;SAVE "WRITE SHUTDOWN"
1444  002200  005067  001004                  CLR     TIME
1445                                  ;TIME "BACKSPACE SHUTDOWN" AT 200 BPI
1446  002204  012777  177777  172572          MOV     #-1,@BC
1447  002212  042777  000010  172562          BIC     #10,@MTC
1448  002220  052777  000013  172554          BIS     #13,@MTC        ;BACKSPACE 1 RECORD, GO
1449  002226  105777  172550                  TSTB    @MTC
1450  002232  100375                          BPL     .-4             ;WAIT FOR CU READY
1451  002234  032777  000010  172536  T12H:   BIT     #10,@MTS        ;IS SETTLEDOWN SET?
1452  002242  001003                          BNE     T12J            ;YES
1453  002244  004767  000716                  JSR     %7,TIMER        ;NO COUNT TIME
1454  002250  000771                          BR      T12H
1455  002252  016723  000732          T12J:   MOV     TIME,(3)+       ;SAVE "BACKSPACE SHUTDOWN"
1456  002256  005067  000726                  CLR     TIME
1457                                  ;TIME "LAST CHAR IN TO MTF" AT 200 BPI
1458  002262  006077  172512                  ROR     @MTS
1459  002266  103375                          BCC     .-4             ;WAIT FOR TU READY
1460  002270  012777  177470  172506          MOV     #-200.,@BC      ;556 BYTES
1461  002276  012777  011342  172502          MOV     #WBUF,@CA
1462  002304  016777  000454  172470          MOV     FDRIVE,@MTC     ;SELECT DRIVE
1463  002312  052777  000003  172462          BIS     #00003,@MTC     ;556 BPI, READ, GO
1464  002320  005777  172460                  TST     @BC
1465  002324  001375                          BNE     .-4             ;WAIT FOR LAST WORD OUT
1466  002326  105777  172450          T12K:   TSTB    @MTC            ;IS CU READY SET?
1467  002332  100403                          BMI     T12L            ;YES
```

```
1468  026334  004767  000626              JSR     %7,TIMER        ;NO COUNT TIME
1469  026340  000772                      BR      T12K
1470  026342  016724  000642      T12L:   MOV     TIME,(4)+       ;SAVE "LAST CHAR IN TO MTF"
1471  026346  005067  000636              CLR     TIME
1472  026352  032777  000010  172420  T12M:   BIT     #10,@MTS
1473  026360  001003                      BNE     T12N
1474  026362  004767  000620              JSR     %7,TIMER
1475  026366  000771                      BR      T12M
1476  026370  016725  000614      T12N:   MOV     TIME,(5)+       ;SAVE "READ SHUTDOWN"
1477  026374  000406                      BR      T12R
1478
1479  026376  005020              T12P:   CLR     (0)+
1480  026400  005021                      CLR     (1)+
1481  026402  005022                      CLR     (2)+
1482  026404  005023                      CLR     (3)+
1483  026406  005024                      CLR     (4)+
1484  026410  005025                      CLR     (5)+
1485  026412  004767  000274      T12R:   JSR     %7,CHGDRV
1486  026416  000401                      BR      .+4
1487  026420  000402                      BR      .+6
1488  026422  000167  177366              JMP     T12A
1489  026426  012720  177777              MOV     #-1,(0)+        ;TERMINATE DRIVES
1490  026432  012721  177777              MOV     #-1,(1)+
1491  026436  012722  177777              MOV     #-1,(2)+
1492  026442  012723  177777              MOV     #-1,(3)+
1493  026446  012724  177777              MOV     #-1,(4)+
1494  026452  012725  177777              MOV     #-1,(5)+
1495  026456  005767  172362              TST     T11T            ;HAVE TESTED ANY 7 TRACKS?
1496  026462  001461                      BEQ     T13             ;NO
1497  026464  012767  011055  001356      MOV     #MSG21, MESAGE  ;PRINT "FUNCTIONS AT 200"
1498  026472  004767  001232              JSR     %7,TOP
1499  026476  012767  010177  001344      MOV     #MSG3,MESAGE
1500  026504  012708  007212              MOV     #TM1,%0
1501  026510  004767  000736              JSR     %7,TYPTIM       ;PRINT "WRITE FROM HOT DELAY"
1502  026514  012767  011027  001326      MOV     #MSG20,MESAGE
1503  026522  012708  007236              MOV     #TM2,%0
1504  026526  004767  000720              JSR     %7,TYPTIM       ;PRINT "ONE INCH DATA TIME"
1505  026532  012767  010225  001310      MOV     #MSG4,MESAGE
1506  026540  012708  007262              MOV     #TM3,%0
1507  026544  004767  000702              JSR     %7,TYPTIM       ;PRINT "WRITE SHUTDOWN"
1508  026550  012767  010403  001272      MOV     #MSG9,MESAGE
1509  026556  012708  007306              MOV     #TM4,%0
1510  026562  004767  000664              JSR     %7,TYPTIM       ;PRINT "BACKSPACE SHUTDOWN"
1511  026566  012767  010650  001254      MOV     #MSG14,MESAGE
1512  026574  012708  007332              MOV     #TM5,%0
1513  026600  004767  000646              JSR     %7,TYPTIM       ;PRINT "LAST CHAR IN TO MTF"
1514  026604  012767  010431  001236      MOV     #MSG10,MESAGE
1515  026612  012708  007356              MOV     #TM6,%0
1516  026616  004767  000630              JSR     %7,TYPTIM       ;PRINT "READ SHUTDOWN"
1517  026622  004767  000216              JSR     %7,ST10
1518  026626  012767  011104  001214  T13:  MOV     #MSG27,MESAGE
1519  026634  004767  001070              JSR     %7,TOP          ;PRINT "END OF TIMING"
1520  026640  000000                      HALT
1521  026642  000167  172224              JMP     ST0
1522
1523                          ;RESET DRIVE SELECTION TO LOWEST NUMBER
```

```
1524  026646  005067  002124          RSFDRV: CLR     CDRIVE          ;START WITH DRIVE 0
1525  026652  012767  100000  000100          MOV     #100000,CDRVBT  ;INITIALIZE FOR 0
1526  026660  036767  000074  000074  RSF1:   BIT     CDRVBT,DRIVES   ;MASK WITH SELECTED DRIVES
1527  026666  001006                          BNE     RSF2
1528  026670  005267  000062                  INC     CDRIVE          ;+1 TO DRIVE NUMBER
1529  026674  000241                          CLC
1530  026676  006067  000056                  ROR     CDRVBT          ;MOVE MASK BIT TO NEXT DRIVE
1531  026702  000766                          BR      RSF1
1532  026704  004767  000056          RSF2:   JSR     %7,GTNINE       ;CHECK 9 TRACK
1533  026710  000207                          RTS     %7
1534                                  ;SELECT NEXT DRIVE IN SEQUENCE
1535                                  ;SKIP FIRST EXIT ADDRESS IF LAST DRIVE SELECTED
1536  026712  005267  000040          CHGDRV: INC     CDRIVE          ;+1 TO DRIVE
1537  026716  000241                          CLC
1538  026720  006067  000034                  ROR     CDRVBT          ;MOVE MASK BIT TO NEXT DRIVE
1539  026724  001005                          BNE     CHG1
1540  026726  004767  177714                  JSR     %7,RSFDRV       ;RESET TO LOWEST DRIVE
1541  026732  062716  000002                  ADD     #2,(6)          ;+2 TO SKIP FIRST EXIT
1542  026736  000207                          RTS     %7              ;EXIT
1543  026740  036767  000014  000014  CHG1:   BIT     CDRVBT,DRIVES   ;MASK WITH SELECTED DRIVES
1544  026746  001761                          BEQ     CHGDRV          ;CHECK FOR NEXT DRIVE
1545  026750  004767  000012                  JSR     %7,GTNINE       ;CHECK 9 TRACK
1546  026754  000207                          RTS     %7
1547  026756  000000                  CDRIVE: 0
1548  026760  000000                  CDRVBT: 0
1549  026762  000000                  DRIVES: 0
1550  026764  000000                  FDRIVE: 0
1551                                  ;CHECK FOR NINE TRACK DRIVES
1552  026766  016767  177764  177770  GTNINE: MOV     CDRIVE,FDRIVE
1553  026774  000367  177764                  SWAB    FDRIVE          ;POSITION UNIT SELECT BITS
1554  027000  042767  174377  177756          BIC     #174377,FDRIVE  ;CLEAR ALL OTHER BITS
1555  027006  032767  000010  177742          BIT     #10,CDRIVE      ;TEST FOR 9 TRACK
1556  027014  001403                          BEQ     GNT1            ;NO
1557  027016  052767  020000  177740          BIS     #20000,FDRIVE   ;YES SET 9 TRACK BIT
1558  027024  000207                  GNT1:   RTS     %7
1559                                  ;INITIALIZE BYTE COUNT AND CURRENT ADDRESS FOR WRITE
1560  027026  012777  172110  171750  WRINT:  MOV     #-BLENTH,@BC
1561  027034  012777  011342  171744          MOV     #WBUF,@CA
1562  027042  000207                          RTS     %7
1563                                  ;STORE 1'S IN WRITE BUFFER
1564  027044  012700  011342          ST1S:   MOV     #WBUF,%0
1565  027050  012720  177777          ST1SA:  MOV     #-1,(0)+
1566  027054  022700  017334                  CMP     #WBUF+BLENTH+2,%0
1567  027060  001373                          BNE     ST1SA
1568  027062  000207                          RTS     %7
1569                                  ;START REWIND OPERATIONS
1570  027064  016777  177674  171710  STRREW: MOV     FDRIVE,@MTC     ;SELECT DRIVE
1571  027072  105777  171704                  TSTB    @MTC
1572  027076  100375                          BPL     .-4             ;WAIT FOR CU READY
1573  027100  006077  171674                  ROR     @MTS
1574  027104  103375                          BCC     .-4             ;WAIT FOR TAPE UNIT READY
1575  027106  052777  000017  171666          BIS     #17,@MTC        ;GO REWIND
1576  027114  105777  171662                  TSTB    @MTC
1577  027120  100375                          BPL     .-4             ;WAIT FOR CONTROL UNIT READY
1578  027122  000207                          RTS     %7
1579                                  ;WAIT FOR REWIND TO FINISH
```

```
1588  027124  016777  177634  171650  WATREW: MOV     FDRIVE,@MTC
1589  027132  006077  171642          ROR     @MTS
1590  027136  103375                  BCC     .-4
1591  027140  032777  000040  171632  BIT     #40,@MTS        ;IS BOT SET?
1592  027146  001006                  BNE     1$              ;YES
1593  027150  012767  011153  000672  MOV     #MSG28,MESAGE
1594  027156  004767  000546          JSR     PC,TOP
1595  027162  000000                  HALT                    ;ERROR, NOT AT BOT AFTER REWIND
1596  027164  000207          1$:     RTS     %7
1597                          ;KEEP COUNT OF ELAPSED TIME
1598                          ;EXIT EVERY 100 USEC
1599  027166  005777  171620  TIMER:  TST     @MTRD
1600  027172  100375                  BPL     .-4
1601  027174  005777  171612          TST     @MTRD
1602  027200  100775                  BMI     .-4
1603  027202  005267  000002          INC     TIME            ;+1 TO 100 USEC COUNT
1604  027206  000207                  RTS     %7
1605  027210  000000          TIME:   0
1606  027212  000000          TM1:    0
1607          027234                  .=TM1+20.
1608  027234  000000          TM2:    0
1609          027260                  .=TM2+20.
1610  027260  000000          TM3:    0
1611          027304                  .=TM3+20.
1612  027304  000000          TM4:    0
1613          027330                  .=TM4+20.
1614  027330  000000          TM5:    0
1615          027354                  .=TM5+20.
1616  027354  000000          TM6:    0
1617          027400                  .=TM6+20.
1618  027400  000000          TM7:    0
1619          027424                  .=TM7+20.
1620  027424  000000          TM8:    0
1621          027450                  .=TM8+20.
1622                          ;PRINT TITLE OF TEST EXECUTED AND THE DRIVE TIMES
1623  027450  004767  000252  TYPTIM: JSR     %7,TOP          ;PRINT TITLE
1624  027454  012067  000224  TYPT0:  MOV     (0)+,VALUE      ;GET TIME
1625  027460  022767  177777  000216  CMP     #-1,VALUE       ;FINISHED TIME BUFFER
1626  027466  001001                  BNE     .+4
1627  027470  000207                  RTS     %7
1628  027472  012767  027726  000214  MOV     #DECPNT+2,DECPNT;INITIALIZE DECIMAL VALUE POINTER
1629  027500  012767  000040  000204  MOV     #40,ZERO        ;INITIALIZE SPACE
1630  027506  012767  177774  000172  MOV     #-4,DIGCNT      ;DIGIT COUNT
1631  027514  012767  177777  000166  TYPT1:  MOV     #-1,DIGIT       ;INITIAL VALUE
1632  027522  005267  000162  TYPT2:  INC     DIGIT           ;+1 TO VALUE
1633  027526  167767  000162  000150  SUB     @DECPNT,VALUE   ;SUBTRACT CONSTANT
1634  027534  100372                  BPL     TYPT2           ;NOT NEGATIVE YET
1635  027536  067767  000152  000140  ADD     @DECPNT,VALUE   ;RESTORE LAST POSITIVE VALUE
1636  027544  004767  000064          JSR     %7,DECOUT       ;PRINT DECIMAL DIGIT
1637  027550  005267  000132          INC     DIGCNT          ;+1 TO DIGIT COUNT
1638  027554  001006                  BNE     TYP2A
1639  027556  012767  010173  000262  MOV     #MSG2B,MESAGE
1640  027564  004767  000136          JSR     %7,TOP
1641  027570  000731                  BR      TYPT0
1642  027572  022767  177777  000106  TYP2A:  CMP     #-1,DIGCNT      ;CHECK FOR DECIMAL PLACE
1643  027600  001011                  BNE     TYPT3           ;NO
```

F3

```
1636  002604  105777  171212                  TSTB    @TPS
1637  002610  100375                          BPL     .-4
1638  002612  012777  000056  171204          MOV     #'.,@TPB                ;PRINT DECIMAL POINT
1639  002620  012767  000060  000066          MOV     #60,ZERO
1640  002626  062767  000002  000062  TYPT3:  ADD     #2,DECPNT               ;+2 TO DECIMAL VALUE POINTER
1641  002634  000730                          BR      TYPT1                   ;DO AGAIN
1642
1643  002636  005767  000050          DECOUT: TST     DIGIT                   ;IS DIGIT 0
1644  002642  001004                          BNE     DEC1                    ;NO
1645  002644  016767  000044  000040          MOV     ZERO,DIGIT              ;SUPPRESS LEADING ZEROS
1646  002652  000406                          BR      DEC2
1647  002654  012767  000060  000032  DEC1:  MOV     #60,ZERO                ;INITIALIZE ZERO AFTER SOME VALUE FOUND
1648  002662  052767  000060  000022          BIS     #60,DIGIT               ;CONVERT TO ANSCII
1649  002670  105777  171126          DEC2:   TSTB    @TPS
1650  002674  100375                          BPL     .-4
1651  002676  016777  000010  171120          MOV     DIGIT,@TPB              ;PRINT
1652  002704  000207                          RTS     %7
1653  002706  000000                  VALUE:  0
1654  002710  000000                  DIGCNT: 0
1655  002712  000000                  DIGIT:  0
1656  002714  000040                  ZERO:   40                              ;CONTAINS ZERO OR SPACE
1657  002716  002720                  DECPNT: .+2
1658  002720  001750                          1000.
1659  002722  000144                          100.
1660  002724  000012                          10.
1661  002726  000001                          1.
1662                                  ;TELETYPE OUTPUT PACKAGE
1663  002730  142777  000177  171064  TOP:    BICB    #177,@TPS               ;CLEAR FLAGS
1664  002736  117767  000126  000102          MOVB    @MESAGE,EOMK            ;SAVE MESSAGE DELIMETER
1665  002744  005267  000120                  INC     MESAGE                  ;+2 TO POINTER
1666  002750  127767  000074  000070  TOP1:   CMPB    @MESAGE,EOMK            ;IS CHARACTER THE 2ND DELIMETER
1667  002756  001001                          BNE     .+4                     ;NO
1668  002760  000207                          RTS     %7                      ;YES ENT
1669  002762  127727  000062  000100          CMPB    @MESAGE,#'@             ;IS CHARACTER AN @ INDICATING A CARRIAGE RETURN
1670  002770  001411                          BEQ     TOP3                    ;YES
1671  002772  105777  171024                  TSTB    @TPS
1672  002776  100375                          BPL     .-4
1673  003000  117777  000044  171016          MOVB    @MESAGE,@TPB            ;PRINT CHARACTER
1674  003006  005267  000036          TOP2:   INC     MESAGE                  ;+2 TO POINTER
1675  003012  000756                          BR      TOP1                    ;LOOP
1676                                  ;CARRIAGE RETURN, LINE FEED
1677  003014  105777  171002          TOP3:   TSTB    @TPS
```

```
 1678  010020  100375                          BPL     .-4
 1679  010022  112777  000215  170774          MOVB    #215,@TPB
 1680  010030  105777  170766                  TSTB    @TPS
 1681  010034  100375                          BPL     .-4
 1682  010036  112777  000212  170760          MOVB    #212,@TPB
 1683  010044  000760                          BR      TOP2
 1684  010046  000000                  EOMK1:  0
 1685  010050  000000                  MESAGE: 0
 1686  010052  040057  046523  026504  MSG1:   .ASCII  !/@@MD-11-DZTMD-E          TM-11 DRIVE FUNCTION !
 1687  010062  030461  042055  052132
 1688  010066  042115  042455  020040
 1689  010074  020040  020040  020040
 1690  010102  052040  026515  030461
 1691  010110  042040  044522  042526
 1692  010116  043040  047125  052103
 1693  010124  047511  020116
 1694  010132  044524  042515  040122          .ASCII  !TIMER@/!
 1695  010136     057
 1696  010137     057  043100  047125  MSG2:   .ASCII  !/@FUNCTION          /!
 1697  010144  052103  047511  020116
 1698  010152  020040  020040  020040
 1699  010160  020040     057
 1700  010163     057  052440  044516  MSG2A:  .ASCII  !/ UNIT /!
 1701  010170  020124     057
 1702  010173     057  020040     057  MSG2B:  .ASCII  !/  /!
 1703  010177     057  053520  044522  MSG3:   .ASCII  !/@WRITE FROM BOT      /!
 1704  010204  042524  043040  047522
 1705  010212  020115  047502  020124
 1706  010220  020040  020040     057
```

```
 1707  010225     057   053500  044522  MSG4:   .ASCII  /?WRITE SHUTDOWN     /
 1708  010232  042524   051440  052510
 1709  010240  042124   053517  020116
 1710  010246  020040   020040     057
 1711  010253     057   053500  044522  MSG5:   .ASCII  /?WRITE START        /
 1712  010260  042524   051440  040524
 1713  010266  052122   020040  020040
 1714  010274  020040   020040     057
 1715  010301     057   051500  052105  MSG6:   .ASCII  /?SETTLE DOWN DELAY  /
 1716  010306  046124   020105  047504
 1717  010314  047127   042040  046105
 1718  010322  054501   020040     057
 1719  010327     057   053500  044522  MSG7:   .ASCII  /?WRITE TO ERASE HEAD/
 1720  010334  042524   052040  020117
 1721  010342  051105   051501  020105
 1722  010350  042516   042101     057
```

```
1723  010355  000057  053500  044522  MSG8:   .ASCII  /?WRITE NONSTOP GAP  /
1724  010362  042524  047040  047117
1725  010370  052123  050117  043440
1726  010376  050101  020040  000057
1727  010403  000057  041120  041501  MSG9:   .ASCII  /?BACKSPACE SHUTDOWN /
1728  010410  051513  040520  042503
1729  010416  051440  052510  042124
1730  010424  053517  020116  000057
1731  010431  000057  051120  040505  MSG10:  .ASCII  /?READ SHUTDOWN      /
1732  010436  020104  044123  052125
1733  010444  047504  047127  020040
1734  010452  020040  020040  000057
1735  010457  000057  043520  050101  MSG11:  .ASCII  /?GAPS SHOULD = 0>7>6>5>4>1, 1=2<1,7, 2=3(=1,1, =0,2),/
1736  010464  020123  044123  052517
1737  010472  042114  036440  034040
1738  010500  033476  033076  032476
1739  010506  032076  030476  020054
1740  010514  026461  036062  027061
1741  010522  026067  031040  031475
1742  010530  025450  027061  026061
1743  010536  026440  027060  024462
1744  010544  027456
1745  010546  040057  040527  020120  MSG11A: .ASCII  /?GAP 1              /
1746  010554  020061  020040  020040
1747  010562  020040  020040  020040
1748  010570  020040  027440
1749  010574  040057  051127  052111  MSG12:  .ASCII  /?WRITE XIRG         /
1750  010602  020105  044530  043522
1751  010610  020040  020040  020040
1752  010616  020040  027440
1753  010622  040057  042522  042101  MSG13:  .ASCII  /?READ FROM BOT DELAY/
1754  010630  043040  047522  020115
1755  010636  047502  020124  042504
1756  010644  040514  027531
1757  010650  040057  040514  052123  MSG14:  .ASCII  /?LAST CHAR TO CU RDY/
1758  010656  041440  040510  020122
1759  010664  047524  041440  020125
1760  010672  042122  027531
1761  010676  040057  051127  052111  MSG15:  .ASCII  /?WRITE EOF          /
1762  010704  020105  047505  020106
1763  010712  020040  020040  020040
1764  010720  020040  027440
1765  010724  040057  047505  020122  MSG16:  .ASCII  /?EOR TO EOF SP TIME /
1766  010732  047524  042440  043117
1767  010740  051440  020120  044524
1768  010746  042515  027440
1769  010752  040057  050123  041501  MSG18:  .ASCII  /?SPACE SHUTDOWN     /
1770  010760  020105  044123  052125
1771  010766  047504  047127  020040
1772  010774  020040  027440
1773  011000  040057  052506  041516  MSG19:  .ASCII  /?FUNCTIONS AT 556 BPI/
1774  011006  044524  047117  020123
1775  011014  052101  032440  033065
1776  011022  041040  044520  000057
1777  011027  000057  047500  042516  MSG20:  .ASCII  /?ONE INCH DATA TIME /
1778  011034  044440  041516  020110
```

```
1779  011842  040504  040524  052040
1780  011850  046511  020105     057
1781  011855     057  043100  047125  MSG21:  .ASCII  /?FUNCTIONS AT 200 BPI?/
1782  011862  052103  047511  051516
1783  011870  040440  020124  030062
1784  011876  020060  050102  027511
1785  012104  040057  025052  025052  MSG27:  .ASCII  /?**********END OF TIMING**********?/
1786  012112  025052  025052  025052
1787  012120  042452  042116  047440
1788  012126  020106  044524  044515
1789  012134  043516  025052  025052
1790  012142  025052  025052  025052
1791  012150  040052     057
1792  012153     057  040100  051105  MSG28:  .ASCII  /?%ERROR-NOT AT BOT AFTER REWIND-HALT??%/
1793  012160  047522  026522  047516
1794  012166  020124  052101  041040
1795  012174  052117  040440  052106
1796  012202  051105  051040  053505
1797  012210  047111  026504  040510
1798  012216  052114  040100     057
1799  012223     057  040100  047514  MSG29:  .ASCII  /?%LOC. 176 MUST CONTAIN UNIT CONFIGURATION?
1800  012230  027103  030440  033067
1801  012236  046440  051525  020124
1802  012244  047503  052116  044501
1803  012252  020116  047125  052111
1804  012260  041440  047117  044506
1805  012266  052507  040522  044524
1806  012274  047117
1807  012276  052100  020117  052522          .ASCII  /TO RUN-REFER 4.3 DOCUMENT--HALT??%/
1808  012304  026516  040522  040506
1809  012312  020122  027064  020063
1810  012320  047504  052503  042515
1811  012326  052116  026455  040510
1812  012334  052114  020441  027500
1813                                          .EVEN
1814  012342  000000                  MBUF:   0
1815          000001                          .END
```

K3

```
BC          001004          MSG7        010327          TM1         007212          T11G        005322          T4A         002172
BLENTH=     002670          MSG8        010355          TM2         007236          T11H        005362          T4AA        002130
CA          001006          MSG9        010403          TM3         007262          T11J        005400          T4B         002210
CC          001036          MTC         001002          TM4         007306          T11K        005454          T4C         002312
CDRIVE      006756          MTC         001010          TM5         007332          T11L        005470          T4D         002330
CDRVET      006760          MTRD        001012          TM6         007356          T11M        005500          T4E         002374
CHGDRV      006712          MTS         001000          TM7         007402          T11N        005516          T4F         002412
CHG1        006740          MTV         001026          TM8         007426          T11P        005524          T4G         002524
CKCOLT      007636          MULBAK      002714          TOP         007730          T11R        005540          T5          003076
CKCPAT      007716          MULWRT      002676          TOP1        007750          T11T        001044          T5A         003140
CKC1        007654          MUL1        003016          TOP2        010006          T12         005760          T5B         003102
CKC2        007670          MUL2        003034          TOP3        010014          T12A        006014          T5C         003200
C SCNT      007710          MUL3        003052          TPB         001024          T12B        006070          T5DRV       001042
D..IT       007712          PC      =%000007            TPS         001022          T12C        006114          T6          003110
DRIVES      006762          RSPDRV      006646          TYPTIM      007452          T12D        006124          T6A         003520
ECHK        010046          RSP1        006660          TYPT0       007456          T12E        006140          T6B         003632
FCRIVE      006764          RSP2        006704          TYPT1       007516          T12F        006156          T6C         003650
GNT1        007024          R0      =%000000            TYPT2       007524          T12G        006174          T6D         003706
GTNINE      006766          R1      =%000001            TYPT3       007626          T12H        006234          T6E         003724
MESAGE      010050          R10         001032          TYP2A       007574          T12J        006252          T6F         004014
MSG1        010052          R11         001034          T1          001240          T12K        006326          T7          004026
MSG10       010431          R12         001036          T1A         001256          T12L        006342          T7A         004032
MSG11       010457          R13         001040          T1B         001302          T12M        006352          T7B         004056
MSG11A      010546          R2      =%000002            T1C         001320          T12N        006370          T7C         004074
MSG12       010574          R3      =%000003            T1D         001336          T12P        006376          T8          004150
MSG13       010622          R4      =%000004            T1E         001354          T12R        006412          T8A         004154
MSG14       010650          R5      =%000005            T1F         004460          T13         006626          T8B         004206
MSG15       010676          SP      =%000006            T1GA        004474          T2          001432          T8C         004222
MSG16       010724          SR          001014          T1GB        004610          T2A         001446          T8D         004270
MSG18       010752          STACK =     001000          T1GC        004626          T2B         001472          T9          004302
MSG19       011006          START       001046          T1GCC       004644          T2C         001510          T9A         004306
MSG2        010137          STRREW      007064          T1GD        004660          T2D         001536          T9B         004372
MSG2A       010163          ST0         001072          T1GE        004676          T2E         001552          T9C         004406
MSG2B       010173          ST1         001122          T1GF        004714          T3          001630          T9D         004446
MSG20       011027          ST1S        007044          T1GG        004772          T3A         001642          VALUE       007706
MSG21       011055          ST1SA       007050          T1GH        005006          T3B         001654          WATREW      007124
MSG27       011104          ST2         001134          T11         005112          T3C         001732          WBUF        011342
MSG28       011153          ST3         001160          T11A        005146          T3D         001750          WRINT       007026
MSG29       011223          SWREG       000176          T11B        005224          T3E         002014          ZERO        007714
MSG3        010177          TIME        007210          T11C        005242          T3F         002030          .       =   011344
```

```
ERRORS DETECTED:  0
DEFALLT GLOBALS GENERATED:  0

@DZTMCE,DZTMCE/SOL=DZTMDE,P11
RLN-TIME: 6 11 .5 SECONDS
RLN-TIME RATIO: 143/18=7.9
CORE USED:  11K  (21 PAGES)
```