TM02/TU45

DRIVE FUNCTION TIMER

CZTULA0

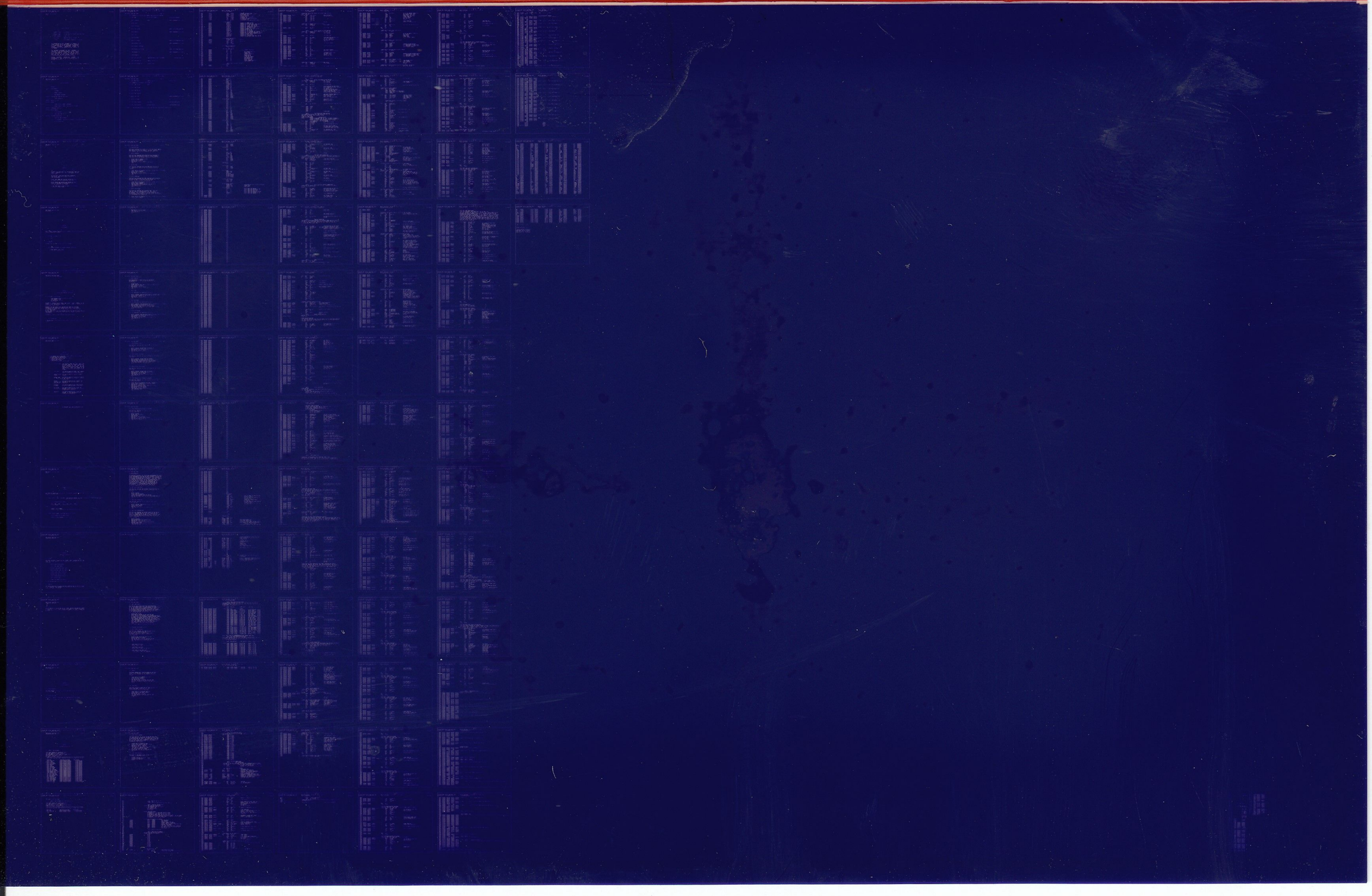
AH-E479A-MC

FICHE 1 OF 1

JUL 1978

digital

MADE IN USA



```
        .NLIST  SEQ,LOC,BIN
        .REM_
```

IDENTIFICATION

PRODUCT CODE: AC-E478A-MC

PRODUCT NAME: CZTULA0 TM02/TU45 DRIVE FUNCTION TIMER

DATE CREATED: 25 MAY 1978

MAINTAINER: COMPUTER SPECIAL SYSTEMS

AUTHOR: JOHN ADAMS/R. BARNES/R. J. COLLINS

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ABSTRACT

PROGRAM CZTULA MEASURES THE TIME REQUIRED AND GAP SIZES PRODUCED BY THE TM02/TU45 MAGTAPE DRIVE/SLAVE.

THE TEST WILL CHECK BOTH THE LOGIC GENERATED TIME DELAYS, AND THE DISTANCES TRAVLED BY THE TAPE IN RESPONSE.

ACTUAL TAPE SPEED MAY ALSO BE CHECKED BY USING THE SPEED TESTS WITH AN 800 BPI SKEW TAPE.

DEVICE ERRORS ARE CHECKED AND PRINTED AS THEY OCCUR. IF THE ERROR IS DATA RELATED(PARITY; ETC) THEY ARE PRINTED AS SOFT ERRORS.

IF THE TIME CHECK IS OUT OF RANGE, IT IS PRINTED AS AN OUT OF RANGE ERROR.

CHAPTER 1

REQUIREMENTS

PDP-11 FAMILY CENTRAL PROCESSOR WITH 4K MEMORY WITH UP TO 64 TM11/TM02 CONTROLLER/MAGTAPE STATIONS.

1.1 OPTIONAL EQUIPMENT USED

1. NONE

1.2 STORAGE

PROGRAM LOADS AND RUNS IN THE FIRST 4K OF MEMORY.

1.3 PRELIMINARY PROGRAMS (TO ASSURE HARDWARE OPERATION)

CZTUKA CONTROL LOGIC TEST
CZTUJA BASIC FUNCTION TEST

CHAPTER 2

LOADING AND STARTING PROCEDURE

THE PROCEDURE IS AS FOLLOWS:

LOAD PROGRAM USING THE ABSOLUTE LOADER
LOAD ADDRESS = 200
SET OPERATING SWITCHES
PRESS START

PROGRAM WILL REQUEST DRIVE (TM02) AND SLAVE (TU45) NUMBERS TO BE TESTED. TYPE DRIVE/SLAVE NUMBERS WITH A COMMA (,) BETWEEN EACH DRIVE/SLAVE TO BE TESTED.

REQUESTS FOR TAPE SPEED TESTS AND NRZ ONLY MODE WILL BE MADE.
RESPONSE TO TAPE SPEED ONLY REQUEST WITH A ONE (1) WILL CAUSE THE PROGRAM TO EXECUTE TEST 31 AND 32 ONLY. THIS IS THE ONLY WAY TO TEST TAPE SPEED.
NRZ ONLY MODE WILL CAUSE THE PROGRAM TO SKIP THE 1600 BPI DATA TIME TEST.
TYPE CONTROL U (U) TO DELETE LINE TYPED OR RUBOUT TO DELETE LAST CHARACTER(S).

PROGRAM WILL PUBLISH TIMES REQUIRED AND REPORT ERRORS.

2.1 ACT11 OPERATION

IF THE PROGRAM IS RUN IN QUICK VERIFY MODE, FUNCTION TESTS ARE NOT ITERATED.

CHAPTER 3

SWITCH SETTINGS

IF A CONSOLE SWITCH REGISTER IS NOT PRESENT, THE FOLLOWING PROCEDURE MUST BE IMPLEMENTED:
A) LOAD ADDRESS 1000(8) LABELLED "SWR"
B) DEPOSIT THE VALUE 176(8)
C) LOAD ADDRESS 176(8)
D) DEPOSIT THE DESIRED SWITCH VALUE.

SW15	HALT ON ERROR	THIS SWITCH WHEN SET WILL HALT THE PROCESSOR WHEN AN ERROR IS DETECTED. THE PC+2 AND PSW AT THE TIME OF THE ERROR IS STORED ON THE STACK. PRESSING CONTINUE WILL CAUSE THE ERROR TO BE TYPED (IF SELECTED) AND FURTHER TESTING RESUMED.
SW14	LOOP SUBTEST	THIS SWITCH WHEN SET LOOPS THE CURRENT SUBTEST REGARDLESS OF ERROR CONDITION.
SW13	INHIBIT ERROR TYPEOUT	THIS SWITCH WHEN SET INHIBITS ERROR TYPEOUT.
SW11	INHIBIT SUB-TEST ITERATION	THIS SWITCH WHEN SET CAUSES EACH SUBTEST TO BE EXECUTED ONLY ONCE. (INITIAL STARTUP ONLY).
SW10	INHIBIT FUNCTION TIME PUBLICATION	THIS SWITCH WHEN SET WILL INHIBIT THE PRINTING OF THE FUNCTION TIMES. (SEE CHAPTER 8.)
SW09	RING BELL ON ERROR	THIS SWITCH WHEN SET WILL RING THE BELL ON THE TTY WHEN AN ERROR IS DETECTED.
SW07	HALT AFTER SELECTED TEST	THIS SWITCH WHEN SET WILL CAUSE THE PROGRAM TO HALT AFTER THE TEST SELECTED IN SW05-SW00 IS EXECUTED.
SW06	CONTINUOUS CYCLE	THIS SWITCH WHEN SET WILL CAUSE THE PROGRAM TO RUN CONTINUOUSLY UNTIL STOPPED BY THE OPERATOR.

SW5-0 TEST SELECT THE PROGRAM WILL HALT AFTER EXECUTION
OF THE TEST SELECTED WHEN SW07 IS SET.

CHAPTER 4

ERRORS

TWO TYPES OF ERRORS ARE DETECTED BY THIS PROGRAM, HARDWARE ERRORS AND INCORECT FUNCTION TIMES.

4.1 ERROR TYPEOUT FORMAT (HARDWARE): DATA RELATED ERRORS (IE: PARITY ERROR) ARE PRINTED AS SOFT ERRORS AND HAVE NO EFFECT ON TIME.

```
TEST # XXXXXX DEVICE ERROR

CS1    WE     BA     FC     CS2    DS     ER1
AAAAAA BBBBBB CCCCCC DDDDDD EEEEEE FFFFFF GGGGGG
```

WHERE:

XXXXXX = TEST NUMBER
AAAAAA-IIIIII = CONTENTS OF TAPE REGISTER 172440-172454

4.2 ERROR TYPEOUT FORMAT (FUNCTION TIME OUT OF RANGE)

```
TEST # XXXXXX OUT OF RANGE ERROR

RANGE = <AAAAAA-BBBBBB> ACTUAL = CCCCCC
```

CHAPTER 5

SUBROUTINE ABSTRACTS

5.1 .SCOPE

THE SCOPE ROUTINE IS CALLED BY THE SCOPE (EMT) INSTRUCTION AT THE START OF EACH SUBTEST. THE .SCOPE ROUTINE PERFORMS THE FOLLOWING FUNCTIONS:

1. LOADS R5 WITH BASE ADDRESS
2. TYPES TIME LINE <SW08>
3. PROVIDES CONTINUOUS LOOP <SW14>
4. MOVES FUNCTION TIME INTO TABLE
5. OUTPUTS LINE ITEM IF SELECTED
6. PROVIDES HALT ON TEST <SW07>
7. DELAYS 350MS BEFORE STARTING TEST
8. INIT'S DRIVE/SLAVE
9. CLEARS THE ERROR FLAG (ERFLG)

THE ROUTINE MONITORS SW14, SW11, SW10, SW08, AND SW07.

5.2 PUBLISH

THE PUBLISH ROUTINE IS CALLED FROM THE SCOPE ROUTINE IF SW10 IS EQUAL TO 0 (PUBLISH TIME DOCUMENT). THE ROUTINE WILL PRINT A "SINGLE LINE ITEM" EACH TIME IT IS CALLED.

5.3 .HLT

THE HLT ROUTINE IS CALLED BY THE HLT (TRAP) INSTRUCTION WHEN AN ERROR IS DETECTED. A HLT (TRAP) INSTRUCTION FORMATS THE ERROR INFORMATION AS SHOWN IN SEC 4.1. A HLT+1 (TRAP+1) FORMATS THE ERROR AS SHOWN IN SEC 4.2.

CHAPTER 6

MISCELLANEOUS

6.1 STACK POINTER

THE STACK POINTER IS INITAILLY SET TO 500 AND IS RESET TO 500 BY THE SCOPEA ROUTINE.

6.2 EXECUTION TIME

WHEN SW11=1 (INHIBIT ITERATIONS) THE TIME REQUIRED IS 3.5 MIN.

WHEN SW11=0 (ITERATE SUBTESTS) THE TIME REQUIRED IS 4.5 MIN.

CHAPTER 7

PROGRAM DESCRIPTION

7.1 SAMPLE TIME DOCUMENT

```
TYPE FIRST ADDRESS OF CONTROLER 172440
TYPE TM02 DRIVE #'S TO BE TESTED 0
FOR TM02 DRIVE 0- TYPE SLAVE #'S TO BE TESTED 7
TAPE SPEED TESTS ONLY? (YES/NO = 1/0) 0
NRZ ONLY? (YES/NO = 1/0) 0
********************************************************************************
* TM02 DRIVE FUNCTION TIMES- DRIVE # 0 SLAVE # 7 9 CHAN. SER. # 5009
*
* FUNCTION                TIME(SPECIFICATION)     TIME(ACTUAL)
* WRITE FROM BOT          RANGE=<080000-068000>       ACTUAL=074000
* WRITE START             RANGE=<005500-004500>       ACTUAL=005000
* WRITE SHUTDOWN          RANGE=<004500-003600>       ACTUAL=004050
* WRITE SETTLEDOWN        RANGE=<006000-004600>       ACTUAL=005300
* READ FROM BOT           RANGE=<009500-007900>       ACTUAL=008700
* READ START              RANGE=<001800-001500>       ACTUAL=001650
* READ SHUTDOWN           RANGE=<001700-001300>       ACTUAL=001500
* READ SETTLEDOWN         RANGE=<006000-004600>       ACTUAL=005300
* READ REV START          RANGE=<001800-001500>       ACTUAL=001650
* READ REV SHUTDOWN       RANGE=<002300-001900>       ACTUAL=002100
* READ REV SETTLEDOWN     RANGE=<006000-004600>       ACTUAL=005300
* TURN AROUND DELAY F-R   RANGE=<008000-006000>       ACTUAL=007000
* TURN AROUND DELAY R-F   RANGE=<008000-006000>       ACTUAL=007000
* GAP SIZE-STOP HALF      RANGE=<008000-006000>       ACTUAL=007000
* GAP SIZE-START HALF     RANGE=<008000-006000>       ACTUAL=007000
* GAP SIZE-INTERRECORD    RANGE=<008000-006600>       ACTUAL=007300
* GAP CONSISANCY          RANGE=<008000-006800>       ACTUAL=007400
* DATA TIME-200 BPI       RANGE=<014560-013710>       ACTUAL=014135
* DATA TIME-556 BPI       RANGE=<014560-013710>       ACTUAL=014135
* DATA TIME-800BPI        RANGE=<014560-013710>       ACTUAL=014135
* DATA TIME-1600BPI       RANGE=<015000-013000>       ACTUAL=014000
* ERASE GAP TIME          RANGE=<061000-055000>       ACTUAL=058000
* WRITE FILE MARK         RANGE=<064000-058000>       ACTUAL=061000
```

7.1.1 SAMPLE TIME DOCUMENT FOR TAPE SPEED TESTS

```
TYPE FIRST ADDRESS OF CONTROLLER 172440
TYPE TM02 DRIVE #'S TO BE TESTED 0
FOR TM02 DRIVE 0- TYPE SLAVE #'S TO BE TESTED 7
SPEED TESTS ONLY? (YES/NO = 1/0) 1
*********************************************************************
*TM02 DRIVE FUNCTION TIMES- DRIVE # 0 SLAVE # 7 9 CHAN. SER. # 5009
*
*FUNCTION              TIME(SPECIFICATION)     TIME(ACTUAL)
*TAPE SPEED FWD        RANGE=<013800-013000>       ACTUAL=013330
*TAPE SPEED REV        RANGE=<013800-013000>       ACTUAL=013330
```

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7.2 TEST SEQUENCE WITH RELATED ADJUSTMENTS AND ASSOCIATED HARDWARE

TEST NO./NAME	RELATED ADJUSTMENTS	ASSOCIATED HARDWARE
1. WRITE FROM BOT	*NONE	*M8921 ROM*M8903 ACCL CNTR
2. WRITE START	* "	* " * "
3. WRITE SHUTDOWN	* "	* " * "
4. WRITE SETTLEDOWN	* "	*M8921 SETTLEDOWN ONE SHOT
5. READ FROM BOT	* "	*M8921 ROM*M8903 ACCL CNTR
6. READ START	* "	* " * "
7. READ SHUTDOWN	* "	* " * "
10. READ SETTLEDOWN	* "	*M8921 SETTLEDOWN ONE SHOT
11. READ REVERSE START	* "	*M8921 ROM*M8903 ACCL CNTR
12. READ REVERSE SHUTDOWN	* "	* " * "
13. READ REVERSE SETTLEDOWN	* "	*M8921 SETTLEDOWN ONE SHOT
14. TURN AROUND F-R	* "	*M8921 ROM*M8903 ACCL CNTR
15. TURN AROUND R-F	* "	* " * "
16. GAP SIZE-STOP HALF	*FWRD/REV SPEED-START/STOP-RAMPS	*CAPSTAN SERVO LOOP
17. GAP SIZE-START HALF	*SAME AS IN TEST 16	* " " "
20. GAP SIZE INTERRECORD	*FWD/REV SPEED	* " " "

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21. GAP CONSISTENCY	*SAME AS IN TEST 16	*WRITE CLOCK
*TEST NUMBER 22 IS RESERVED FOR FUTURE USE		
23. DATA TIME 200 BPI	*NONE	* " "
24. DATA TIME 556 BPI	* "	* " "
25. DATA TIME 800 BPI	* "	* " "
26. DATA TIME 1600 BPI	* "	* " "
27. ERASE GAP TIME	* "	*M8921 ROM*M8903 ACCL CNTR
30. WRITE FILE MARK	* "	* " " * " " "
31. TAPE SPEED-FORWARD	*FWD SPEED	*CAPSTAN SERVO LOOP
32. TAPE SPEED-REVERSE	*REVERSE SPEED	*CAPSTAN SERVO LOOP

*****NOTE: IF TIME PROBLEMS APPEAR IN T1 THRU T30, RUN TAPE SPEED TESTS FIRST*******

7.3 TEST DESCRIPTIONS:

THE FIRST THIRTEEN (13) TESTS (T1 - T15) ARE CHECKS OF THE ROM CIRCUITS IN THE TU45 (M8921), THE ACCL COUNTER IN THE TM02 (M8903), AND THE SETTLEDOWN ONE SHOT (M8921).

T1. WRITE FROM BOT:

THIS TEST WILL MEASURE ACCELLERATION DELAY REQUIRED TO MOVE THE TAPE APPROXIMATELY SEVEN (7) INCHES FORWARD FROM DEAD STOP AT BOT BEFORE STARTING TO TRANSFER DATA.

1. ASSURE TAPE IS STOPPED AT BOT.
2. ISSUE A WRITE COMMAND
3. MONITOR BIT 15 OF TC (ACCL)
4. TIME FROM GO TO ACCL RESET IS BOT DELAY
5. STOP

T2. WRITE START:

THIS TEST WILL MEASURE ACCELLERATION DELAY JUST AS IN T1. HOWEVER THE TIME WILL BE LESS WHEN NOT STARTING FROM BOT.

1. LEAVE TAPE AT ITS PRESENT POSITION. ASSURE THAT IT IS STOPPED
2. ISSUE A WRITE COMMAND
3. MONITOR BIT 15 OF TC (ACCL)
4. TIME FROM GO TO RESET OF ACCL IS START DELAY
5. STOP

T3. WRITE SHUTDOWN:

THIS TEST WILL MEASURE THE TIME FROM EOR (LAST CHARACTER WRITTEN ON TAPE) TO THE START OF SETTLEDOWN TIME. THIS ASSURES, IN PART, A PROPER INTERRECORD GAP.

1. LEAVE TAPE AT ITS PRESENT POSITION. ASSURE THAT IT IS STOPPED
2. ISSUE A WRITE COMMAND.
3. MONITOR FRAME COUNTER AND BIT 4 OF DS (SDWN)
4. TIME FROM FC=0 TO ASSERTION OF SDWN IS THE SHUTDOWN TIME.
5. STOP

T4. WRITE SETTLEDOWN:

THIS TEST WILL MEASURE THE SLOWDOWN TIME. THE TIME FROM THE START OF SLOWDOWN UNTIL THE TAPE SHOULD BE STOPPED. THIS IS A PART OF THE GAP TIMING IN LOGIC. THE MECHANICAL POSITIONING OF THE TAPE IN THE GAP DISTANCE WILL BE MEASURED IN A LATER TEST.

1. LEAVE TAPE AT ITS PRESENT POSITION. ASSURE THAT IT IS STOPPED
2. ISSUE A WRITE COMMAND

3. MONITOR BIT 4 OF DS (SDWN)
4. TIME FROM SET OF SDWN TO RESET OF SDWN IS THE
   SETTLEDOWN DELAY
5. STOP

T5. READ FROM BOT

THIS MEASUREMENT IS MADE EXACTLY AS THE WRITE
MEASUREMENT IN T1. USE THE SAME RECORD THAT WAS
WRITTEN IN T1.

1. REWIND TO BOT
2. ASSURE TAPE HAS HAD TIME TO COME TO A COMPLETE STOP
3. READ FORWARD 1 RECORD.
4. MONITOR BIT 15 OF TC (ACCL)
5. TIME FROM GO TO ACCL IS BOT DELAY
6. STOP

T6. READ START

THIS TEST MEASURES THE SAME DELAY AS IN T2.

1. WRITE 1 RECORD, THEN BACKSPACE OVER IT, ASSURE TAPE IS STOPPED.
2. ISSUE A READ FORWARD OF THE RECORD WRITTEN IN STEP 1.
3. MONITOR BIT 15 OF TC (ACCL)
4. TIME FROM GO TO RESET OF ACCL IS START DELAY
5. STOP

T7. READ SHUTDOWN:

THIS TEST MEASURES THE SAME DELAY AS IN T3.

1. WRITE 1 RECORD, THEN BACKSPACE OVER IT, ASSURE TAPE IS STOPPED.
2. READ FORWARD THE RECORD WRITTEN IN STEP 1.
3. MONITOR FRAME COUNT AND BIT 4 OF DS (SDWN).
4. TIME FROM FC=RECORD SIZE (LAST FRAME READ) TO SDWN=1
   IS THE SHUTDOWN TIME.
5. STOP

T10. READ SETTLEDOWN:

THIS TEST MEASURES THE SAME DELAY AS IN T4.

1. WRITE 1 RECORD, THEN BACKSPACE OVER IT, ASSURE TAPE IS STOPPED.
2. READ FORWARD THE RECORD WRITTEN IN STEP 1.
3. MONITOR BIT 4 OF DS (SDWN)
4. TIME FROM SET OF SDWN TO RESET OF SDWN IS THE
   SETTLEDOWN DELAY.
5. STOP

T11. READ REVERSE START:

THIS TEST WILL MEASURE THE START DELAY IN THE REVERSE DIRECTION.

1. WRITE 1 RECORD, ASSURE TAPE IS STOPPED.
2. READ REVERSE THE RECORD WRITTEN IN STEP 1.
3. MONITOR BIT 15 OF TC (ACCL)
4. THE TIME FROM GO TO RESET OF ACCL IS THE START TIME
5. STOP

T12. READ REVERSE SHUTDOWN

THIS TEST WILL MEASURE THE READ SHUTDOWN IN THE REVERSE DIRECTION.

1. WRITE 1 RECORD, ASSURE TAPE IS STOPPED.
2. READ REVERSE THE RECORD WRITTEN IN STEP 1.
3. MONITOR FRAME COUNTER AND BIT 4 OF DS (SDWN).
4. TIME FROM FC=RECORD SIZE (LAST FRAME READ) TO SDWN=1 IS THE READ REVERSE SHUTDOWN TIME.
5. STOP

T13. READ REVERSE SETTLEDOWN:

THIS TEST WILL MEASURE THE READ SETTLEDOWN IN THE REVERSE DIRECTION.

1. WRITE 1 RECORD, ASSURE TAPE IS STOPPED.
2. READ REVERSE THE RECORD WRITTEN IN STEP 1.
3. MONITOR BIT 4 OF DS (SDWN)
4. TIME FROM SET OF SDWN TO RESET OF SDWN IS THE SETTLEDOWN DELAY
5. STOP

T14. TURN AROUND DELAY-FORWARD TO REVERSE

THIS TEST WILL MEASURE THE TIME REQUIRED FOR THE TAPE TO CHANGE DIRECTION.

1. LEAVE TAPE AT ITS PRESENT POSITION. ASSURE THAT IT IS STOPPED
2. ISSUE A WRITE FORWARD OF AT LEAST 20 FRAMES
3. MONITOR BIT 7 OF DS (DRY)
4. WHEN DRY IS ASSERTED (EOR), IMMEDIATELY ISSUE A READ REVERSE OF THAT RECORD.
5. MONITOR BIT 15 OF TC (ACCL).
6. TIME FROM GO OF READ REVERSE TO RESET OF ACCL IS THE TURNAROUND TIME.
7. STOP

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T15. TURN AROUND DELAY-REVERSE TO FORWARD

THIS TEST WILL MEASURE THE TIME AS IN T14, BUT IN THE
OPPOSITE DIRECTION.

1. WRITE 1 RECORD.
2. ASSURE TAPE IS STOPPED
3. READ REVERSE
4. MONITOR DRY (BIT 7 OF DS)
5. WHEN DRY = 1, ISSUE A READ FORWARD
6. MONITOR ACCL (BIT 15 OF TC)
7. TIME FROM GO FORWARD TO ACCL = 1 IS THE TURN AROUND TIME.
8. STOP.

GAP MEASUREMENTS:

THE PREVIOUS THIRTEEN (13) TESTS WERE MEASUREMENTS OF LOGIC DELAYS PERFORMED BY THE TM02 OR TU45 IN ORDER TO ALLOW FOR PROPER ACCELERATION AND DECELLERATION OF TAPE ACCORDING TO THE DESIRED INTEROCORD GAP (.6 INCHES). THIS TEST, HOWEVER, WILL MEASURE THE PHYSICAL SIZE OF THE INTERCORD GAP THAT EXISTS ON TAPE AS A RESULT OF THE START/STOP TIMES OF THE CAPSTAN ITSELF. BECAUSE THE INTERRCORD GAP IS CREATED BY TWO ACTIONS, THE START OF MOTION AND THE STOP OF MOTION IT IS NECESSARY TO MAKE TWO SEPERATE MEASUREMENTS. A THIRD MEASUREMENT, MADE ON THE FLY, OF THE ENTIRE LENGTH OF THE GAP WILL ALSO BE MADE.

T16. GAP SIZE (STOP HALF)

THIS TEST WILL MEASURE THE DISTANCE TRAVLED BY THE TAPE IN A STOP CYCLE. IN OTHER WORDS, THE DISTANCE INTO THE IRG.

1. WRITE 1 RECORD.
2. ASSURE TAPE IS STOPPED.
3. ISSUE A READ REVERSE OVER THE RECORD
4. MONITOR THE FRAME COUNT FOR THE FIRST FRAME READ (FC = 1)
5. THE TIME FROM GO=1 TO FC=1 IS THE LENGTH OF THE GAP
6. STOP

T17. GAP SIZE (START HALF)

THIS TEST WILL MEASURE THE DISTANCE OF TAPE TRAVEL DURING START UP.

1. WRITE 1 RECORD, THEN REVERSE OVER IT, ASSURE TAPE IS STOPPED.
2. ISSUE A READ FORWARD
3. MONITOR FC FOR FC=1
4. TIME FROM GO=1 TO FC=1 IS START DISTANCE
5. STOP

T20. GAP SIZE (INTERRECORD)

THIS TEST WILL MEASURE THE ENTIRE LENGTH OF THE IRG ON THE FLG. THE TIME VALUE OF THIS TEST SHOULD NOT BE EQUAL TO A SUMMATION OF T16 AND T17 DUE TO THE FACT THAT THE ACCELLERATION AND DECELLERATION CURVES ARE NOT IN EFFECT. THE VALUE HERE SHOULD ACTUALLY BE LESS THAN THE SUM OF T16 AND T17.

1. WRITE 2 RECORDS.
2. READ REVERSE OVER THE SECOND RECORD
3. MONITOR DRY (BIT 7 OF DS)
4. WHEN DRY = 1, ISSUE A SECOND READ REVERSE
5. MONITOR FRAME COUNT
6. TIME FROM GO=1 OF SECOND READ REVERSE TO FC=1 IS THE LENGTH OF THE GAP.

7. STOP

T21. GAP CONSISTENCY:

NOW THAT WE HAVE ESTABLISHED THAT THE INTERRCORD
GAP IS THE PROPER SIZE, LET US DETERMINE THE CONSISTENCY
OF THE GAP UNDER VARIOUS COMMAND EXECUTION TIMES.
BY WRITING A SERIES OF RECORDS, EACH WITH A DIFFERENT
DELAY BETWEEN EXECUTION, WE CAN ESTABLISH THE CONSISTENCY
OF THE GAPS BY READING THESE RECORDS AND MONITORING
THEIR INTERRECORD GAPS, ON THE FLY.

1. REWIND TAPE TO BOT.
2. WRITE ONE (1) RECORD TO GET TAPE OFF BOT
3. WRITE SIXTEEN (16) RECORDS WITH A PROGRESSIVE DELAY
   OF FROM 0 TO 16 MILLISECONDS (APPROX) BETWEEN COMMANDS.
4. BACKSPACE 16 RECORDS AND ALLOW THE TAPE TO STOP.
5. READ FORWARD (NON-STOP) OVER THESE 16 RECORDS, EACH
   TIME MONITORING THE TIME FROM THE END OF RECORD (DRY)
   UNTIL THE FRAME COUNT NEXT GOES FROM 0 TO 1 (FC=1).
6. THE TIMES FROM DRY TO FC=1 IS THE GAP TIME AND IT
   SHOULD REMAIN CONSISTANT FOR ALL RECORDS.
7. STOP

(SEE GTIMTBL IN CZTULA LISTING FOR GAP TIMES)

T22. RESERVED FOR FUTURE USE*****

T23. DATA TIME AT 200 BPI:

THIS TEST WILL MEASURE THE TIME REQUIRED TO WRITE
ONE (1) INCH OF TAPE AT 200 BPI.
BY WRITING A RECORD OF ENOUGH FRAMES TO MOVE
THE TAPE 1 INCH (200 FRAMES), DATA RATE
CAN BE VARIFIED.

1. REWIND TO BOT AND ALLOW TAPE TO STOP
2. WRITE A RECORD AT 200 BPI.
3. MONITOR DRY (BIT 7 OF DS) FOR EACH RECORD
4. THE TIME FROM FC=FC+1 TO DRY WILL BE THE TIME REQUIRED
   FOR 1 INCH AT THE SELECTED DENSITY
5. STOP

T24. DATA TIME AT 556 BPI:
     REPEAT STEPS 1 THRU 5 OF T23 AT 556 BPI.

T25. DATA TIME AT 800 BPI:
     REPEAT STEPS 1 THRU 5 AT 800 BPI.

T26. DATA TIME AT 1600 BPI (PE):
     REPEAT STEPS 1 THRU 5 AT 1600 BPI.
        THIS TEST IS NOT EXECUTED IF NRZ ONLY

T27. ERASE:

THE ERASE COMMAND WILL CAUSE AN AREA OF THE THREE (3)
INCHES TO BE DC ERASED IN THE FORWARD DIRECTION.
THIS TEST WILL ASSURE THAT THE PROPER DISTANCE IS
ERASED.

1. LEAVE TAPE AT ITS PRESENT POSITION.
2. ISSUE AN ERASE COMMAND.
3. MONITOR DRY (BIT 7 OF DS)
4. THE TIME FROM GO TO DRY WILL BE THE TIME
   REQUIRED TO ERASE 3 INCHES OF TAPE AND WILL
   REFLECT THE DISTANCE. DENSITY IS NOT A FACTOR.
5. STOP

T30. TAPE MARK:

THIS TEST IS ALSO A CHECK ON THE THREE (3) INCH GAP.
WHEN A TAPE MARK IS WRITTEN, A 3 INCH GAP IS
CREATED BEFORE DATA IS PUT ON TAPE.

1. LEAVE TAPE AT ITS PRESENT POSITION
2. ISSUE A WRITE TAPE MARK COMMAND
3. MONITOR DRY (BIT 7 OF DS)
4. THE TIME FROM GO TO DRY WILL BE THE TIME
   REQUIRED TO WRITE THE TM RECORD PLUS THE
   3 INCH GAP.
5. STOP

T31. TAPE SPEED FORWARD:

THIS TEST REQUIRES THE USE OF AN 800 BPI SKEW TAPE!
THE OPERATOR WILL BE REQUIRED TO MOUNT THE SKEW TAPE
BEFORE EXECUTING THE TEST. THE SKEW TAPE IS THE ONLY
WAY TO ASSURE THAT TAPE IS MOVING AT THE PROPER SPEED
BECAUSE THE FREQUENCY OF FRAMES ON A SKEW TAPE IS
GUARANTEED TO BE ACCURATE.

1. ASSURE TAPE IS STOPPED AT BOT.
2. ISSUE A READ FORWARD (800 BPI, NORMAL)
3. MONITOR FC FOR FC = 800(10)
4. MONITOR FC FOR FC = 8800(10)
5. TIME FROM FC = 800 TO FC = 8800 IS THE TIME REQUIRED
   FOR TAPE TO TRAVEL 10 INCHES
6. DIVIDE THE TIME FOR 10 INCHES BY 10.
7. THE RESULT IS AN AVERAGE SPEED FOR 1 INCH.
8. STOP.

T32. TAPE SPEED REVERSE:

THIS TEST IS THE SAME AS TEST 31, BUT SPEED IS
MEASURED IN THE REVERSE DIRECTION.

1. ADVANCE TAPE OFF OF BOT.
2. ISSUE A READ REVERSE.
3. REPEAT STEPS 3 THRU 6 IN THE REVERSE DIRECTION.
4. STOP.

```
                        .NLIST  MC
                                .LIST   ME,SEQ,LOC,BIN
                                .ENABL  ABS
                                .TITLE  CZTULA0 TM02 DRIVE FUNCTION TIMER

                                .SBTTL  STARTING INSTRUCTIONS
                        ;LOADING AND STARTING PROCEEDURE
                        ;       LOAD PROGRAM USING ABS LOADER
                        ;       LOAD ADDRESS 200
                        ;       SET SWITCH OPTIONS
                        ;       PRESS START

                        ;GENERAL REGISTER USAGE:
                        ;       R0=ADDRESS OF 'FC' REGISTER (SET BY SCOPE)
                        ;       R1=ADDRESS OF 'DS' REGISTER (SET BY SCOPE)
                        ;       R2=RETURN PC FROM TIMER (SET BY EACH TEST)
                        ;       R3=INDEX INDICATING PREVIOUS OSCILLATOR POLARITY (SET BY TIMER)
                        ;       R4=CONTAINS 'TICK' COUNT WHEN TIMER IS RUNNING (SET BY TIMER)
                        ;       R5=ADDRESS OF CS1 (SET BY SCOPE)

                        ;SWITCH REGISTER SWITCH ASSIGNMENTS
100000                          SW15=   100000          ;HALT ON ERROR
040000                          SW14=   040000          ;LOOP SUBTEST
020000                          SW13=   020000          ;INHIBIT ERROR TYPE OUT
004000                          SW11=   004000          ;INHIBIT SUBTEST ITERATION
002000                          SW10=   002000          ;INHIBIT PUBLICATION OF FUNCTION TIMES
001000                          SW09=   001000          ;RING BELL ON ERROR
000400                          SW08=   000400          ;TYPE LINE ITEM AFTER EACH ITERATION
000200                          SW07=   000200          ;HALT ON TEST SELECTED IN SW05-SW00
000100                          SW06=   000100          ;CONTINUOUS CYCLE

                                .SBTTL  MACRO DEFINITIONS

                                .SBTTL  REGISTER ASSIGNMENTS
                        ;;DEFINITIONS AND REGISTER ASSIGNMENTS
                        ;;GENERAL REGISTER ASSIGNMENTS
000000                          R0=%0
000001                          R1=%1
000002                          R2=%2
000003                          R3=%3
000004                          R4=%4
000005                          R5=%5
000006                          SP=%6
000007                          PC=%7
000000                          R10=%0
000001                          R11=%1
000002                          R12=%2
000003                          R13=%3
000004                          R14=%4
000005                          R15=%5

                        ;;REGISTER ADDRESSES
177776                          PSW=    177776          ;;PROCESSER STATUS WORD
177774                          SLR=    177774          ;;STACK LIMIT REGISTER (11/40,11/45)
```

```
                                PIRQ=   177772          ;;PROGRAM INTERRUPT REQ. (11/45)
                                UBREAK= 177770          ;;MICRO-BREAK REGISTER (11/45)
                                HSWR=   177570          ;;SWITCH REGISTER
                                DISPLAY=177570          ;;DISPLAY REGISTER (11/45)
                                TKS=    177560          ;;KEYBOARD CSR
                                TKB=    177562          ;;KEYBOARD DATA BUFFER REGISTER
                                TPS=    177564          ;;TELEPRINTER CSR
                                TPB=    177566          ;;TELEPRINTER DATA BUFFER REGISTER

                        ;;VECTOR ADDRESSES
                                ERRVEC=4                ;;ADDRESS OF ERROR VECTOR
                                RESVEC=10               ;;ADDRESS OF RESERVED INST. TRAP VECTOR
                                TBITVEC=14              ;;ADDRESS OF 'T' BIT TRAP VECTOR
                                TRTVEC=14               ;;ADDRESS OF 'TRACE' TRAP VECTOR
                                BPTVEC=14               ;;ADDRESS OF 'BREAKPOINT' TRAP VECTOR
                                IOTVEC=20               ;;ADDRESS OF IOT TRAP VECTOR
                                PFVEC=24                ;;ADDRESS OF POWER FAIL TRAP VECTOR
                                EMTVEC=30               ;;ADDRESS OF EMT VECTOR
                                TRAPVEC=34              ;;ADDRESS OF TRAP VECTOR
                                TKVEC=  60              ;;ADDRESS OF TTY KEYBOARD INT. VECTOR
                                TPVEC=64                ;;ADDRESS OF TTY PRINTER INTERRUPT VECTOR
                                PARVEC= 114             ;;ADDRESS OF MA/MF PARITY ERROR VECTOR
                                PIRVEC=240              ;;ADDRESS OF PIRQ VECTOR
                                FPEVEC=244              ;;ADDRESS OF FLOATING POINT INT. VECTOR
                                MMVEC=250               ;;ADDRESS OF MEM MGMT ERROR TRAP VECTOR

                        ;CLOCK ADDRESS AND VECTORS
                                PLKCSR= 172540          ;KW11-P
                                PLKVEC= 104
                                 KS=    177546          ;KW11-L
                                LKVEC=  100
                                LPS=    177514          ;LP11
                                LPB=    177516

                        ;RH11,TM02/TU45 REGISTERS
                                TMCS1=  172440

                        ;TM02/TU45 INDEX VALUES
                                CS1=    00                      ;CONTROL STATUS #1
                                WC=     02
                                BA=     04                      ;BUS ADDRESS REGISTER
                                FC=     06                      ;FRAME COUNT
                                CS2=    10                      ;CONTROL STATUS #2
                                DS=     12                      ;DRIVE STATUS
                                ER=     14                      ;ERROR REG #1
                                AS=     16                      ;ATTENTION SUMMARY
                                DB=     22                      ;DATA BUFFER REG
                                MR=     24                      ;MAINTENANCE REG
                                DT=     26                      ;DRIVE TYPE REG
                                SN=     30                      ;SERIAL NUMBER REGISTER
                                TC=     32                      ;TAPE CONTROL REG

                                .SBTTL  TM02/TU45 REGISTER BITS
                        ;RHCS1-CS1(R5)
                                GO=     1
                                NOP=    0
```

```
 1061            000002                  RWDOFF= 2
 1062            000006                  RWD=    6
 1063            000010                  DRYCLR= 10
 1064            000026                  WFMK=   26
 1065            000024                  ERASE=  24
 1066            000030                  SPCFWD= 30
 1067            000032                  SPCREV= 32
 1068            000050                  WCHKF=  50
 1069            000056                  WCHKR=  56
 1070            000060                  WFWD=   60
 1071            000070                  RDFWD=  70
 1072            000076                  RDREV=  76
 1073            000100                  IE=     100
 1074            000200                  RDY=    200
 1075            000400                  A16=    400
 1076            001000                  A17=    1000
 1077            002000                  PSEL=   2000
 1078            004000                  DVA=    4000
 1079            020000                  MCPE=   20000
 1080            040000                  TRE=    40000
 1081            100000                  SC=     100000
 1082                            ;RHCS2-CS2(R5)
 1083            000000                  DV0=    0
 1084            000001                  DV1=    1
 1085            000002                  DV2=    2
 1086            000003                  DV3=    3
 1087            000004                  DV4=    4
 1088            000005                  DV5=    5
 1089            000006                  DV6=    6
 1090            000007                  DV7=    7
 1091            000010                  BAI=    10
 1092            000020                  PAT=    20
 1093            000040                  CLR=    40
 1094            000100                  IR=     100
 1095            000200                  OR=     200
 1096            000400                  MDPE=   400
 1097            001000                  MXF=    1000
 1098            002000                  PGE=    2000
 1099            004000                  NEM=    4000
 1100            010000                  NED=    10000
 1101            020000                  UPE=    20000
 1102            040000                  WCE=    40000
 1103            100000                  DLT=    100000
 1104                            ;RHDS-DS(R5)
 1105            000001                  SLA=    1
 1106            000002                  BOT=    2
 1107            000004                  TMK=    4
 1108            000010                  IDB=    10
 1109            000020                  SDWN=   20
 1110            000040                  PES=    40
 1111            000100                  SSC=    100
 1112            000200                  DRY=    200
 1113            000400                  DPR=    400
 1114            002000                  EOT=    2000
 1115            004000                  WRL=    4000
 1116            010000                  MOL=    10000
```

```
 1117            020000                          PIP=    20000
 1118            040000                          ERR=    40000
 1119            100000                          ATA=    100000
 1120                                    ;RHER-ER(R5)
 1121            000001                          ILF=    1
 1122            000002                          ILR=    2
 1123            000004                          RMR=    4
 1124
 1125            000020                          FMT=    20
 1126            000100                          INCVAE= 100
 1127            000200                          PEFLRC= 200
 1128            000400                          NSG=    400
 1129            001000                          FCE=    1000
 1130            002000                          CSITM=  2000
 1131            004000                          NEF=    4000
 1132            010000                          DTE=    10000
 1133            020000                          OPI=    20000
 1134            040000                          UNS=    40000
 1135
 1136                                    ;RHMR-MR(R5)
 1137            000100                          OSC=    100
 1138
 1139                                    ;RHDT-DT(R5)
 1140            002000                          SPR=    2000
 1141            010000                          CH7=    10000
 1142            040000                          TAP=    40000
 1143
 1144                                    ;RHTC-TC(R5)
 1145            000300                          NORM11= 300
 1146            000320                          CDM11=  320
 1147            000000                          BPI200= 0
 1148            000400                          BPI556= 000400
 1149            001000                          BPI800= 001000
 1150            002000                          PE1600= 002000
 1151            100000                          ACCL=   100000
 1152
 1153                                    ;INSTRUCTION EQUATES
 1154            104400                          HLT=    TRAP
 1155            104000                          SCOPE=  EMT
 1156            000004                          TYPE=   IOT
 1157
 1158                                    ;MISCELLANEOUS EQUATES
 1159            005340                          OUTBUF=INIT             ;OTPUT BUFFER START AT BEG OF PROGRAM
 1160            177400                          FRMCNT= -256.           ;FRAME COUNT
 1161            177600                          WRDCNT= -128.           ;WORD COUNT
 1162                                    ;ASCII EQUATES
 1163            000003                          CNTRLC= 3               ;ASCII CODE FOR CONTROL C ( C)
 1164            000011                          HT=     11              ;ASCII CODE FOR HORIZONTAL TAB
 1165            000012                          LF=     12              ;ASCII CODE FOR LINE FEED
 1166            000015                          CR=     15              ;ASCII CODE FOR CARRIAGE RETURN
 1167            000017                          CNTRLO= 17              ;ASCII CODE FOR CONTROL O ( O)
 1168            000025                          CNTRLU= 25              ;ASCII CODE FOR CONTROL U ( U)
 1169            000000                          .=0
 1170   000000   000000                          0
 1171   000002   000000                          0
 1172   000004   000006                          .+2
```

```
1173  000006  000000          HALT
1174  000010  000012          .+2
1175  000012  000000          HALT
1176  000014  000016          .+2
1177  000016  000000          HALT
1178  000020  000022          .+2
1179  000022  000000          HALT
1180  000024  000026          .+2
1181  000026  000000          HALT
1182  000030  000032          .+2
1183  000032  000000          HALT
1184  000034  000036          .+2
1185  000036  000000          HALT
1186  000040  000042          .+2
1187  000042  000000          HALT
1188  000044  000046          .+2
1189  000046  000000          HALT
1190  000050  000052          .+2
1191  000052  000000          HALT
1192  000054  000056          .+2
1193  000056  000000          HALT
1194  000060  000062          .+2
1195  000062  000000          HALT
1196  000064  000066          .+2
1197  000066  000000          HALT
1198  000070  000072          .+2
1199  000072  000000          HALT
1200  000074  000076          .+2
1201  000076  000000          HALT
1202  000100  000102          .+2
1203  000102  000000          HALT
1204  000104  000106          .+2
1205  000106  000000          HALT
1206  000110  000112          .+2
1207  000112  000000          HALT
1208  000114  000116          .+2
1209  000116  000000          HALT
1210  000120  000122          .+2
1211  000122  000000          HALT
1212  000124  000126          .+2
1213  000126  000000          HALT
1214  000130  000132          .+2
1215  000132  000000          HALT
1216  000134  000136          .+2
1217  000136  000000          HALT
1218  000140  000142          .+2
1219  000142  000000          HALT
1220  000144  000146          .+2
1221  000146  000000          HALT
1222  000150  000152          .+2
1223  000152  000000          HALT
1224  000154  000156          .+2
1225  000156  000000          HALT
1226  000160  000162          .+2
1227  000162  000000          HALT
1228  000164  000166          .+2
```

```
 1229  000166  000000                HALT
 1230  000170  000172                .+2
 1231  000172  000000                HALT
 1232  000174  000176                .+2
 1233  000176  000000                HALT
 1234  000200  000202                .+2
 1235  000202  000000                HALT
 1236  000204  000206                .+2
 1237  000206  000000                HALT
 1238  000210  000212                .+2
 1239  000212  000000                HALT
 1240  000214  000216                .+2
 1241  000216  000000                HALT
 1242  000220  000222                .+2
 1243  000222  000000                HALT
 1244  000224  000226                .+2
 1245  000226  000000                HALT
 1246  000230  000232                .+2
 1247  000232  000000                HALT
 1248  000234  000236                .+2
 1249  000236  000000                HALT
 1250  000240  000242                .+2
 1251  000242  000000                HALT
 1252  000244  000246                .+2
 1253  000246  000000                HALT
 1254  000250  000252                .+2
 1255  000252  000000                HALT
 1256  000254  000256                .+2
 1257  000256  000000                HALT
 1258  000260  000262                .+2
 1259  000262  000000                HALT
 1260  000264  000266                .+2
 1261  000266  000000                HALT
 1262  000270  000272                .+2
 1263  000272  000000                HALT
 1264  000274  000276                .+2
 1265  000276  000000                HALT
 1266  000300  000302                .+2
 1267  000302  000000                HALT
 1268  000304  000306                .+2
 1269  000306  000000                HALT
 1270  000310  000312                .+2
 1271  000312  000000                HALT
 1272  000314  000316                .+2
 1273  000316  000000                HALT
 1274  000320  000322                .+2
 1275  000322  000000                HALT
 1276  000324  000326                .+2
 1277  000326  000000                HALT
 1278  000330  000332                .+2
 1279  000332  000000                HALT
 1280  000334  000336                .+2
 1281  000336  000000                HALT
 1282  000340  000342                .+2
 1283  000342  000000                HALT
 1284  000344  000346                .+2
```

```
 1285  000346  000000                HALT
 1286  000350  000352                .+2
 1287  000352  000000                HALT
 1288  000354  000356                .+2
 1289  000356  000000                HALT
 1290  000360  000362                .+2
 1291  000362  000000                HALT
 1292  000364  000366                .+2
 1293  000366  000000                HALT
 1294  000370  000372                .+2
 1295  000372  000000                HALT
 1296  000374  000376                .+2
 1297  000376  000000                HALT
 1298  000400  000402                .+2
 1299  000402  000000                HALT
 1300  000404  000406                .+2
 1301  000406  000000                HALT
 1302  000410  000412                .+2
 1303  000412  000000                HALT
 1304  000414  000416                .+2
 1305  000416  000000                HALT
 1306  000420  000422                .+2
 1307  000422  000000                HALT
 1308  000424  000426                .+2
 1309  000426  000000                HALT
 1310  000430  000432                .+2
 1311  000432  000000                HALT
 1312  000434  000436                .+2
 1313  000436. 000000                HALT
 1314  000440  000442                .+2
 1315  000442  000000                HALT
 1316  000444  000446                .+2
 1317  000446  000000                HALT
 1318  000450  000452                .+2
 1319  000452  000000                HALT
 1320  000454  000456                .+2
 1321  000456  000000                HALT
 1322  000460  000462                .+2
 1323  000462  000000                HALT
 1324  000464  000466                .+2
 1325  000466  000000                HALT
 1326  000470  000472                .+2
 1327  000472  000000                HALT
 1328  000474  000476                .+2
 1329  000476  000000                HALT
 1330  000500  000502                .+2
 1331  000502  000000                HALT
 1332  000504  000506                .+2
 1333  000506  000000                HALT
 1334  000510  000512                .+2
 1335  000512  000000                HALT
 1336  000514  000516                .+2
 1337  000516  000000                HALT
 1338  000520  000522                .+2
 1339  000522  000000                HALT
 1340  000524  000526                .+2
```

```
 1341  000526  000000                HALT
 1342  000530  000532                .+2
 1343  000532  000000                HALT
 1344  000534  000536                .+2
 1345  000536  000000                HALT
 1346  000540  000542                .+2
 1347  000542  000000                HALT
 1348  000544  000546                .+2
 1349  000546  000000                HALT
 1350  000550  000552                .+2
 1351  000552  000000                HALT
 1352  000554  000556                .+2
 1353  000556  000000                HALT
 1354  000560  000562                .+2
 1355  000562  000000                HALT
 1356  000564  000566                .+2
 1357  000566  000000                HALT
 1358  000570  000572                .+2
 1359  000572  000000                HALT
 1360  000574  000576                .+2
 1361  000576  000000                HALT
 1362  000600  000602                .+2
 1363  000602  000000                HALT
 1364  000604  000606                .+2
 1365  000606  000000                HALT
 1366  000610  000612                .+2
 1367  000612  000000                HALT
 1368  000614  000616                .+2
 1369  000616  000000                HALT
 1370  000620  000622                .+2
 1371  000622  000000                HALT
 1372  000624  000626                .+2
 1373  000626  000000                HALT
 1374  000630  000632                .+2
 1375  000632  000000                HALT
 1376  000634  000636                .+2
 1377  000636  000000                HALT
 1378  000640  000642                .+2
 1379  000642  000000                HALT
 1380  000644  000646                .+2
 1381  000646  000000                HALT
 1382  000650  000652                .+2
 1383  000652  000000                HALT
 1384  000654  000656                .+2
 1385  000656  000000                HALT
 1386  000660  000662                .+2
 1387  000662  000000                HALT
 1388  000664  000666                .+2
 1389  000666  000000                HALT
 1390  000670  000672                .+2
 1391  000672  000000                HALT
 1392  000674  000676                .+2
 1393  000676  000000                HALT
 1394  000700  000702                .+2
 1395  000702  000000                HALT
 1396  000704  000706                .+2
```

```
 1397  000706  000000                    HALT
 1398  000710  000712                    .+2
 1399  000712  000000                    HALT
 1400  000714  000716                    .+2
 1401  000716  000000                    HALT
 1402  000720  000722                    .+2
 1403  000722  000000                    HALT
 1404  000724  000726                    .+2
 1405  000726  000000                    HALT
 1406  000730  000732                    .+2
 1407  000732  000000                    HALT
 1408  000734  000736                    .+2
 1409  000736  000000                    HALT
 1410  000740  000742                    .+2
 1411  000742  000000                    HALT
 1412  000744  000746                    .+2
 1413  000746  000000                    HALT
 1414  000750  000752                    .+2
 1415  000752  000000                    HALT
 1416  000754  000756                    .+2
 1417  000756  000000                    HALT
 1418  000760  000762                    .+2
 1419  000762  000000                    HALT
 1420                          ;SETUP TRAP VECTORS
 1421          000014                    .=TBITVEC
 1422  000014  000016                    .WORD   .+2             ;SET 'T' TRAP TO TIMER ROUTINE
 1423  000016  000000                    .WORD   HALT            ;PRIORITY LEVEL 7
 1424  000020  001776                    .WORD   .TYPE           ;SET IOT TRAP TO .TYPE ROUTINE
 1425  000022  000000                    .WORD   0               ;PRIOTITY LEVEL 0
 1426  000024  000026                    .WORD   PFVEC+2         ;POWER FAIL TRAP TO HALT
 1427  000026  000000                    .WORD   HALT            ;AT PFVEC+2
 1428  000030  003552                    .WORD   .SCOPE          ;SET EMT TRAP TO .SCOPE ROUTINE
 1429  000032  000340                    .WORD   340             ;PRIORITY LEVEL 7
 1430  000034  003304                    .WORD   .HLT            ;SET TRAP TRAP TO .HLT ROUTINE
 1431  000036  000340                    .WORD   340             ;PRIORITY LEVEL 7
 1432          000060                    .=TKVEC
 1433  000060  003240                    .WORD   TKISR
 1434  000062  000340                    .WORD   340
 1435          000200                    .=200
 1436  000200  000137  005340            JMP     @#INIT                  ;GO TO START OF PROGRAM
 1437
 1438          000500                    .=500
 1439          000600          STKPTR= 600                     ;STACK
 1440
 1441          001000                    .=1000
 1442
 1443                          ;PROGRAM TAGS
 1444
 1445  001000  177570          SWR:      .WORD   HSWR
 1446  001002  000000          SCPADR:   .WORD   0
 1447  001004     000          DRVNUM:   .BYTE   0               ;TM02 DRIVE UNDER TEST
 1448  001005     000          SLVNUM:   .BYTE   0               ;TU45 SLAVE UNDER TEST
 1449  001006  000000          SLVPTR:   .WORD   0               ;POINTER TO SLAVE TABLE (SLVTBL) BELOW
 1450  001010  172440          TMBASE:   .WORD   TMCS1           ;BASE ADDRESS OF TM02/TU45 REGISTERS
 1451  001012  000000          ATIME:    .WORD   0                       ;CONTAINS 'TICK' COUNT
 1452  001014  000020          ATIMTBL:  .BLKW   16.             ;EACH ENTRY CONTAINS TIME FOR FUNCTION
```

```
                                                        ;ENTRIES ARE MADE BY 'SCOPE' ROUTINE
001054  000020          GAPTBL: .BLKW   16.           ;TIMES RECORDED BY 'GAP CONSISTANCY' TEST
001114  000000          DELTIM: .WORD   0             ;VARIBLE DELAY
001116  000000          OCTAL0: .WORD   0
001120     000          GAP:    .BYTE   0             ;CONTAINS GAP # (USED FOR TST 021)
001121     000          ITCNT:  .BYTE   0             ;ITERATION COUNT
001122     000          TSTNUM: .BYTE   0             ;TEST #
001123     000          ERFLG:  .BYTE   0             ;ERROR FLAG
001124     000          PRGFLG: .BYTE   0             ;PROGRAM FLAG
001125     000          UNTFND: .BYTE   0             ;UNIT FOUND INDICATOR
001126     000          TYPFLG: .BYTE   0
001127     000          NRZFLG: .BYTE   0             ;INDICATES IF DRIVE IS NRZ ONLY.
001130     000          ASFLG:  .BYTE   0             ;1/0 = YES/NO.
        001132          DIGTAB: .EVEN
001132  030460                  ''01
001134  031462                  ''23
001136  032464                  ''45
001140  033466                  ''67
001142  034470                  ''89
001144  000006          ODIGITS:.BLKB   6             ;RESERVE SPACE FOR CONVERTED DIGITS
001152     000                  .BYTE   0             ;TERMINATOR
        001154                  .EVEN
001154  000010          DRVTBL: .BLKB   8.            ;A 0/-1 = DRIVE NOT TO BE/TO BE TESTED
001164  000100          SLVTBL: .BLKB   64.           ;A 0/-1 = SLAVE NOT TO BE/TO BE TESTED
001264  000110          INBUF:  .BLKB   72.           ;TELETYPE INPUT BUFFER
001374  005015  000     CRLF:   .ASCIZ  <CR><LF>      ;MISCELLANEOUS ASCII CHARACTERS
001377     134  000     BKSLSH: .ASCIZ  '\'
001401     060  000     ECHO:   .ASCIZ  '0'
001403     007  000     BELL:   .ASCIZ  <7>
001405     055  000     DASH:   .ASCIZ  '-'
001407     040          SPACE2: .ASCII  ' '
001410  000040          SPACE:  .ASCIZ  ' '
001412  004476  000     ANGTAB: .ASCIZ  '>'<HT>
        001416                  .EVEN
```

```
                        .SBTTL  TIME SPECIFICATION TABLE
                ;THE BELOW TABLE CONTAINS THE SPECIFIED FUNCTION TIMES IN TENS OF
                ;MICROCESONDS. NOTE THAT WHEN TIMES ARE TYPED THAT THEY ARE TYPED IN
                ;MICROSECONDS (BY APPENDING A 0).
                ;FORMAT IS
                ;       .WORD   MAX,MIN         ;TIME IN MS     FUNCTION        TEST #

001416  000000  000000  STIMTBL:.WORD   0,0              ;SPARE
001422  017500  015220          .WORD   8000.,6800.     ;80.0-68.0      WRITE FROM BOT  TST001
001426  001046  000702          .WORD   00550.,00450.   ;5.50-4.50      WRITE START     TST002
001432  000702  000550          .WORD   00450.,00360.   ;4.50-3.90      WRITE SHUTDOWN  TST003
001436  001130  000714          .WORD   00600.,00460.   ;6.0-4.60       WRITE STLDOWN   TST004
001442  001666  001426          .WORD   0950.,0790.     ;9.5-7.9        READ FROM BOT   TST005
001446  000264  000226          .WORD   00180.,00150.   ;1.80-1.50      READ START      TST006
001452  000252  000202          .WORD   00170.,00130.   ;1.70-1.30      READ SHUTDOWN   TST007
001456  001130  000714          .WORD   00600.,00460.   ;6.00-4.60      READ SETTLEDOWN TST010
001462  000264  000226          .WORD   00180.,00150.   ;1.80-1.50      RD REV START    TST011
001466  000346  000276          .WORD   00230.,00190.   ;2.30-1.90      RD REV SHTDWN   TST012
001472  001130  000714          .WORD   00600.,00460.   ;6.00-4.60      RD REV STLDWN   TST013
001476  001440  001130          .WORD   00800.,00600.   ;8.00-6.00      TRN RND DLY F-R TST014
001502  001440  001130          .WORD   00800.,00600.   ;8.00-6.00      TRN RND DLY R-F TST015
001506  001440  001130          .WORD   00800.,00600.   ;8.00-6.00      GAP SIZE STOP   TST016
001512  001440  001130          .WORD   00800.,00600.   ;8.00-6.00      GAP SIZE STRT   TST017
001516  001440  001130          .WORD   00800.,00600.   ;8.00-6.00      GAP SIZE INTER  TST020
001522  001440  001250          .WORD   00800.,00680.   ;8.00-6.80      GAP CONSISANCY  TST021
001526  000000  000000          .WORD   0,0             ;0.0-0.0        DUMMY           TST022
001532  002660  002533          .WORD   01456.,01371.   ;14.56-13.71    DAT TIME 200BPI TST023
001536  002660  002533          .WORD   01456.,01371.   ;14.56-13.71    DAT TIME 556BPI TST024
001542  002660  002533          .WORD   01456.,01371.   ;14.56-13.71    DAT TIME 800BPI TST025
001546  002734  002424          .WORD   01500.,01300.   ;15.00-13.00    DAT TIME 1600PE TST026
001552  013724  012574          .WORD   06100.,05500.   ;61.00-55.00    ERASE           TST027
001556  014400  013250          .WORD   06400.,05800.   ;64.00-58.00    WRT FILE MARK   TST030
001562  002544  002424          .WORD   01380.,01300.   ;13.80-13.00    READ 1" TAPE    TST031
001566  002544  002424          .WORD   01380.,01300.   ;13.80-13.00    RD REV 1" TAPE  TST032

                ;NOTE: TEST 31 AND 32 REQUIRE PRERECORDED 800BPI SKEW TAPE.
                        .SBTTL  GAP TIME SPECIFICATION TABLE
                ;THIS TABLE CONTAINS THE GAP SIZES (IN TENS OF MICROSECONDS) FOR EACH
                ;OF THE 16. GAPS RECORDED BY THE GAP CONSISTANCY TEST (TST021).
                ;NOTE: GAP #'S ARE IN OCTAL.

                ;       .WORD   MAX,MIN(10)     ;TIME IN MS(10) GAP #   DELAY IN MS(10)

001572  001452  001274  GTIMTBL:.WORD   00810.,00700.   ;8.10-7.00      GAP-0   0 MS
001576  001564  001406          .WORD   00884.,00774.   ;8.84-7.74      GAP-1   1.0 MS
001602  001556  001376          .WORD   00878.,00766.   ;8.78-7.66      GAP-2   2.0 MS
001606  001452  001274          .WORD   00810.,00700.   ;8.10-7.00      GAP-3   3.0 MS
001612  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-4   4.0 MS
001616  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-5   5.0 MS
001622  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-6   6.0 MS
001626  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-7   7.0 MS
001632  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-10  8.0 MS
001636  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-11  9.0 MS
001642  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-12  10.0 MS
001646  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-13  11.0 MS
001652  001426  001250          .WORD   00790.,00680.   ;7.90-6.80      GAP-14  12.0 MS
```

```
 1543  001656  001426  001250                .WORD   00790.,00680.   ;7.90-6.80      GAP-15  13.1 MS
 1544  001662  001426  001250                .WORD   00790.,00680.   ;7.90-6.80      GAP-16  14.1 MS
 1545  001666  001426  001250                .WORD   00790.,00680.   ;7.90-6.80      GAP-17  15.1 MS
```

```
                                        .SBTTL  TEST HEADER POINTERS
                                ;THE BELOW TABLE CONTAINS POINTERS TO EACH TEST'S DESCRIPTOR
001672  000000                  NAMPTR: .WORD   0
001674  014215                          .WORD   A.T001
001676  014237                          .WORD   A.T002
001700  014257                          .WORD   A.T003
001702  014301                          .WORD   A.T004
001704  014325                          .WORD   A.T005
001706  014347                          .WORD   A.T006
001710  014366                          .WORD   A.T007
001712  014410                          .WORD   A.T010
001714  014433                          .WORD   A.T011
001716  014455                          .WORD   A.T012
001720  014502                          .WORD   A.T013
001722  014531                          .WORD   A.T014
001724  014562                          .WORD   A.T015
001726  014613                          .WORD   A.T016
001730  014641                          .WORD   A.T017
001732  014670                          .WORD   A.T020
001734  014720                          .WORD   A.T021
001736  000000                          .WORD   0                       ;DUMMY TEST
001740  014743                          .WORD   A.T023
001742  014767                          .WORD   A.T024
001744  015013                          .WORD   A.T025
001746  015037                          .WORD   A.T026
001750  015064                          .WORD   A.T027
001752  015106                          .WORD   A.T030
001754  015131                          .WORD   A.T031
001756  015153                          .WORD   A.T032

                                        .SBTTL  PROGRAM SUBROUTINES
                                        .SBTTL          TYPE SUBROUTINE
                                ;;ROUTINE TO TYPE ASCII MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
                                ;;THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
                                ;;CALL: TYPE                    ;;A TRAP TYPE INSTRUCTION
                                ;;      MESADR                  ;;MESADR IS FIRST ADDRESS OF ASCIZ STRING

                                ;;TAGS USED BY THE TYPE ROUTINE BELOW
000011                                  $HT=11                  ;;HORIZONTAL TAB
001760     000                  $NULL:  .BYTE   0               ;;CONTAINS NULL CHARACTER
001761     002                  $FILL:  .BYTE   2               ;;CONTAINS # OF FILLER CHARACTERS
001762     000                  $TPFLG: .BYTE   0               ;;CONTAINS TELEPRINTER AVAILABLE FLAG
                                                                ;;0/377 = AVAIL/NOT AVAIL
001763     000                  $TKFLG: .BYTE   0               ;;CONTAINS KEYBOARD AVAILABLE FLAG
001764  177564                  $TPS:   .WORD   177564          ;;ADDRESS OF TLEPRINTER STATUS REGISTER
001766  177566                  $TPB:   .WORD   177566          ;;ADDRESS OF TELEPRINTER DATA BUFFER
001770     000                  $CHARCNT:.BYTE  0               ;;CONTAINS # OF CHARS TYPED
001771     000                  $CNTRLO:.BYTE   0               ;;CONTAINS CONTROL O CHAR (IF TYPED)
001772  005015      000         $CRLF:  .ASCIZ  <15><12>
001776                                  .EVEN

001776  010046                  .TYPE:  MOV     R0,-(SP)        ;;SAVE R0
002000  017600  000002                  MOV     @2(SP),R0       ;;GET MESSAGE ADDRESS
002004  062766  000002  000002          ADD     #2,2(SP)        ;;ADJUST RETURN PC
002012  105067  177753                  CLRB    $CNTRLO
```

```
1602  002016  105767  177747          1$:   TSTB    $CNTRLO          ;;BRANCH IF CONTROL O( O) WASN'T TYPED
1603  002022  001403                        BEQ     12$
1604  002024  000004  001772                TYPE,$CRLF               ;;TYPE <CR><LF>
1605  002030  000403                        BR      11$
1606  002032  112046                  12$:  MOVB    (R0)+,-(SP)      ;;PUSH CHARACTER TO BE TYPED ONTO STACK
1607  002034  001003                        BNE     2$               ;;BRANCH IF NOT THE TERMINATOR
1608  002036  005726                        TST     (SP)+            ;;POP TERMINATOR CHAR OFF THE STACK
1609  002040  012600                  11$:  MOV     (SP)+,R0         ;;RESTORE R0
1610  002042  000002                        RTI                      ;;RETURN TO CALLER
1611
1612  002044  122716  000011          2$:   CMPB    #$HT,(SP)        ;;BRANCH IF HORIZONTAL TAB <HT>
1613  002050  001445                        BEQ     9$
1614  002052  004767  000026                JSR     PC,5$            ;;TYPE CHARACTER
1615  002056  122726  000012          3$:   CMPB    #12,(SP)+        ;;CHECK IF CHARACTER WAS A LINE FEED
1616  002062  001355                        BNE     1$               ;;BRANCH IF NOT LINE FEED
1617  002064  016746  177670                MOV     $NULL,-(SP)      ;;GET # OF FILLERS REQUIRED AND FILLER
1618                                                                 ;;CHARACTER.
1619
1620  002070  105366  000001          4$:   DECB    1(SP)            ;;DECREMENT FILLERS REQ. COUNT
1621  002074  002770                        BLT     3$               ;;BRANCH IF NO MORE FILLERS ARE REQUIRED
1622  002076  004767  000002                JSR     PC,5$            ;;TYPE FILLER CHARACTER
1623  002102  000772                        BR      4$
1624
1625  002104  105777  177654          5$:   TSTB    @$TPS            ;;WAIT FOR OUTPUT DEVICE
1626  002110  100375                        BPL     .-4
1627  002112  122737  000017  001771        CMPB    #17,@#$CNTRLO    ;;CHECK IF CONTROL O WAS TYPED
1628  002120  001403                        BEQ     6$               ;;STOP TYPING MESSAGE IF  O WAS TYPED
1629  002122  116677  000002  177636        MOVB    2(SP),@$TPB      ;;OUTPUT CHARACTER
1630  002130  122766  000015  000002  6$:   CMPB    #15,2(SP)        ;;BRANCH IF NOT <CR>
1631  002136  001003                        BNE     7$
1632  002140  105067  177624                CLRB    $CHARCNT         ;;CLEAR CHARACTERS TYPED COUNT
1633  002144  000406                        BR      8$
1634  002146  122766  000012  000002  7$:   CMPB    #12,2(SP)        ;;BRANCH IF <LF> OR 'NULL'
1635  002154  002002                        BGE     8$
1636  002156  105267  177606                INCB    $CHARCNT         ;;INCREMENT CHARACTER TYPED COUNT
1637  002162  000207                  8$:   RTS     PC
1638
1639                                  ;;HORIZONTAL TAB <HT> PROCESSER
1640  002164  112716  000040          9$:   MOVB    #40,(SP)         ;;LOAD 'SPACE'
1641  002170  004767  177710          10$:  JSR     PC,5$            ;;TYPE 'SPACE'
1642  002174  132767  000007  177566        BITB    #7,$CHARCNT      ;;TYPE SPACES UNTIL A MULTIPLE
1643  002202  001372                        BNE     10$              ;;OF 8 CHARACTERS HAVE BEEN TYPED
1644  002204  105726                        TSTB    (SP)+            ;;POP SPACE
1645  002206  000703                        BR      1$               ;;GET NEXT CHARACTER
1646
1647                                  ;SUBROUTINE TO SAVE GENERAL REGISTERS ON THE STACK
1648                                  ;CALL:  SAVE
1649  002210  010546                  .SAVE:  MOV     R5,-(SP)                 ;SAVE REGISTERS ON THE STACK
1650  002212  010446                          MOV     R4,-(SP)
1651  002214  010346                          MOV     R3,-(SP)
1652  002216  010246                          MOV     R2,-(SP)
1653  002220  010146                          MOV     R1,-(SP)
1654  002222  010046                          MOV     R0,-(SP)
1655  002224  016646  000014                  MOV     14(SP),-(SP)             ;GET RETURN PC
1656  002230  000207                          RTS     PC                       ;RETURN
1657
```

```
 1658                                   ;SUBROUTINE TO RESTORE GENERAL REGISTERS FROM THE STACK
 1659                                   ;CALL:  RESTORE
 1660  002232  012666  000014          .RESTORE:MOV     (SP)+,14(SP)            ;MOVE RETURN PC
 1661  002236  012600                          MOV     (SP)+,R0                ;RESTORE REGISTERS
 1662  002240  012601                          MOV     (SP)+,R1
 1663  002242  012602                          MOV     (SP)+,R2
 1664  002244  012603                          MOV     (SP)+,R3
 1665  002246  012604                          MOV     (SP)+,R4
 1666  002250  012605                          MOV     (SP)+,R5
 1667  002252  000207                          RTS     PC                      ;RETURN
 1668
 1669                                   ;SUBROUTINE TO CONVERT OCTAL DATA TO ASCII
 1670                                   ;CALL:  MOV     NUMBER,R2               ;MOVE NUMBER TO R2
 1671                                   ;       JSR     PC,CNVOCT
 1672
 1673  002254  110667  176646          CNVOCT: MOVB    SP,TYPFLG               ;SET DO NOT TYPE FLAG
 1674  002260  000402                          BR      CNVTO
 1675
 1676                                           .SBTTL          OCTAL TO ASCII & TYPE ROUTINE
 1677                                   ;SUBROUTINE TO CONVERT OCTAL NUMBER TO ASCII AND TYPE IT OUT
 1678                                   ;CALL:  MOV     NUMBER,R2               ;PUT # IN R2
 1679                                   ;       JSR     PC,TYPOCT               ;CALL ROUTINE
 1680
 1681  002262  105037  001126          TYPOCT: CLRB    @#TYPFLG                ;SET TYPE FLAG
 1682  002266                          CNVTO:
 1683  002266  004767  177716                  JSR     PC,..SAVE               ;SAVE REGISTERS ON THE STACK
 1684  002272  012704  001144                  MOV     #ODIGITS,R4             ;SET PTR TO OUTPUT
 1685  002276  005003                          CLR     R3                      ;R3 WILL CONTAIN OCTAL DIGIT
 1686  002300  010201                          MOV     R2,R1                   ;GET # TO BE TYPED
 1687  002302  006302                  1$:     ASL     R2                      ;SHIFT #
 1688  002304  006103                          ROL     R3
 1689  002306  012700  000006                  MOV     #6,R0                   ;SET DIGIT COUNTER
 1690  002312  000404                          BR      3$
 1691
 1692  002314  006302                  2$:     ASL     R2                      ;SHIFT # 3 PLACES LEFT
 1693  002316  006103                          ROL     R3
 1694  002320  005301                          DEC     R1
 1695  002322  001374                          BNE     2$
 1696  002324  012701  000003          3$:     MOV     #3,R1                   ;SET SHIFT COUNTER
 1697  002330  116324  001132                  MOVB    DIGTAB(R3),(R4)+        ;MOVE ASCII EQUIV TO OUTPUT
 1698  002334  005003                          CLR     R3
 1699  002336  005300                          DEC     R0                      ;DECREMENT DIGIT COUNT
 1700  002340  001365                          BNE     2$                      ;GET NEXT DIGIT
 1701  002342  105737  001126                  TSTB    @#TYPFLG                ;BRANCH IF ASCII IS
 1702  002346  001002                          BNE     4$                      ;NOT TO BE TYPED
 1703  002350  000004  001144                  TYPE,ODIGITS
 1704  002354                          4$:
 1705  002354  004767  177652                  JSR     PC,..RESTORE            ;RESTORE REGISTERS FROM THE STACK
 1706  002360  000207                          RTS     PC
 1707
 1708
 1709                                   ;SUBROUTINE TO CONVERT OCTAL DATA TO DECIMAL ASCII
 1710                                   ;CALL:  MOV     NUMBER,R2               ;MOVE NUMBER TO R2
 1711                                   ;       JSR     PC,CNVDEC
 1712
 1713  002362  110637  001126          CNVDEC: MOVB    SP,@#TYPFLG             ;SET DO NOT TYPE FLAG
```

```
 1714  002366  000402                    BR      CNVTD
 1715                                    .SBTTL          OCTAL TO DECIMAL & TYPE ROUTINE
 1716                                ;THIS ROUTINE CONVERTS AN OCTAL # TO DECIMAL ASCII AND TYPES IT OUT
 1717                                ;CALL:  MOV     NUMBER,R2               ;PUT # IN R2
 1718                                ;       JSR     PC,TYPDEC               ;CALL ROUTINE
 1719
 1720  002370  105037  001126      TYPDEC: CLRB    @#TYPFLG                ;SET TYPE FLAG
 1721  002374                      CNVTD:
 1722  002374  004767  177610              JSR     PC,.SAVE                ;SAVE REGISTERS ON THE STACK
 1723  002400  005000                      CLR     R0                      ;R0 IS INDEX TO DECIMAL CONSTANT
 1724  002402  012704  001144              MOV     #ODIGITS,R4             ;SET OUTPUT PTR
 1725  002406  005003              1$:     CLR     R3                      ;R3 CONTAINS DECIMAL DIGIT
 1726  002410  166002  002470      2$:     SUB     DCONST(R0),R2           ;SUBTRACT DECIMAL CONSTANT UNTIL
 1727  002414  103402                      BLO     3$                      ;INPUT # GOES NEGATIVE
 1728  002416  005203                      INC     R3                      ;KEEPING TRACK OF SUBTRACTIONS
 1729  002420  000773                      BR      2$
 1730  002422  066002  002470      3$:     ADD     DCONST(R0),R2           ;ADD BACK CONSTANT WHEN NEGATIVE
 1731  002426  116324  001132              MOVB    DIGTAB(R3),(R4)+        ;MOVE ASCII EQUIVILENT
 1732  002432  062700  000002              ADD     #2,R0                   ;NEXT CONSTANT
 1733  002436  005760  002470              TST     DCONST(R0)              ;UNTIL ALL CONSTANTS DONE
 1734  002442  001361                      BNE     1$
 1735  002444  112724  000060              MOVB    #'0,(R4)+               ;LAST DIGIT IS 0
 1736  002450  105737  001126              TSTB    @#TYPFLG                ;BRANCH IF ASCII IS
 1737  002454  001002                      BNE     4$                      ;NOT TO BE TYPED
 1738  002456  000004  001144              TYPE,ODIGITS
 1739  002462                      4$:
 1740  002462  004767  177544              JSR     PC,.RESTORE             ;RESTORE REGISTERS FROM THE STACK
 1741  002466  000207                      RTS     PC
 1742
 1743  002470  023420              DCONST: .WORD   10000.
 1744  002472  001750                      .WORD   1000.
 1745  002474  000144                      .WORD   100.
 1746  002476  000012                      .WORD   10.
 1747  002500  000001                      .WORD   1.
 1748  002502  000000                      .WORD   0                       ;TERMINATOR
 1749
 1750                                    .SBTTL          TYPE SPECIFIED TIMES ROUTINE
 1751                                ;THIS SUBROUTINE OUTPUTS THE TIME SPECIFICATIONS FOR THE TEST
 1752                                ;AND ALSO THE ACTUAL TIME RECORDED (ATIME)
 1753                                ;FORMAT OF LINE TYPED
 1754                                ;RANGE=<AAAAAA-BBBBBB>          ACTUAL=CCCCCC
 1755                                ;WHERE:         AAAAAA IS MAXIMUM TIME FOR TEST (STIMTBL(TSTNUMX4)).
 1756                                ;               BBBBBB IS MINIMUM TIME FOR TEST (STIMTBL(TSTNUMX4+2)).
 1757                                ;               CCCCCC IS ACTUAL TIME RECORDED BY TEST (ATIME).
 1758                                ;CALL:  MOVB    TEST NUMBER,R2  ;LOAD TEST NUMBER
 1759                                ;       MOV     #TIME,@#ATIME           ;MOVE TIME TO ATIME
 1760                                ;       JSR     PC,OUTSPC
 1761  002504  010246              OUTSPC: MOV     R2,-(SP)                ;SAVE R2 & R3 ON THE STACK
 1762  002506  010346                      MOV     R3,-(SP)
 1763  002510  006302                      ASL     R2                      ;MULTIPLY TEST # TIMES 4
 1764  002512  006302                      ASL     R2                      ;TO FORM INDEX INTO STIMTBL
 1765  002514  010203                      MOV     R2,R3                   ;R3 CONTAINS INDEX INTO TABLE
 1766  002516  000004  014175              TYPE,L.RNG
 1767  002522  016302  001416              MOV     STIMTBL(R3),R2          ;GET MAXIMUM SPEC TIME
 1768  002526  004767  177636              JSR     PC,TYPDEC               ;CONVERT TO DECIMAL & TYPE
 1769  002532  000004  001405              TYPE,DASH
```

```
 1770  002536  016302  001420                 MOV     STIMTBL+2(R3),R2        ;GET MINIMUM TIME
 1771  002542  004767  177622                 JSR     PC,TYPDEC               ;CONVERT TO DECIMAL & TYPE
 1772  002546  000004  001412                 TYPE,ANGTAB
 1773  002552  000004  014205                 TYPE,L.ACT
 1774  002556  013702  001012                 MOV     @#ATIME,R2              ;GET ACTUAL TIME
 1775  002562  004767  177602                 JSR     PC,TYPDEC               ;CONVERT TO DECIMAL & TYPE
 1776  002566  000004  001374                 TYPE,CRLF
 1777  002572  012603                         MOV     (SP)+,R3
 1778  002574  012602                         MOV     (SP)+,R2
 1779  002576  000207                         RTS     PC                      ;RETURN
 1780
 1781                                  .SBTTL          TYPE GAP TIMES SUBROUTINE
 1782                                ;THIS SUBROUTINE IS USED TO TYPE THE SPECIFIED GAP SIZES (RECORDED IN
 1783                                ;TST021). IT IS CALLED BY THE GAPOK ROUTINE IF THE GAP SIZE IS OUT OF
 1784                                ;RANGE VIA THE HLT ROUTINE (HLT+2).
 1785                                ;CALL:  MOVB    #GAP,GAP                ;LOAD GAP # INTO GAP
 1786                                ;       MOV     #TIME,ATIME             ;LOAD ACTUAL TIME INTO ATIME
 1787                                ;       JSR     PC,OUTGAP
 1788
 1789  002600  010246                OUTGAP: MOV     R2,-(SP)                ;SAVE R2 AND R3
 1790  002602  010346                        MOV     R3,-(SP)
 1791  002604  116703  176310                MOVB    GAP,R3                  ;GET GAP #
 1792  002610  006303                        ASL     R3
 1793  002612  006303                        ASL     R3
 1794  002614  000004  014175                TYPE,L.RNG
 1795  002620  016302  001572                MOV     GTIMTBL(R3),R2          ;GET MAX TIME
 1796  002624  004767  177540                JSR     PC,TYPDEC               ;CONVERT TO DECIMAL & TYPE
 1797  002630  000004  001405                TYPE,DASH
 1798  002634  016302  001574                MOV     GTIMTBL+2(R3),R2        ;GET MIN TIME
 1799  002640  004767  177524                JSR     PC,TYPDEC               ;CONVERT TO DECIMAL & TYPE
 1800  002644  000004  001412                TYPE,ANGTAB                     ;TYPE <
 1801  002650  000004  014205                TYPE,L.ACT
 1802  002654  013702  001012                MOV     @#ATIME,R2              ;GET ACTUAL TIME
 1803  002660  004767  177504                JSR     PC,TYPDEC               ;CONVERT TO DECIMAL & TYPE
 1804  002664  000004  013664                TYPE,E.GAP
 1805  002670  113702  001120                MOVB    @#GAP,R2                ;GET GAP #
 1806  002674  004767  177362                JSR     PC,TYPOCT               ;TYPE GAP #
 1807  002700  000004  001374                TYPE,CRLF
 1808  002704  012603                        MOV     (SP)+,R3                ;RESTORE R3 AND R2
 1809  002706  012602                        MOV     (SP)+,R2
 1810  002710  000207                        RTS     PC
 1811
 1812                                  .SBTTL          ASCII TO OCTAL CONVERT SUBROUTINE
 1813                                ;SUBROUTINE TO CONVERT ASCII DATA TO OCTAL. CONVERTED OCTAL DATA
 1814                                ;IS LEFT IN OCTAL0 <15-00>.
 1815  002712                        CNVTAO:
 1816  002712  004767  177272                JSR     PC,.SAVE                ;SAVE REGISTERS ON THE STACK
 1817  002716  012700  001264                MOV     #INBUF,R0               ;SET PTR TO ASCII DATA
 1818  002722  012701  001116                MOV     #OCTAL0,R1              ;GET ADDRESS OF OCTAL DATA
 1819  002726  005011                        CLR     (R1)                    ;CLEAR OUT OLD OCTAL DATA
 1820  002730  005061  000002                CLR     2(R1)
 1821  002734  122710  000015        1$:     CMPB    #CR,(R0)                ;<CR> TERMINATES INPUT
 1822  002740  001414                        BEQ     3$
 1823  002742  112002                        MOVB    (R0)+,R2                ;GET 'OCTAL' DATA
 1824  002744  042702  177770                BIC     #177770,R2              ;STRIP UNUSED BITS
 1825  002750  012703  000003                MOV     #3,R3                   ;SET SHIFT COUNT
```

```
1826  002754  006311                2$:     ASL     (R1)                    ;SHIFT LAST
1827  002756  006161  000002              ROL     2(R1)                   ;OCTAL DIGIT
1828  002762  005303                      DEC     R3
1829  002764  001373                      BNE     2$
1830  002766  050211                      BIS     R2,(R1)                 ;AND INSERT THIS DIGIT
1831  002770  000761                      BR      1$                      ;GO GET NEXT DIGIT
1832  002772                        3$:
1833  002772  004767  177234              JSR     PC,.RESTORE             ;RESTORE REGISTERS FROM THE STACK
1834  002776  000207                      RTS     PC                      ;RETURN
1835
1836                                          .SBTTL          PUBLISH SUBROUTINE
1837                                  ;THE PUBLISH SUBROUTINE AVERAGES THE RECORDED TIMES FOR EACH TEST IT-
1838                                  ;ERATION (IF 16. ITERATIONS) AND PLACES THE AVERAGE RESULT IN 'ATIME'.
1839                                  ;IT TYPES THE NAME OF THE FUNCTION THAT WAS TIMED,THE TIME SPEC-
1840                                  ;IFICATION AND THE ACTUAL TIME .
1841
1842  003000                        PUBLISH:
1843  003000  004767  177204              JSR     PC,.SAVE                ;SAVE REGISTERS ON THE STACK
1844  003004  012700  001014              MOV     #ATIMTBL,R0     ;GET TABLE ADDRESS CONTAINING TIMES
1845  003010  113701  001121              MOVB    @#ITCNT,R1      ;GET # OF ENTRIES (GIVEN BY ITERATION COUNT)
1846  003014  122701  000001              CMPB    #1,R1                   ;BRANCH IF SINGLE ITERATION
1847  003020  001423                      BEQ     4$
1848  003022  005002                      CLR     R2                      ;CLEAR 'SUM' REGISTERS
1849  003024  005003                      CLR     R3
1850  003026  122701  000004              CMPB    #4,R1                   ;BRANCH IF 4. ITERATIONS
1851  003032  001402                      BEQ     1$
1852  003034  000000                      HALT                            ;ITERATION COUNT MUST BE 1 OR 16.
1853  003036  000777                      BR      .                       ;DO NOT CHANGE POSIT OF SW11
1854                                                                        ;WHEN TEST IS RUNNING.
1855
1856  003040  062002              1$:     ADD     (R0)+,R2                ;SUM INDIVIDUAL TIMES
1857  003042  005503                      ADC     R3
1858  003044  005301                      DEC     R1
1859  003046  001374                      BNE     1$
1860
1861  003050  012700  000002       2$:     MOV     #2,R0
1862  003054  006203               3$:     ASR     R3                      ;SHIFT TIME IN R3 & R2 4 PLACES
1863  003056  006002                      ROR     R2                      ;RIGHT = DIVIDE BY 16.
1864  003060  005300                      DEC     R0
1865  003062  001374                      BNE     3$
1866  003064  010237  001012              MOV     R2,@#ATIME              ;MOVE AVERAGED TIMES
1867
1868  003070  113700  001122       4$:     MOVB    @#TSTNUM,R0             ;GET TEST #
1869  003074  006300                      ASL     R0
1870  003076  016067  001672  000002      MOV     NAMPTR(R0),5$           ;GET TEST NAME STRING ADDRESS
1871  003104  000004                      TYPE
1872  003106  000000               5$:     .WORD   0
1873  003110  113702  001122              MOVB    @#TSTNUM,R2             ;GET TEST #
1874  003114  004767  177364              JSR     PC,OUTSPC               ;OUTPUT TIMES
1875  003120  004767  177106              JSR     PC,.RESTORE             ;RESTORE REGISTERS FROM THE STACK
1876  003124  000207                      RTS     PC
1877
1878                                          .SBTTL          INPUT SUBROUTINE
1879                                  ;SUBROUTINE TO GET TTY INPUT
1880                                  ;CALL:  JSR     PC,.INPUT
1881                                  ;INPUT DATA IS RETUNED IN BUFFER BEGINNING AT INBUF.
```

```
 1882
 1883  003126  010046                .INPUT: MOV     R0,-(SP)        ;SAVE R0 ON THE STACK
 1884  003130  012700  001264        1$:     MOV     #INBUF,R0
 1885  003134  105737  177560        2$:     TSTB    @#TKS
 1886  003140  100375                        BPL     2$
 1887
 1888  003142  113746  177562                MOVB    @#TKB,-(SP)     ;GET CHARACTER
 1889  003146  042716  000200                BIC     #200,(SP)
 1890  003152  122716  000177                CMPB    #177,(SP)       ;CHECK RUBOUT
 1891  003156  001004                        BNE     3$
 1892  003160  124026                        CMPB    -(R0),(SP)+     ;REMOVE CHARACTER FROM INPUT
 1893  003162  000004  001377                TYPE,BKSLSH
 1894  003166  000762                        BR      2$              ;WAIT FOR NEXT CHARACTER
 1895  003170  122716  000025        3$:     CMPB    #CNTRLU,(SP)    ;CHECK CONTROL U ( U)
 1896  003174  001004                        BNE     4$
 1897  003176  005726                        TST     (SP)+
 1898  003200  000004  001374                TYPE,CRLF
 1899  003204  000751                        BR      1$
 1900  003206  111637  001401        4$:     MOVB    (SP),@#ECHO
 1901  003212  111620                        MOVB    (SP),(R0)+
 1902  003214  122726  000015                CMPB    #CR,(SP)+
 1903  003220  001403                        BEQ     5$
 1904  003222  000004  001401                TYPE,ECHO
 1905  003226  000742                        BR      2$
 1906  003230  000004  001374        5$:     TYPE,CRLF
 1907  003234  012600                        MOV     (SP)+,R0
 1908  003236  000207                        RTS     PC
 1909
 1910                                ;KEYBOARD INTERRUPT SERVICE ROUTINE
 1911  003240  113746  177562        TKISR:  MOVB    @#TKB,-(SP)     ;GET TYPED CHARACTER
 1912  003244  042716  000200                BIC     #200,(SP)       ;STRIP PARITY BIT
 1913  003250  022716  000017                CMP     #CNTRLO,(SP)    ;BRANCH IF NOT CONTROL O ( O)
 1914  003254  001003                        BNE     1$
 1915  003256  112667  176507                MOVB    (SP)+,$CNTRLO   ;SET CONTROL O INDICATOR IN TYPE ROUTINE
 1916  003262  000002                        RTI                     ;EXIT
 1917
 1918  003264  122726  000003        1$:     CMPB    #3,(SP)+        ;BRANCH IF NOT CONTROL C ( C)
 1919  003270  001003                        BNE     2$
 1920  003272  000005                        RESET
 1921  003274  000137  005340                JMP     @#INIT          ;RESTART PROGRAM
 1922  003300  000002                2$:     RTI                     ;EXIT
 1923                                        .SBTTL          ERROR SERVICE ROUTINES
 1924                                ;ROUTINE TO PROCESS ERROR TRAPS (TRAPS TO 4)
 1925  003302  000000                ERRTRP: HALT
 1926
 1927                                ;ERROR SERVICE ROUTINE
 1928                                ;THIS ROUTINE PROCESSES TWO TYPES OF ERRORS (OUT OF RANGE AND HARDWARE)
 1929                                ;THE CALLS FOR AN OUT OF RANGE ERROR ARE <HLT+1>,<HLT+2> AND, FOR A
 1930                                ;HARDWARE ERROR THE CALL IS <HLT>.
 1931
 1932  003304  000240                .HLT:   NOP
 1933  003306  004767  176676                JSR     PC,.SAVE                ;SAVE REGISTERS ON THE STACK
 1934  003312  110637  001123        1$:     MOVB    SP,@#ERFLG              ;SET ERROR FLAG
 1935  003316  032777  020000  175454        BIT     #SW13,@SWR              ;BRANCH IF NO TYPOUT
 1936  003324  001075                        BNE     4$
 1937  003326  000004  013465                TYPE,E.HDR
```

```
1938  003332  113702  001122                  MOVB    @#TSTNUM,R2             ;GET TEST #
1939  003336  004767  176720                  JSR     PC,TYPOCT               ;AND TYPE IT
1940  003342  016600  000016                  MOV     16(SP),R0               ;GET RETURN PC
1941  003346  162700  000002                  SUB     #2,R0                   ;NOW PC OF HLT CALL
1942  003352  111000                          MOVB    (R0),R0                 ;NOW HLT CALL ITSELF
1943  003354  001417                          BEQ     2$                      ;BRANCH IF HLT
1944  003356  000004  013550                  TYPE,E.HDR2
1945  003362  122700  000002                  CMPB    #2,R0                   ;BRANCH IF NOT HLT+2
1946  003366  001005                          BNE     10$
1947  003370  004767  177204                  JSR     PC,OUTGAP               ;TYPE GAP SPECIFIED TIMES
1948  003374  000004  001374                  TYPE,CRLF
1949  003400  000447                          BR      4$
1950  003402  004767  177076          10$:    JSR     PC,OUTSPC               ;TYPE SPECIFIED TIMES
1951  003406  000004  001374                  TYPE,CRLF
1952  003412  000442                          BR      4$
1953  003414  016500  000014          2$:     MOV     ER(R5),R0
1954  003420  032765  002000  000032          BIT     #PE1600,TC(R5)
1955  003426  001403                          BEQ     20$
1956  003430  042700  102100                  BIC     #102100,R0
1957  003434  000402                          BR      21$
1958  003436  042700  102300          20$:    BIC     #102300,R0
1959  003442  005700                  21$:    TST     R0
1960  003444  001003                          BNE     22$
1961  003446  000004  013441                  TYPE,E.SFT              ;TYPE SOFT ERROR MESSAGE
1962  003452  000434                          BR      6$
1963
1964  003454  000004  013475          22$:    TYPE,E.HDR1
1965  003460  010500                          MOV     R5,R0                   ;GET FIRST ADDRESS OF REGS.
1966  003462  012701  000007                  MOV     #7.,R1                  ;TYPE FIRST 7 REGS.
1967  003466  012002                  3$:     MOV     (R0)+,R2                ;GET REG CONTENTS
1968  003470  004767  176566                  JSR     PC,TYPOCT               ;AND TYPE IT
1969  003474  000004  001407                  TYPE,SPACE2
1970  003500  005301                          DEC     R1
1971  003502  001371                          BNE     3$
1972  003504  016502  000032                  MOV     TC(R5),R2               ;GET CONTENTS OF TC REGISTER
1973  003510  004767  176546                  JSR     PC,TYPOCT
1974  003514  000004  001374                  TYPE,CRLF
1975
1976  003520  032777  001000  175252  4$:     BIT     #SW09,@SWR              ;BRANCH IF NO RING THE BELL
1977  003526  001402                          BEQ     5$
1978  003530  000004  001403                  TYPE,BELL
1979  003534  005777  175240          5$:     TST     @SWR                    ;HALT ON ERROR?
1980  003540  100001                          BPL     6$
1981  003542  000000                          HALT
1982  003544                          6$:
1983  003544  004767  176462                  JSR     PC,.RESTORE             ;RESTORE REGISTERS FROM THE STACK
1984  003550  000002                          RTI                             ;RETURN
1985
1986
1987                                          .SBTTL          SCOPE SUBROUTINE
1988                                  ;SCOPE ROUTINE
1989                                  ;THIS ROUTINE IS ENTERED UPON COMPLETION OF EACH SUBTEST
1990                                  ;THE SCOPE ROUTINE:
1991                                  ;       OUTPUTS TIME SPEC ON EACH ITERATION IF SW08 IS SET
1992                                  ;       REPEATS TEST IF SW14 IS SET
1993                                  ;       STORES ACTUAL TIME FOR FUNCTION IN TIME TABLE (ATIMTBL)
```

```
                        ;       PUBLISHES TIME IF SW10=0
                        ;       UPDATES ITERATION COUNT AND IF ITERATIONS COMPLETE CONTINUES
                        ;       TO NEXT TEST, OTHERWISE REPEATS TEST.
                        ;       DELAYS BEFORE CONTINUING OR REPEATING TEST.
                        ;       INITIALIZES DRIVE
                        ;RETURNS:      R5=BASE ADDRESS OF TM02 REGISTERS (ADDRESS OF CS1)
                        ;              R1='DS' REG ADDRESS
                        ;              R0='FC' REG ADDRESS

003552  013705  001010        .SCOPE: MOV     @#TMBASE,R5             ;SET R5 TO FIRST TM REG
003556  032777  000400  175214          BIT     #SW08,@SWR              ;BRANCH IF SPECIFICATION LINE
003564  001404                        BEQ     10$                     ;NOT DESIRED ON EACH ITERATION
003566  113702  001122                MOVB    @#TSTNUM,R2             ;GET TEST NUMBER
003572  004767  176706                JSR     PC,OUTSPC               ;OUTPUT TIME  RECORDED
003576  032777  040000  175174  10$:  BIT     #SW14,@SWR              ;BRANCH IF CONTINUOS LOOP
003604  001417                        BEQ     2$                      ;NOT DESIRED
003606  004767  000542          1$:   JSR     PC,DELAY                ;DELAY 350 MS
003612  004767  000772                JSR     PC,RHINIT               ;INIT
003616  105037  001123                CLRB    @#ERFLG                 ;CLEAR ERROR FLAG
003622  016716  175154                MOV     SCPADR,(SP)
003626  010501                        MOV     R5,R1
003630  062701  000012                ADD     #DS,R1                  ;ADDRESS OF 'DS' REG IS IN R1
003634  010500                        MOV     R5,R0
003636  062700  000006                ADD     #FC,R0                  ;ADDRESS OF 'FC' REG IS IN R0
003642  000002                        RTI

003644  105737  001123          2$:   TSTB    @#ERFLG                 ;BRANCH IF ERROR FLAG IS SET
003650  001006                        BNE     3$
003652  113700  001121                MOVB    @#ITCNT,R0              ;GET ITERATION COUNT
003656  006300                        ASL     R0                      ;STORE TIME IN TABLE
003660  013760  001012  001014        MOV     @#ATIME,ATIMTBL(R0)
003666  105237  001121          3$:   INCB    @#ITCNT                 ;INCREMENT ITERATION COUNT
003672  032777  004000  175100        BIT     #SW11,@SWR              ;BRANCH IF SINGLE ITERATION DESIRED
003700  001004                        BNE     4$
003702  122737  000004  001121        CMPB    #4,@#ITCNT              ;BRANCH IF ITERATIONS INCOMPLETE
003710  001336                        BNE     1$
003712  011637  001002          4$:   MOV     (SP),@#SCPADR           ;SET SCOPE ADDRESS TO NEXT TEST
003716  032777  002000  175054        BIT     #SW10,@SWR              ;BRANCH IF NO PUBLICATION DESIRED
003724  001002                        BNE     5$
003726  004767  177046                JSR     PC,PUBLISH              ;GO PUBLISH TEST DATA
003732  105037  001121          5$:   CLRB    @#ITCNT                 ;RESET ITERATION COUNT
003736  105777  175036                TSTB    @SWR                    ;BRANCH IF USER DOES NOT WANT TO
003742  001721                        BEQ     1$                      ;HALT ON A SELECTED TEST
003744  017746  175030                MOV     @SWR,-(SP)              ;GET SWITCHES
003750  042716  177740                BIC     #177740,(SP)            ;CLEAR ALL BUT TEST #
003754  005316                        DEC     (SP)                    ;FORM TEST # -1
003756  123726  001122                CMPB    @#TSTNUM,(SP)+          ;BRANCH IF NOT AT TEST
003762  001311                        BNE     1$
003764  000000                        HALT
003766  000707                        BR      1$

                                .SBTTL  TIMER SUBROUTINES

                        ;SUBROUTINE TO SYNCHRONIZE THE TIMER AND TURN IT ON.
                        ;REGISTER 4 IS CLEARED, AND THE OSCILLATOR POLARITY IS MONITORED
                        ;THE ROUTINE IS EXITED WHEN THE OSCILLATOR POLARITY CHANGES WITH R3
```

```
2050                                    ;SET TO INDICATE THE POLARITY OF THE OSCILLATOR.
2051                                    ;CALL:  JSR     PC,TIMON
2052                                    ;RETURNS:       R3 SET TO INDICATE LAST POLARITY (+24/-24=0/1)
2053                                    ;               R4 = 0
2054
2055  003770  005004                    TIMON:  CLR     R4                      ;CLEAR TIME COUNT
2056  003772  012703  000024                    MOV     #24,R3                  ;SET POLARITY TO '0' STATE
2057  003776  032765  000100  000024            BIT     #OSC,MR(R5)             ;BRANCH IF POLARITY IS '0'
2058  004004  001405                            BEQ     2$
2059  004006  032765  000100  000024  1$:      BIT     #OSC,MR(R5)             ;WAIT FOR OSCILLATOR TO RETURN
2060  004014  001374                            BNE     1$
2061  004016  000405                            BR      4$
2062
2063  004020  005403                    2$:     NEG     R3                      ;NEGATE PREV POLARITY INDICATOR
2064  004022  032765  000100  000024  3$:      BIT     #OSC,MR(R5)             ;WAIT FOR OSCILLATOR TO RETURN
2065  004030  001774                            BEQ     3$                      ;TO '1' STATE
2066  004032  000207                    4$:     RTS     PC
2067
2068                                    ;SUBROUTINE TO COUNT TIME
2069                                    ;EACH TIME THE OSCILLATOR TOGGLES (BIT <06> IN MR REG) REGISTER
2070                                    ;R4 IS INCREMENTED, AND THE REGISTER R3 IS NEGATED TO INDICATE
2071                                    ;THE LAST STATE OF THE OSCILLATOR.
2072                                    ;CALL   JMP     TIMER(R3)               ;R3 IS SET BY TIMON ROUTINE
2073                                    ;       R2=RETURN ADDRESS TO CALLER
2074                                    ;NOTE: THE TIME TO EXECUTE THIS ROUTINE IS VERY CRITICAL. IT MUST BE
2075                                    ;LESS THAN 40 US.
2076
2077                                    ;ENTER HERE VIA JMP  TIMER(R3) WHEN R3=-24 (PREV STATE=1)
2078  004034  032765  000100  000024  TIMER1: BIT     #OSC,MR(R5)             ;BRANCH IF CURRENT STATE IS '0'
2079  004042  001406                            BEQ     TIMER                   ;GO INCREMENT TIME
2080  004044  000112                            JMP     (R2)                    ;RETURN TO TEST
2081
2082          004060                            .=TIMER1+24
2083  004060  005403                    TIMER:  NEG     R3                      ;NEGATE PREV STATE INDICATOR
2084  004062  005204                            INC     R4                      ;INCREMENT 'TICK' COUNT
2085  004064  100401                            BMI     TIMERR                  ;BRANCH ON OVERFLOW
2086  004066  000112                            JMP     (R2)                    ;RETURN TO TEST
2087  004070  000004  013576            TIMERR: TYPE,E.TIMOV                    ;TYPE 'TIMER OVERFLOWED'
2088  004074  104400                            HLT                             ;REPORT HARDWARE ERROR
2089  004076  000177  174700                    JMP     @SCPADR                 ;RETURN TO BEGINNING OF TEST
2090
2091          004104                            .=TIMER+24
2092                                    ;ENTER HERE VIA JMP  TIMER(R3) WHEN R3=+24 (PREV STATE=0)
2093  004104  032765  000100  000024  TIMER0: BIT     #OSC,MR(R5)             ;BRANCH IF CURRENT STATE = '1'
2094  004112  001362                            BNE     TIMER
2095  004114  000112                            JMP     (R2)
2096
2097                                    ;SUBROUTINE TO CHECK TIME RECORDED BY SUBTEST.
2098                                    ;THIS SUBROUTINE COMPUTES THE ACTUAL TIME (IN MICROSECONDS) AND CHECKS
2099                                    ;THAT THE TIME RECORDED BY THE SUBTEST IS CORRECT BY COMPARING THE TIME
2100                                    ;WITH THE HIGH LIMIT (STIMTBL(R0)) AND THE LOW LIMIT (STIMTBL+2(R0)).
2101                                    ;IF THE TIME IS OUT OF RANGE AN OUT OF RANGE ERROR TYPEOUT RESULTS.
2102                                    ;THE SUBROUTINE IS ENTERED WITH:
2103                                    ;       R4=TICK COUNT
2104
2105  004116                            TIMOK:
```

```
 2106  004116  004767  176066                JSR     PC,.SAVE                ;SAVE REGISTERS ON THE STACK
 2107  004122  012700  000104                MOV     #68.,R0                 ;GET TIME PER TICK
 2108  004126  010401                        MOV     R4,R1                   ;GET TICKS COUNT
 2109  004130  005002                        CLR     R2                      ;CLEAR SUMMING REGISTERS
 2110  004132  005003                        CLR     R3
 2111  004134  060002                1$:     ADD     R0,R2                   ;MULTIPLY TIME PER TICK
 2112  004136  005503                        ADC     R3                      ;BY TICK COUNT
 2113  004140  005301                        DEC     R1
 2114  004142  001374                        BNE     1$
 2115  004144  010246                        MOV     R2,-(SP)                ;DIVIDE COUNT BY 10.
 2116
 2117  004146  010346                        MOV     R3,-(SP)
 2118  004150  012746  000012                MOV     #10.,-(SP)
 2119  004154  004767  000262                JSR     PC,DIVIDE
 2120  004160  005726                        TST     (SP)+                   ;DISCARD REMAINDER
 2121  004162  012637  001012                MOV     (SP)+,@#ATIME           ;STORE QUOTIENT
 2122  004166  113700  001122                MOVB    @#TSTNUM,R0             ;GET TEST #
 2123  004172  006300                        ASL     R0
 2124  004174  006300                        ASL     R0
 2125  004176  023760  001012  001416        CMP     @#ATIME,STIMTBL(R0)     ;CHECK THAT TIME IS WITHIN
 2126  004204  101004                        BHI     2$                      ;LIMITS SPECIFIED
 2127  004206  023760  001012  001420        CMP     @#ATIME,STIMTBL+2(R0)
 2128  004214  101001                        BHI     3$
 2129  004216  104401                2$:     HLT+1                           ;CALL ERROR ROUTINE
 2130  004220                        3$:
 2131  004220  004767  176006                JSR     PC,.RESTORE             ;RESTORE REGISTERS FROM THE STACK
 2132  004224  000207                        RTS     PC                      ;RETURN
 2133
 2134                                ;SUBROUTINE TO CHECK INDIVIDUAL GAP TIMES (PRODUCED BY TST021)
 2135                                ;SUBROUTINE COMPUTES THE ACTUAL TIME (IN MICROSECONDS) AND CHECKS
 2136                                ;THAT THE GAP TIME RECORDED BY THE SUBTEST (TST021) BY COMPARING THE
 2137                                ;TIME WITH THE MAX LIMIT (GTIMTBL-GAPTBL(R1)) AND THE MIN LIMIT
 2138                                ;(GTIMTBL+2-GAPTBL(R1)).
 2139                                ;CALL:  MOV     #TICK COUNT,R4          ;R4 CONTAINS TICK COUNT
 2140                                ;       MOVB    #GAP,@#GAP              ;LOCATION GAP CONTAINS GAP #
 2141                                ;       JSR     PC,GAPOK
 2142
 2143  004226                        GAPOK:
 2144  004226  004767  175756                JSR     PC,.SAVE                ;SAVE REGISTERS ON THE STACK
 2145  004232  012700  000104                MOV     #68.,R0                 ;GET TIME PER TICK
 2146  004236  010401                        MOV     R4,R1                   ;GET TICK COUNT
 2147  004240  005002                        CLR     R2                      ;CLEAR SUMMING REGISTERS
 2148  004242  005003                        CLR     R3
 2149  004244  060002                1$:     ADD     R0,R2                   ;MULTIPLY TICK COUNT
 2150  004246  005503                        ADC     R3                      ;BY TIME PER TICK
 2151  004250  005301                        DEC     R1
 2152  004252  001374                        BNE     1$
 2153
 2154  004254  010246                        MOV     R2,-(SP)                ;DIVIDE TIME BY 10.
 2155  004256  010346                        MOV     R3,-(SP)
 2156  004260  012746  000012                MOV     #10.,-(SP)
 2157  004264  004767  000152                JSR     PC,DIVIDE
 2158  004270  005726                        TST     (SP)+                   ;DISCARD REMAINDER
 2159  004272  012637  001012                MOV     (SP)+,@#ATIME           ;STORE QUOTIENT
 2160  004276  113703  001120                MOVB    @#GAP,R3                ;GET GAP #
 2161  004302  006303                        ASL     R3                      ;MULTPLY BY 4
```

```
                                                    ;TO GET AT TABLE ENTRY
                                                    ;CHECK TIME (MAX)
                                                    ;CHECK TIME (MIN)
                                                    ;REPORT OUT OF RANGE ERROR
                                                    ;BRANCH IF TIMES NOT WANTED
                                                    ;TYPE GAP TIMES

                                                    ;RESTORE REGISTERS FROM THE STACK
                                                    ;RETURN TO TEST

                                .SBTTL              DELAY SUBROUTINES
                                ;THIS SUBROUTINE CAUSES A DELAY OF 350 MS.
                                                    ;SAVE R2 ON THE STACK
                                                    ;SET RETURN ADDRESS FOR TIMER
                                                    ;GO TO TIMER & RETURN VIA R2
                                                    ;RESTORE R2

                                ;THIS SUBROUTINE ALLOWS A CALLER SPECIFIED DELAY (UP TO 65MS.)
                                ;CALL:  MOV     DELAY TIME,DELTIM       ;LOAD DELAY TIME (IN US)
                                ;       JSR     PC,DELAYV
                                                    ;BRANCH IF 0 DELAY
                                                    ;TURN TIMER ON
                                                    ;SAVE R2 ON THE STACK
                                                    ;SET RETURN ADDRESS FROM TIMER
                                                    ;GO TO TIMER & RETURN VIA R2
                                                    ;RESTORE R2

                                .SBTTL  DIVIDE SUBROUTINE
                                ;THIS SUBROUTINE DIVIDES A DOUBLE PRECISION # AND RETURNS THE RESULT
                                ;TO THE CALLER ON THE STACK. BOTH DIVIDEND & DIVISOR MUST BE POSITIVE.
                                ;CALL:  MOV     LEAST SIGNIFICANT HALF DIVIDEND,-(SP)
                                ;       MOV     #MOST SIGNIFICANT HALF DIVIDEND,-(SP)
                                ;       MOV     #DIVISOR,-(SP)
                                ;       JSR     PC,DIVIDE
                                ;RETURN
                                ;       (SP)=REMAINDER ON STACK
                                ;       2(SP)=QUOTIENT

                                ;NOTE:  THIS SUBROUTINE DESTROYS PREVIOUS CONTENTS OF R0,R1,R2 & R3.

004442  005046                  DIVIDE: CLR     -(SP)                   ;SAVE LOC FOR SIGNS
```

```
2218  004444  012746  000021                  MOV     #17.,-(SP)              ;SET ITERATION COUNT
2219  004450  016601  000012                  MOV     12(SP),R1               ;GET LSH DIVIDEND
2220  004454  016600  000010                  MOV     10(SP),R0               ;GET MSH DIVIDEND
2221  004460  016602  000006                  MOV     6(SP),R2                ;GET DIVISOR
2222  004464  005402                          NEG     R2                      ;NEGATE DIVISOR
2223  004466  000241                          CLC                             ;CLEAR 'C' BIT IN PSW
2224  004470  000405                          BR      2$
2225  004472  006100                  1$:     ROL     R0                      ;ROTATE MSH DIVIDEND
2226  004474  010003                          MOV     R0,R3                   ;SAVE IN R3
2227  004476  060203                          ADD     R2,R3                   ;SUBTRACT DIVISOR FROM MSH DIVIDEND
2228  004500  103001                          BCC     2$                      ;BRANCH IF DIVIDEND > DIVISOR
2229  004502  010300                          MOV     R3,R0                   ;SAVE REMAINDER IN R0
2230  004504  006101                  2$:     ROL     R1                      ;ROTATE LSH DIVIDEND
2231  004506  005316                          DEC     (SP)                    ;DECREMENT ITERATION COUNT
2232  004510  001370                          BNE     1$
2233  004512  005726                          TST     (SP)+                   ;POP ITERATION COUNTER
2234  004514  005726                          TST     (SP)+                   ;POP SIGN CORRECTION
2235  004516  010166  000006                  MOV     R1,6(SP)                ;PUSH REMAINDER ON STACK
2236  004522  010066  000004                  MOV     R0,4(SP)                ;PUSH QUOTIENT ONTO STACK
2237  004526  012616                          MOV     (SP)+,(SP)
2238  004530  000207                          RTS     PC
2239
2240                                          .SBTTL  DRIVE SUBROUTINES
2241                                  ;SUBROUTINE TO CHECK IF DRIVE IS AVAILABLE
2242                                  ;CALL:  MOVB    DRIVE#,DRVNUM
2243                                  ;       JSR     PC,DRVAVA
2244                                  ;RETURN:        'C' BIT SET IF NOT AVAILABLE
2245  004532  113765  001004  000010  DRVAVA: MOVB    @#DRVNUM,CS2(R5)        ;LOAD DRIVE #
2246  004540  032765  040000  000026          BIT     #TAP,DT(R5)             ;CHECK IF TAPE UNIT
2247  004546  001003                          BNE     1$
2248  004550  004767  000034                  JSR     PC,RHINIT
2249  004554  000262                          SEV                             ;SET 'V' TO IND NOT AVAIL
2250  004556  000207                  1$:     RTS     PC                      ;RETURN
2251
2252                                  ;SUBROUTINE TO CHECK IF TU45 SLAVE IS AVAILABLE FOR TEST
2253                                  ;CALL:  MOVB    DRIVE #,@#DRVNUM        ;PASS DRIVE # VIA DRVNUM
2254                                  ;       MOVB    SLAVE #,@#SLVNUM        ;PASS SLAVE # VIA SLVNUM
2255                                  ;       JSR     PC,SLVAVA               ;CALL SUBROUTINE
2256  004560  113765  001004  000010  SLVAVA: MOVB    @#DRVNUM,CS2(R5)        ;LOAD DRIVE #
2257  004566  113765  001005  000032          MOVB    @#SLVNUM,TC(R5)         ;AND SLAVE #
2258  004574  032765  002000  000026          BIT     #SPR,DT(R5)             ;BRANCH IF SLAVE PRESENT
2259  004602  001001                          BNE     1$
2260  004604  000262                          SEV                             ;SET 'V' TO INDICATE NO SLAVE
2261  004606  000207                  1$:     RTS     PC
2262
2263                                  ;SUBROUTINE TO  INITIALIZE RH CONTROLLER
2264                                  ;CALL:  JSR PC,RHINIT
2265
2266  004610  012765  000040  000010  RHINIT: MOV     #40,CS2(R5)
2267  004616  113765  001004  000010          MOVB    @#DRVNUM,CS2(R5)
2268  004624  005046                          CLR     -(SP)
2269  004626  113716  001005                  MOVB    @#SLVNUM,(SP)
2270  004632  012665  000032                  MOV     (SP)+,TC(R5)            ;LOAD SLAVE # INTO TC REG
2271  004636  052765  000300  000032          BIS     #NORM11,TC(R5)
2272  004644  000207                          RTS     PC
2273
```

```
                                        ;SUBROUTINE TO WAIT FOR DRIVE READY (DRY)
004646  005027                          WAITRDY:CLR     (PC)+                   ;CLEAR WAIT TIMER
004650  000000                          WAITTIM:.WORD   0
004652  105765  000012                  1$:     TSTB    DS(R5)                  ;WAIT FOR READY TO SET
004656  100406                                  BMI     2$
004660  005267  177764                          INC     WAITTIM                 ;INCREMENT WAIT TIMER
004664  001372                                  BNE     1$                      ;BRANCH IF TIME HAS NOT EXPIRED
004666  000004  013623                          TYPE,E.TIMEXP                   ;TYPE 'TIME EXPIRED WAITING FOR RDY'
004672  000425                                  BR      99$                     ;TAKE ERROR EXIT
004674  032765  002000  000012  2$:     BIT     #EOT,DS(R5)             ;CHECK FOR END OF TAPE
004702  001415                                  BEQ     3$                      ;BRANCH IF NO EOT
004704  000004  012660                          TYPE,M.NAM
004710  000004  013206                          TYPE,M.EOT                      ;TYPE 'END OF TAPE'
004714  004767  000032                          JSR     PC,.REWIND              ;REWIND SLAVE
004720  102412                                  BVS     99$                     ;BRANCH IF ERROR ON REWIND
004722  004767  000106                          JSR     PC,WRITE                ;WRITE A RECORD
004726  005215                                  INC     (R5)                    ;SET 'GO' BIT
004730  004767  177712                          JSR     PC,WAITRDY              ;WAIT FOR READY
004734  000404                                  BR      99$                     ;TAKE ERROR EXIT
004736  032765  040000  000012  3$:     BIT     #ERR,DS(R5)             ;CHECK ERROR EXIT
004744  001401                                  BEQ     100$
004746  000262                          99$:    SEV
004750  000207                          100$:   RTS     PC

                                        ;SUBROUTINE TO REWIND A UNIT (DRIVE/SLAVE COMBINATION)
                                        ;CALL   MOVB    DRIVE #,@#DRVNUM
```

```
                                ;       MOVB    SLAVE #,@#SLVNUM
                                ;       JSR     PC,.REWIND
                                ;SUBROUTINE RETURNS TO CALLER WITH SELECTED SLAVE AT 'BOT', & 'V' SET IF
                                ;AN ERROR OCCURS.
                                
004752  004767  177632        .REWIND:JSR     PC,RHINIT               ;INITIALIZE CONTROLLER
```

```
2306  004756  004367  000206            JSR     R3,TMCMD                ;GO TO TM COMMAND SUBROUTINE
2307  004762  000000                    .WORD   0                       ;BUS ADDRESS (NOT USED)
2308  004764  000000                    .WORD   0                       ;WORD COUNT (NOT USED)
2309  004766  000000                    .WORD   0                       ;FRAME COUNT (NOT USED)
2310  004770  000006                    .WORD   RWD                     ;REWIND COMMAND
2311  004772  005215                    INC     (R5)                    ;SET 'GO' BIT
2312  004774  032765  000002  000012  1$:     BIT     #BOT,DS(R5)             ;BRANCH IF 'BOT' SET
2313  005002  001005                    BNE     2$
2314  005004  032765  040000  000012        BIT     #ERR,DS(R5)             ;CHECK ERROR BIT
2315  005012  001006                    BNE     99$                     ;BRANCH IF ERROR BIT SET
2316  005014  000767                    BR      1$
2317
2318  005016  032765  020000  000012  2$:     BIT     #PIP,DS(R5)             ;WAIT FOR TAPE MOTION TO STOP
2319  005024  001374                    BNE     2$
2320  005026  000401                    BR      100$
2321  005030  000262                99$:    SEV
2322  005032  000207                100$:   RTS     PC
2323
2324                                  ;SUBROUTINE TO WRITE 256. WORD RECORD
2325                                  ;CALL:  JSR     PC,WRITE
2326
2327  005034  004367  000130        WRITE:  JSR     R3,TMCMD                ;GO TO TM COMMAND SUBROUTINE
2328  005040  015176                        .WORD   WTBUF                   ;BUS ADDRESS
2329  005042  177600                        .WORD   WRDCNT                  ;WORD COUNT
2330  005044  177400                        .WORD   FRMCNT                  ;FRAME COUNT
2331  005046  000060                        .WORD   WFWD                    ;WRITE FORWARD COMMAND
2332  005050  000207                        RTS     PC
2333
2334                                  ;SUBROUTINE TO READ A 256. WORD RECORD.
2335                                  ;CALL:  JSR     PC,READ
2336
2337  005052  004337  005170        READ:   JSR     R3,@#TMCMD
2338  005056  015176                        .WORD   RDBUF                   ;ADDRESS OF READ BUFFER
2339  005060  177600                        .WORD   WRDCNT                  ;2'S COMPLEMENT OF WORD COUNT
2340  005062  177400                        .WORD   FRMCNT                  ;2'S COMPLEMENT OF FRAME COUNT
2341  005064  000070                        .WORD   RDFWD                   ;READ FORWARD COMMAND
2342  005066  000207                        RTS     PC
2343
2344                                  ;SUBROUTINE TO INITIATE READ REVERSE COMMAND
2345                                  ;CALL:  JSR     PC,REVRD
2346                                  ;
2347  005070  004367  000074        REVRD:  JSR     R3,TMCMD
2348  005074  015576                        .WORD   RDBUF+256.              ;ADDRESS OF READ REVERSE BUFFER
2349  005076  177600                        .WORD   WRDCNT                  ;2'S COMPLEMENT OF WORD COUNT
2350  005100  177400                        .WORD   FRMCNT                  ;2'S COMPLEMENT OF FRAME COUNT
2351  005102  000076                        .WORD   RDREV                   ;READ REVERSE COMMAND
2352  005104  000207                        RTS     PC
2353
2354                                  ;SUBROUTINE TO SPACE FORWARD 1 RECORD
2355  005106  012765  177777  000006  FWDSPC: MOV     #-1,FC(R5)              ;LOAD RECORD COUNT
2356  005114  012715  000031                MOV     #SPCFWD+1,(R5)          ;LOAD COMMAND
2357  005120  004767  177522                JSR     PC,WAITRDY              ;WAIT FOR READY
2358  005124  000207                        RTS     PC                      ;RETURN
2359
2360                                  ;SUBROUTINE TO WRITE A RECORD AND BACK SPACE OVER  THE RECORD.
2361  005126  004767  177702        WRT.BK: JSR     PC,WRITE                ;WRITE THE RECORD
```

```
2362  005132  005215                          INC     (R5)                    ;SET 'GO' BIT
2363  005134  004767  177506                  JSR     PC,WAITRDY
2364  005140  102412                          BVS     2$
2365  005142  012765  177777  000006          MOV     #-1,FC(R5)              ;LOAD RECORD COUNT
2366  005150  012715  000033                  MOV     #SPCREV+1,(R5)          ;LOAD COMMAND
2367  005154  004767  177466                  JSR     PC,WAITRDY
2368  005160  102402                          BVS     2$
2369  005162  004767  177166          1$:     JSR     PC,DELAY                ;WAIT FOR TAPE MOTION TO STOP
2370  005166  000207                  2$:     RTS     PC
2371
2372                                  ;SUBROUTINE TO LOAD A COMMAND
2373                                  ;CALL:  JSR     R3,TMCMD
2374                                  ;       .WORD   BUS ADDRESS
2375                                  ;       .WORD   WORD COUNT (2'S COMPLEMENT)
2376                                  ;       .WORD   FRAME COUNT (2'S COMPLEMENT)
2377                                  ;       .WORD   COMMAND
2378
2379  005170  012365  000004          TMCMD:  MOV     (R3)+,BA(R5)            ;LOAD BUS ADDRESS
2380  005174  012365  000002                  MOV     (R3)+,WC(R5)            ;LOAD WORD COUNT
2381  005200  012365  000006                  MOV     (R3)+,FC(R5)            ;LOAD FRAME COUNT
2382  005204  012315                          MOV     (R3)+,(R5)              ;LOAD COMMAND
2383  005206  000203                          RTS     R3                      ;RETURN
2384
2385                                          ;SUBROUTINE TO PRINT TU45 SERIAL NUMBER
2386                                          ;JSR    PC,SNPT
2387
2388  005210  016503  000030          SNPT:   MOV     SN(R5),R3
2389  005214  012701  001144                  MOV     #ODIGITS,R1
2390  005220  000303                          SWAB    R3
2391  005222  006003                          ROR     R3
2392  005224  006003                          ROR     R3
2393  005226  006003                          ROR     R3
2394  005230  006003                          ROR     R3                      ;GET FIRST DIGIT
2395  005232  042703  177760                  BIC     #177760,R3
2396  005236  052703  000260                  BIS     #260,R3
2397  005242  110321                          MOVB    R3,(R1)+                ;FILL FIRST DIGIT
2398  005244  016503  000030                  MOV     SN(R5),R3
2399  005250  000303                          SWAB    R3
2400  005252  042703  177760                  BIC     #177760,R3
2401  005256  052703  000260                  BIS     #260,R3
2402  005262  110321                          MOVB    R3,(R1)+                ;GET SECOND DIGIT
2403  005264  016503  000030                  MOV     SN(R5),R3
2404  005270  006003                          ROR     R3
2405  005272  006003                          ROR     R3
2406  005274  006003                          ROR     R3
2407  005276  006003                          ROR     R3
2408  005300  042703  177760                  BIC     #177760,R3
2409  005304  052703  000260                  BIS     #260,R3
2410  005310  110321                          MOVB    R3,(R1)+                ;GET THIRD DIGIT
2411  005312  016503  000030                  MOV     SN(R5),R3
2412  005316  042703  177760                  BIC     #177760,R3
2413  005322  052703  000260                  BIS     #260,R3
2414  005326  110321                          MOVB    R3,(R1)+                ;GET FOURTH DIGIT
2415  005330  105011                          CLRB    (R1)
2416  005332  000004  001144                  TYPE,ODIGITS                    ;TYPE SERIAL NUMBER
2417  005336  000207                          RTS     PC                      ;RETURN
```

```
2418
2419
2420                                        .SBTTL  PROGRAM INITIALIZATION
2421  005340  012706  000600          INIT: MOV     #STKPTR,SP              ;SET STACK PTR
2422  005344  105037  001124                CLRB    @#PRGFLG                ;CLEAR PROGRAM FLAG
2423  005350  105037  001121                CLRB    @#ITCNT                 ;CLEAR ITERATION COUNT
2424  005354  105037  001122                CLRB    @#TSTNUM                ;SET TEST # 0
2425  005360  105037  001123                CLRB    @#ERFLG                 ;CLEAR ERROR FLAG
2426  005364  105067  173540                CLRB    ASFLG                   ;CLEAR ASK FLAG
2427  005370  012737  000006  000004        MOV     #ERRVEC+2,@#ERRVEC
2428  005376  012737  000002  000006        MOV     #RTI,@#ERRVEC+2         ;CHECK IF 'LP' IS AVAILABLE
2429  005404  005037  001264          2$:   CLR     @#INBUF
2430  005410  000004  001374                TYPE,CRLF
2431  005414  000004  012660                TYPE,M.NAM                      ;TYPE TITLE
2432  005420  000004  012726                TYPE,I.REG                      ;ASK USER TO TYPE CONT BASE ADRS
2433  005424  004767  175476                JSR     PC,..INPUT              ;GET USER INPUT
2434  005430  004767  175256          4$:   JSR     PC,CNVTAO               ;CONVERT ASCII TO OCTAL
2435  005434  013737  001116  001010        MOV     @#OCTAL0,@#TMBASE       ;SET NEW ADDRESS
2436  005442  013705  001010          5$:   MOV     @#TMBASE,R5
2437
2438                                        ;ROUTINE TO CHECK IF CONTROLLER (RH11) IS AVAILAABLE
2439  005446  000261                       SEC                             ;SET 'C' IN PSW
2440  005450  005715                       TST     (R5)                    ;BRANCH IF CONTROLLER AVAIL
2441  005452  103003                       BCC     6$
2442  005454  000004  013245               TYPE,E.NCON
2443  005460  000727                       BR      INIT
2444  005462  012737  003302  000004  6$:   MOV     #ERRTRP,@#ERRVEC        ;SET ERROR TRAP VECTOR
2445                                        ;ROUTINE TO GET TM02 DRIVES USER DESIRES TO TEST
2446  005470  105037  001123        DRIVES: CLRB    @#ERFLG                 ;CLEAR ERROR FLAG
2447  005474  012701  001154                MOV     #DRVTBL,R1              ;MARK ALL DRIVES AS NOT TO
2448  005500  012700  000004                MOV     #4,R0                   ;BE TESTED. A '0' INDICATES
2449  005504  005021                 1$:   CLR     (R1)+                   ;THAT A DRIVE IS NOT TO BE
2450  005506  005300                       DEC     R0                      ;TESTED
2451  005510  001375                       BNE     1$
2452  005512  000004  012773               TYPE,I.DRVS
2453  005516  004767  175404               JSR     PC,..INPUT              ;GET USER INPUT
2454  005522  012700  001264               MOV     #INBUF,R0
2455  005526  122710  000101               CMPB    #'A,(R0)                ;AN 'A' SPECIFIES ALL
2456  005532  001013                       BNE     3$                      ;DRIVES TO BE TESTED
2457  005534  110667  173364               MOVB    SP,PRGFLG               ;SET FLAG TO IND ALL DRIVES
2458  005540  012701  001154               MOV     #DRVTBL,R1              ;MARK ALL DRIVES TO BE TESTED
2459  005544  012700  000004               MOV     #4,R0                   ;A '-1' INDICATES THAT A DRIVE
2460  005550  012721  177777          2$:   MOV     #-1,(R1)+               ;IS TO BE TESTED
2461  005554  005300                       DEC     R0
2462  005556  001374                       BNE     2$
2463  005560  000417                       BR      CHKDRV                  ;GO CHECK DRIVE AVAILABILITY
2464
2465                                        ;GET USER SELECTED DRIVES AND MARK EACH DRIVE SELECTED TO BE TESTED
2466  005562  122710  000015          3$:   CMPB    #CR,(R0)
2467  005566  001414                       BEQ     CHKDRV
2468  005570  121027  000054               CMPB    (R0),#',                ;CHECK IF 'COMMA'
2469  005574  001001                       BNE     4$
2470  005576  105720                       TSTB    (R0)+                   ;STEP PTR PAST 'COMMA'
2471  005600  112001                 4$:   MOVB    (R0)+,R1
2472  005602  042701  177770               BIC     #177770,R1
2473  005606  112761  177777  001154       MOVB    #-1,DRVTBL(R1)
```

```
2474  005614  000240                          NOP
2475  005616  000761                          BR      3$
2476
2477                                  ;ASCERTAIN THAT DRIVES (TM02'S) SPECIFIED ARE AVAILABLE
2478  005620  005000                  CHKDRV: CLR     R0                      ;A 0/-1 INDICATES THAT THE
2479  005622  105760  001154          1$:     TSTB    DRVTBL(R0)              ;DRIVE IS NOT/IS TO BE TESTED
2480  005626  001005                          BNE     3$
2481  005630  005200                  2$:     INC     R0
2482  005632  122700  000010                  CMPB    #8.,R0
2483  005636  001371                          BNE     1$
2484  005640  000421                          BR      4$
2485  005642  110037  001004          3$:     MOVB    R0,@#DRVNUM
2486  005646  004737  004532                  JSR     PC,@#DRVAVA             ;CHECK IF AVAILABLE
2487  005652  102366                          BVC     2$                      ;'V' BIT SET INDICATES NOT AVAIL
2488  005654  000004  013312                  TYPE,E.NDRV
2489  005660  116037  001132  013344          MOVB    DIGTAB(R0),@#E.NAVA     ;SET DRIVE # IN MESSAGE
2490  005666  000004  013344                  TYPE,E.NAVA
2491  005672  110637  001123                  MOVB    SP,@#ERFLG              ;SET 'ERROR' FLAG
2492  005676  105060  001154                  CLRB    DRVTBL(R0)              ;MARK DRIVE UNAVAILABLE
2493  005702  000752                          BR      2$                      ;CHECK NEXT DRIVE
2494  005704  105737  001123          4$:     TSTB    @#ERFLG                 ;GO GET SLAVES IF NO ERROR
2495  005710  001403                          BEQ     SLAVES
2496  005712  105737  001124                  TSTB    @#PRGFLG                ;ASK USER TO RETYPE DRIVES IF
2497  005716  001664                          BEQ     DRIVES                  ;'ALL' NOT SPECIFIED
2498
2499                                  ;ROUTINE TO GET SLAVES (TU45'S) USER DESIRES TO TEST
2500  005720  105037  001123          SLAVES: CLRB    @#ERFLG                 ;CLEAR 'ERROR' FLAG
2501  005724  012701  001164                  MOV     #SLVTBL,R1              ;MARK ALL SLAVES (64.) AS NOT
2502  005730  012700  000040                  MOV     #32.,R0                 ;TO BE TESTED.A 0 INDICATES THAT
2503  005734  005021                  1$:     CLR     (R1)+                   ;A DRIVE'S SLAVE IS NOT TO BE
2504  005736  005300                          DEC     R0                      ;TESTED
2505  005740  001375                          BNE     1$
2506  005742  005000                          CLR     R0                      ;R0 = DRIVE # FOR SLAVES
2507  005744  012701  001164                  MOV     #SLVTBL,R1              ;R1 POINTS TO DRIVE'S SLAVE
2508  005750  105760  001154          2$:     TSTB    DRVTBL(R0)              ;IF DRIVE IS TO BE TESTED
2509  005754  001007                          BNE     4$                      ;GO TO 4$ OTHERWISE
2510  005756  062701  000010          3$:     ADD     #8.,R1                  ;STEP SLAVE PTR TO NEXT DRIVE'S
2511  005762  005200                          INC     R0                      ;SLAVES AND INCREMENT DRIVE #
2512  005764  122700  000010                  CMPB    #8.,R0                  ;CHECK ALL DRIVES
2513  005770  001367                          BNE     2$                      ;AND WHEN ALL DRIVES CHECKED
2514  005772  000454                          BR      CHKSLV                  ;GO CHECK SLAVE AVAILABILITY
2515
2516  005774  105737  001124          4$:     TSTB    @#PRGFLG                ;BRANCH IF USER SELECTED ALL
2517  006000  001020                          BNE     5$                      ;DRIVES
2518  006002  110067  172776                  MOVB    R0,DRVNUM               ;GET DRIVE #
2519  006006  116037  001132  013054          MOVB    DIGTAB(R0),@#I.DRV      ;PREPARE USER ACTION MESSAGE
2520  006014  000004  013035                  TYPE,I.SLVS
2521  006020  004767  175102                  JSR     PC,..INPUT              ;GET USER INPUT
2522  006024  012703  001264                  MOV     #INBUF,R3               ;SET PTR TO USER INPUT
2523  006030  122710  000101                  CMPB    #'A,(R0)                ;BRANCH IF USER DOES NOT WANT
2524  006034  001015                          BNE     7$                      ;'ALL' SLAVES
2525  006036  110637  001124                  MOVB    SP,@#PRGFLG             ;SET 'ALL' INDICATOR
2526  006042  012701  001164          5$:     MOV     #SLVTBL,R1              ;MARK ALL SLAVES FOR ALL
2527  006046  012700  000040                  MOV     #32.,R0                 ;DRIVES AS TO BE TESTED
2528  006052  012721  177777          6$:     MOV     #-1,(R1)+
2529  006056  005300                          DEC     R0
```

```
2530  006060  001374                    BNE     6$
2531  006062  105737  001124            TSTB    @#PRGFLG                ;BRANCH IF ALL WAS SELECTED
2532  006066  001016                    BNE     CHKSLV
2533
2534  006070  122713  000015    7$:     CMPB    #CR,(R3)                ;GET USER SELECTED SLAVES FOR
2535  006074  001730                    BEQ     3$                      ;DRIVE
2536  006076  121327  000054            CMPB    (R3),#',                ;STEP PTR PAST 'COMMA'
2537  006102  001001                    BNE     8$
2538  006104  105723                    TSTB    (R3)+
2539  006106  112304            8$:     MOVB    (R3)+,R4                ;AND MARK SELECED SLAVE
2540  006110  042704  177770            BIC     #177770,R4              ;AS TO BE TESTED
2541  006114  060104                    ADD     R1,R4
2542  006116  112714  177777            MOVB    #-1,(R4)
2543  006122  000762                    BR      7$
2544
2545                            ;ASCERTAIN THAT SLAVES (TU45'S) SELECTED ARE AVAILABLE
2546  006124  005000            CHKSLV: CLR     R0                      ;R0 WILL CONTAIN THE DRIVE #
2547  006126  005001                    CLR     R1                      ;AND R1 THE SLAVE #
2548  006130  012702  001164            MOV     #SLVTBL,R2              ;SET PTR TO SLAVE TABLE
2549  006134  105760  001154    1$:     TSTB    DRVTBL(R0)              ;BRANCH IF DRIVE SELECTED
2550  006140  001007                    BNE     3$                      ;& AVAILABLE FOR TEST
2551  006142  005200            2$:     INC     R0                      ;INCREMENT DRIVE #
2552  006144  062702  000010            ADD     #8.,R2                  ;STEP SLAVE PTR TO NEXT DRIVE'S
2553  006150  022700  000010            CMP     #8.,R0                  ;SLAVES. BRANCH TO 1$ IF NOT ALL
2554  006154  001367                    BNE     1$                      ;DRIVES CHECKED OTHERWISE EXIT
2555  006156  000434                    BR      7$
2556
2557  006160  005001            3$:     CLR     R1                      ;SET SLAVE # 0
2558  006162  105712            4$:     TSTB    (R2)                    ;BRANCH IF DRIVE'S SLAVE IS SEL-
2559  006164  001006                    BNE     6$                      ;ECTED FOR TEST
2560  006166  005201            5$:     INC     R1                      ;INCREMENT SLAVE #
2561  006170  005202                    INC     R2                      ;STEP PTR TO NEXT SLAVE
2562  006172  022701  000010            CMP     #8.,R1                  ;GO TO 4$ IF ALL SLAVES NOT
2563  006176  001371                    BNE     4$                      ;CHECKED
2564  006200  000760                    BR      2$                      ;OTHERWISE GO TO 2$ ABOVE
2565
2566  006202  110037  001004    6$:     MOVB    R0,@#DRVNUM             ;PASS DRIVE & SLAVE #
2567  006206  110137  001005            MOVB    R1,@#SLVNUM
2568  006212  004737  004560            JSR     PC,@#SLVAVA             ;AND CHECK IF AVAILABLE
2569  006216  102363                    BVC     5$                      ;'V' BIT SET ON RETURN IND-
2570  006220  116037  001132  013334    MOVB    DIGTAB(R0),@#E.DRV      ;ICATES ERROR. PREPARE ERROR
2571  006226  116137  001132  013344    MOVB    DIGTAB(R1),@#E.NAVA     ;MESSAGE
2572  006234  000004  013326            TYPE,E.NSLV
2573  006240  110637  001123            MOVB    SP,@#ERFLG              ;SET ERROR INDICATOR
2574  006244  105012                    CLRB    (R2)                    ;CLEAR SLAVE TABLE ENTRY
2575  006246  000747                    BR      5$                      ;GET NEXT SLAVE
2576
2577  006250  105737  001123    7$:     TSTB    @#ERFLG                 ;BRANCH IF NO ERROR
2578  006254  001403                    BEQ     100$
2579  006256  105737  001124            TSTB    @#PRGFLG                ;BRANCH IF NOT 'ALL'
2580  006262  001616                    BEQ     SLAVES                  ;ASK USER TO RETYPE SLAVES
2581  006264  012737  003302  000004  100$:    MOV     #ERRTRP,@#ERRVEC
2582
2583                            ;SCAN DIVE AND SLAVE TABLE FOR DRIVE/SLAVE COMBINATION TO TEST
2584  006272  105037  001004            CLRB    @#DRVNUM                ;SET DRIVE AND SLAVE # 0
2585  006276  105037  001005            CLRB    @#SLVNUM
```

```
 2586  006302  012737  001164  001006          MOV     #SLVTBL,@#SLVPTR        ;SET PTR TO SLAVE TABLE
 2587  006310  105037  001125                  CLRB    @#UNTFND                ;CLEAR 'UNIT FOUND' IND.
 2588
 2589  006314  113700  001004          BEGIN:  MOVB    @#DRVNUM,R0             ;GET DRIVE #
 2590  006320  113701  001005                  MOVB    @#SLVNUM,R1             ;AND SLAVE #
```

```
 2591  006324  013702  001006          MOV     @#SLVPTR,R2             ;GET SLAVE PTR
 2592  006330  105760  001154  1$:     TSTB    DRVTBL(R0)              ;BRANCH IF DRIVE AVAIL TO TEST
 2593  006334  001011                  BNE     3$
 2594  006336  005001                  CLR     R1                      ;CLEAR SLAVE #
 2595  006340  062702  000010          ADD     #8.,R2                  ;AND STEP PTR TO NEXT DRIVE'S
 2596  006344  005200          2$:     INC     R0                      ;SLAVES AND INCREMENT DRIVE #
 2597  006346  022700  000010          CMP     #8.,R0                  ;EXIT TEST IF ALL DRIVES
 2598  006352  001366                  BNE     1$                      ;CHECKED OTHERWISE CONTINUE
 2599  006354  000137  012266          JMP     @#END                   ;SCAN FOR NEXT 'UNIT'
 2600
 2601  006360  105712          3$:     TSTB    (R2)                    ;BRANCH IF SLAVE ON DRIVE IS
 2602  006362  001007                  BNE     4$                      ;AVAILABLE THERWISE STEP
 2603  006364  005202                  INC     R2                      ;PTR TO NEXT SLAVE
 2604  006366  005201                  INC     R1                      ;INCREMENT SLAVE #
 2605  006370  122701  000010          CMPB    #8.,R1                  ;UNTIL ALL SLAVES CHECKED
 2606  006374  001371                  BNE     3$                      ;WHEN ALL SLAVES CHECKED
 2607  006376  005001                  CLR     R1                      ;SET SLAVE # 0
 2608  006400  000761                  BR      2$                      ;AND CONTINUE SCAN
 2609
 2610  006402  110637  001125  4$:     MOVB    SP,@#UNTFND             ;INDICATE THAT A 'UNIT' IS FOUND
 2611  006406  110037  001004          MOVB    R0,@#DRVNUM             ;SET DRIVE 3
```

```
2612  006412  110137  001005          MOVB    R1,@#SLVNUM             ;SET SLAVE #
2613  006416  010237  001006          MOV     R2,@#SLVPTR             ;SAVE SLAVE PTR
2614
2615  006422  105737  001130  5$:     TSTB    @#ASFLG
2616  006426  001044                  BNE     7$
2617  006430  112767  000001  172472  MOVB    #1,ASFLG
2618
2619  006436  105037  001124          CLRB    @#PRGFLG        ;CLEAR PROGRAM INDICATOR
2620  006442  000004  013114          TYPE,I.SKEW             ;ASK USER IF HE WANTS TO RUN SKEW TESTS
2621  006446  004767  174454          JSR     PC,..INPUT              ;GET USER INPUT
2622  006452  012703  001264          MOV     #INBUF,R3       ;GET REPLY
2623  006456  122713  000060          CMPB    #'0,(R3)        ;BRANCH IF 'NO' (0)
2624  006462  001406                  BEQ     6$
2625  006464  122713  000061          CMPB    #'1,(R3)        ;CHECK IF 'YES' (1)
2626  006470  001354                  BNE     5$              ;NEITHER SO ASK AGAIN
2627  006472  111337  001124          MOVB    (R3),@#PRGFLG   ;SET INDICATOR
2628  006476  000420                  BR      7$
2629
2630  006500  105037  001127  6$:     CLRB    @#NRZFLG        ;CLEAR NRZ INDICATOR
2631  006504  000004  013155          TYPE,I.NRZ              ;ASK USER IF DRIVE 'NRZ' ONLY
2632  006510  004767  174412          JSR     PC,..INPUT              ;GET USER INPUT
2633  006514  012703  001264          MOV     #INBUF,R3       ;GET REPLY
2634  006520  122713  000060          CMPB    #'0,(R3)        ;BRANCH IF 'NO' (0)
2635  006524  001405                  BEQ     7$
2636  006526  122713  000061          CMPB    #'1,(R3)        ;CHECK IF 'YES' (1)
2637  006532  001362                  BNE     6$              ;ASK AGAIN IF NEITHER
2638  006534  111337  001127          MOVB    (R3),@#NRZFLG   ;SET INDICATOR
2639  006540              7$:
2640
2641  006540  052737  000100  177560  TYPHDR: BIS     #100,@#TKS              ;SET KEYBOARD IE BIT
2642  006546  000004  013674          TYPE,L.HDR1
2643  006552  116037  001132  014054  MOVB    DIGTAB(R0),@#L.DRV      ;SET DRIVE #
2644  006560  116137  001132  014066  MOVB    DIGTAB(R1),@#L.SLV      ;AND SLAVE #
2645  006566  112737  000071  014071  MOVB    #'9,@#L.CHAN            ;GET SLAVES CHANNEL TYPE
2646  006574  032765  010000  000026  BIT     #CH7,DT(R5)
2647  006602  001403                  BEQ     1$
2648  006604  112737  000067  014071  MOVB    #'7,@#L.CHAN            ;SET 7 CHANNEL
2649  006612  000004  014007  1$:     TYPE,L.HDR2
2650  006616  004767  175766          JSR     PC,RHINIT               ;INIT RH
2651  006622  004767  176362          JSR     PC,SNPT         ;GO PRINT SERIAL NUMBER
2652  006626  000004  014110          TYPE,L.HDR3
2653  006632  012737  006672  001002  MOV     #TST001,@#SCPADR        ;SET 'SCOPE' ADDRESS FOR FIRST TEST
2654  006640  010500                  MOV     R5,R0
2655  006642  062700  000006          ADD     #FC,R0                  ;R0 CONTAINS ADDRESS OF FC REG
2656  006646  010501                  MOV     R5,R1
2657  006650  062701  000012          ADD     #DS,R1                  ;R1 CONTAINS ADDRESS OF DS REG
2658  006654  012703  004060          MOV     #TIMER,R3               ;SET JUMP ADDRESS TO TIMER
2659  006660  105737  001124          TSTB    @#PRGFLG                ;BRANCH IF NOT SKEW TESTS
2660  006664  001402                  BEQ     TST001
2661  006666  000137  012314          JMP     @#SKEWTST
2662                                  .SBTTL  START OF TESTS
2663                          ;TEST 001 - WRITE FROM BOT
2664                          ;THIS TEST WILL MEASURE ACCELERATION DELAY REQUIRED TO
2665                          ;MOVE THE TAPE APPROXIMATELY SEVEN (7) INCHES FORWARD
2666                          ;FROM DEAD STOP BEFORE STARTING TO TRANSFER DATA.
2667
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                                        ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'ACCL'=0.
006672  112737  000001  001122  TST001: MOVB    #1,@#TSTNUM             ;SET TEST #
006700  012702  006724                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
006704  004767  176042                  JSR     PC,.REWIND              ;REWIND SLAVE
006710  102420                          BVS     99$                     ;BRANCH IF ERROR ON REWIND
006712  004767  176116                  JSR     PC,WRITE                ;GO SETUP WRITE COMMAND
006716  004767  175046                  JSR     PC,TIMON                ;TURN TIMER ON
006722  005215                          INC     (R5)                    ;SET 'GO' BIT
                                
006724  005765  000032          1$:     TST     TC(R5)                  ;BRANCH WHEN 'ACCL'=0
006730  100002                          BPL     2$
006732  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
                                
006736  004767  175704          2$:     JSR     PC,WAITRDY              ;WAIT FOR COMMAND TO FINISH
006742  102403                          BVS     99$                     ;BRANCH IF ERROR
006744  004767  175146                  JSR     PC,TIMOK                ;GO CHECK TIME
006750  000401                          BR      100$
006752  104400                  99$:    HLT
006754  104000                  100$:   SCOPE
                                
                                        ;TEST 002 - WRITE START
                                        ;THIS TST MEASURES TIME FROM 'GO'=1 TO 'ACCL'=0.
006756  112737  000002  001122  TST002: MOVB    #2,@#TSTNUM             ;SET TEST # 2
006764  004767  176044                  JSR     PC,WRITE                ;INITIATE WRITE COMMAND
006770  012702  007002                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
006774  004767  174770                  JSR     PC,TIMON
007000  005215                          INC     (R5)                    ;SET 'GO' BIT
                                
007002  005765  000032          1$:     TST     TC(R5)                  ;BRANCH WHEN 'ACCL'=0
007006  100002                          BPL     2$
007010  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
                                
007014  004767  175626          2$:     JSR     PC,WAITRDY              ;WAIT FOR READY
007020  102403                          BVS     99$                     ;BRANCH IF ERROR
007022  004767  175070                  JSR     PC,TIMOK                ;GO CHECK TIME RECORDED
007026  000401                          BR      100$                    ;EXIT VIA SCOPE
                                
007030  104400                  99$:    HLT                             ;REPORT ERROR
007032  104000                  100$:   SCOPE
                                
                                        ;TEST 003- WRITE SHUTDOWN
                                        ;THIS TEST MEASURES TIME FROM 'FC REG'=0 TO 'SWDN'=1.
007034  112737  000003  001122  TST003: MOVB    #3,@#TSTNUM             ;SET TEST#3
007042  004767  175766                  JSR     PC,WRITE                ;INITIATE WRITE COMMAND
007046  005215                          INC     (R5)                    ;SET 'GO' BIT
                                
007050  005710                  1$:     TST     (R0)                    ;BRANCH WHEN WRITING FINISHED
007052  001404                          BEQ     2$
007054  032711  040000                  BIT     #ERR,(R1)               ;MONITOR ERROR BIT
007060  001017                          BNE     99$
007062  000772                          BR      1$
                                
007064                          2$:
007064  004767  174700                  JSR     PC,TIMON                ;TURN TIMER ON
007070  010702                          MOV     PC,R2                   ;LOAD RETURN PC FROM TIMER
007072  032711  000020          3$:     BIT     #SDWN,(R1)              ;BRANCH WHEN DS <SDWN> SETS
```

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2724  007076  001002                    BNE     4$
2725  007100  000163  004060            JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
2726
2727  007104  004767  175536    4$:     JSR     PC,WAITRDY              ;WAIT FOR READY
2728  007110  102403                    BVS     99$
2729  007112  004767  175000            JSR     PC,TIMOK                ;GO CHECK TIME RECORDED
2730  007116  000401                    BR      100$
2731  007120  104400            99$:    HLT                             ;REPORT ERROR
2732  007122  104000            100$:   SCOPE
2733
2734                            ;TEST 004 - WRITE SETTLEDOWN
2735                            ;THIS TEST MEASURES TIME FROM 'SWDN'=1 TO 'SWDN'=0.
2736  007124  112737  000004  001122 TST004: MOVB    #4,@#TSTNUM
2737  007132  004767  175676            JSR     PC,WRITE
2738  007136  005215                    INC     (R5)                    ;SET 'GO' BIT
2739
2740  007140  005710            1$:     TST     (R0)                    ;BRANCH WHEN WRITING FINISHED
2741  007142  001404                    BEQ     2$
2742  007144  032711  040000            BIT     #ERR,(R1)               ;CHECK ERROR BIT
2743  007150  001026                    BNE     99$
2744  007152  000772                    BR      1$
2745
2746  007154  032711  000020    2$:     BIT     #SDWN,(R1)              ;WAIT FOR ASSERTION OF 'SDWN'
2747  007160  001004                    BNE     3$
2748  007162  032711  040000            BIT     #ERR,(R1)               ;MONITOR ERROR BIT
2749  007166  001017                    BNE     99$
2750  007170  000771                    BR      2$
2751
2752  007172            3$:
2753  007172  004767  174572            JSR     PC,TIMON                ;TURN TIMER ON
2754  007176  010702                    MOV     PC,R2                   ;SET RETURN PC FROM TIMER
2755  007200  032711  000020            BIT     #SDWN,(R1)              ;BRANCH WHEN SWDN CLEARS
2756  007204  001402                    BEQ     5$
2757  007206  000163  004060            JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
2758
2759  007212  004767  175430    5$:     JSR     PC,WAITRDY              ;WAIT FOR READY
2760  007216  102403                    BVS     99$
2761  007220  004767  174672            JSR     PC,TIMOK
2762  007224  000401                    BR      100$
2763
2764  007226  104400            99$:    HLT
2765  007230  104000            100$:   SCOPE
2766
2767                            ;TEST 005 - READ FROM BOT
2768                            ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'ACCL'=0.
2769  007232  112737  000005  001122 TST005: MOVB    #5,@#TSTNUM             ;SET TEST #5
2770  007240  004767  175506            JSR     PC,.REWIND              ;REWIND SLAVE
2771  007244  102422                    BVS     99$                     ;BRANCH IF ERROR ON REWIND
2772  007246  004767  175600            JSR     PC,READ
2773  007252  012702  007264            MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
2774  007256  004767  174506            JSR     PC,TIMON                ;TURN TIMER ON
2775  007262  005215                    INC     (R5)                    ;SET 'GO' BIT
2776
2777  007264  005765  000032    1$:     TST     TC(R5)                  ;BRANCH WHEN 'ACCL' RESETS
2778  007270  100002                    BPL     2$
2779  007272  000163  004060            JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
```

```
2780
2781  007276  004767  175344          2$:     JSR     PC,WAITRDY              ;WAIT FOR READY
2782  007302  102403                          BVS     99$                     ;BRANCH IF ERROR
2783  007304  004767  174606                  JSR     PC,TIMOK                ;CHECK RECORDED TIME
2784  007310  000401                          BR      100$
2785
2786  007312  104400                  99$:    HLT
2787  007314  104000                  100$:   SCOPE
2788
2789                                  ;TEST 006 - READ START
2790                                  ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'ACCL'=0.
2791  007316  112737  000006  001122  TST006: MOVB    #6,@#TSTNUM             ;SET TEST #6
2792  007324  004767  175576                  JSR     PC,WRT.BK               ;WRITE A RECORD & BACK SPACE
2793  007330  102422                          BVS     99$
2794  007332  004767  175514                  JSR     PC,READ
2795  007336  012702  007350                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
2796  007342  004767  174422                  JSR     PC,TIMON                ;TURN TIMER ON
2797  007346  005215                          INC     (R5)                    ;SET 'GO' BIT
2798
2799  007350  005765  000032          1$:     TST     TC(R5)                  ;BRANCH WHEN 'ACCL' RESETS
2800  007354  100002                          BPL     2$
2801  007356  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
2802
2803  007362  004767  175260          2$:     JSR     PC,WAITRDY
2804  007366  102403                          BVS     99$
2805  007370  004767  174522                  JSR     PC,TIMOK
2806  007374  000401                          BR      100$
2807
2808  007376  104400                  99$:    HLT
2809  007400  104000                  100$:   SCOPE
2810
2811                                  ;TEST 007 - READ SHUTDOWN
2812                                  ;THIS TEST MEASURES TIME FROM 'FC REG'=FRAME COUNT TO 'SWDN'=1.
2813  007402  112737  000007  001122  TST007: MOVB    #7,@#TSTNUM             ;SET TEST #7
2814  007410  004767  175512                  JSR     PC,WRT.BK               ;WRITE A RECORD & BACK SPACE
2815  007414  102430                          BVS     99$                     ;BRANCH IF ERROR
2816  007416  004767  175430                  JSR     PC,READ
2817  007422  005215                          INC     (R5)                    ;SET 'GO' BIT
2818
2819  007424  022710  000400          1$:     CMP     #-FRMCNT,(R0)           ;WAIT FOR FRAME COUNT TO
2820  007430  001404                          BEQ     2$                      ;= # OF FRAMES WRITTEN
2821  007432  032711  040000                  BIT     #ERR,(R1)               ;MONITOR ERROR BIT
2822  007436  001017                          BNE     99$
2823  007440  000771                          BR      1$
2824
2825  007442                          2$:
2826  007442  004767  174322                  JSR     PC,TIMON                ;TURN TIMER ON
2827  007446  010702                          MOV     PC,R2                   ;SET RETURN PC FROM TIMER
2828  007450  032711  000020                  BIT     #SDWN,(R1)              ;BRANCH WHEN SDWN SETS
2829  007454  001002                          BNE     3$
2830  007456  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
2831
2832  007462  004767  175160          3$:     JSR     PC,WAITRDY
2833  007466  102403                          BVS     99$
2834  007470  004767  174422                  JSR     PC,TIMOK
2835  007474  000401                          BR      100$
```

```
2836
2837  007476  104400                  99$:    HLT                             ;REPORT ERROR
2838  007500  104000                  100$:   SCOPE
2839
2840                                  ;TEST 010 - READ SETTLEDOWN
2841                                  ;THIS TEST MEASURES TIME FROM 'SWDN'=1 TO 'SWDN'=0.
2842  007502  112737  000010  001122  TST010: MOVB    #10,@#TSTNUM            ;SET TEST #10
2843  007510  012702  007566                  MOV     #4$,R2                  ;SET RETURN PC FROM TIMER
2844  007514  004767  175406                  JSR     PC,WRT.BK               ;WRITE A RECORD & BACK SPACE
2845  007520  102436                          BVS     99$
2846  007522  004767  175324                  JSR     PC,READ
2847  007526  005215                          INC     (R5)                    ;SET 'GO' BIT
2848
2849  007530  105711                  1$:     TSTB    (R1)                    ;WAIT FOR READY
2850  007532  100404                          BMI     2$                      ;BRANCH WHEN SET
2851  007534  032711  040000                  BIT     #ERR,(R1)               ;CHECK ERROR BIT
2852  007540  001026                          BNE     99$
2853  007542  000772                          BR      1$
2854
2855  007544  032711  000020          2$:     BIT     #SDWN,(R1)              ;WAIT FOR ASSERTION OF 'SDWN'
2856  007550  001004                          BNE     3$
2857  007552  032711  040000                  BIT     #ERR,(R1)               ;MONITOR ERROR BIT
2858  007556  001017                          BNE     99$
2859  007560  000771                          BR      2$
2860
2861  007562                          3$:
2862  007562  004767  174202                  JSR     PC,TIMON                ;TURN TIMER ON
2863  007566  032765  000020  000012  4$:     BIT     #SDWN,DS(R5)            ;WAIT FOR NEGATION OF SDWN
2864  007574  001402                          BEQ     5$
2865  007576  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
2866
2867  007602  004767  175040          5$:     JSR     PC,WAITRDY
2868  007606  102403                          BVS     99$
2869  007610  004767  174302                  JSR     PC,TIMOK
2870  007614  000401                          BR      100$
2871
2872  007616  104400                  99$:    HLT
2873  007620  104000                  100$:   SCOPE
2874
2875
2876                                  ;TEST 011-READ REVERSE START
2877                                  ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'ACCL'=0.
2878  007622  112737  000011  001122  TST011: MOVB    #11,@#TSTNUM
2879  007630  012702  007666                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
2880  007634  004767  175174                  JSR     PC,WRITE                ;WRITE A RECORD
2881  007640  005215                          INC     (R5)                    ;SET 'GO' BIT
2882  007642  004767  175000                  JSR     PC,WAITRDY
2883  007646  102422                          BVS     99$
2884  007650  004767  174500                  JSR     PC,DELAY                ;WAIT FOR TAPE MOTION TO STOP
2885  007654  004767  175210                  JSR     PC,REVRD
2886  007660  004767  174104                  JSR     PC,TIMON                ;TURN TIMER ON
2887  007664  005215                          INC     (R5)                    ;SET 'GO' BIT
2888
2889  007666  005765  000032          1$:     TST     TC(R5)                  ;BRANCH WHEN 'ACCL' = 0
2890  007672  100002                          BPL     2$
2891  007674  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
```

```
 2892
 2893  007700  004767  174742          2$:     JSR     PC,WAITRDY
 2894  007704  102403                          BVS     99$                     ;BRANCH IF ERROR
 2895  007706  004767  174204                  JSR     PC,TIMOK
 2896  007712  000401                          BR      100$
 2897
 2898  007714  104400                  99$:    HLT
 2899  007716  104000                  100$:   SCOPE
 2900
 2901                                  ;TEST 012-READ REVERSE SHUTDOWN
 2902                                  ;THIS TEST MEASURES TIME FROM 'FC REG' = FRAME COUNT TO 'SDWN'=1.
 2903  007720  112737  000012  001122  TST012: MOVB    #12,@#TSTNUM
 2904  007726  012702  007776                  MOV     #3$,R2                  ;SET RETURN PC FROM TIMER
 2905  007732  004767  175076                  JSR     PC,WRITE                ;WRITE A RECORD
 2906  007736  005215                          INC     (R5)                    ;SET 'GO' BIT
 2907  007740  004767  174702                  JSR     PC,WAITRDY
 2908  007744  102427                          BVS     99$
 2909  007746  004767  175116                  JSR     PC,REVRD
 2910  007752  005215                          INC     (R5)                    ;SET 'GO' BIT
 2911
 2912  007754  022710  000400          1$:     CMP     #-FRMCNT,(R0)           ;BRANCH WHEN FRAME COUNT
 2913  007760  001404                          BEQ     2$                      ;= # OF RECORD WRITTEN
 2914  007762  032711  040000                  BIT     #ERR,(R1)               ;MONITOR ERROR BIT IN 'DS' REG
 2915  007766  001016                          BNE     99$
 2916  007770  000771                          BR      1$
 2917
 2918  007772                          2$:
 2919  007772  004767  173772                  JSR     PC,TIMON                ;TURN TIMER ON
 2920  007776  032711  000020          3$:     BIT     #SDWN,(R1)              ;BRANCH WHEN SDWN SETS
 2921  010002  001002                          BNE     4$
 2922  010004  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
 2923
 2924  010010  004767  174632          4$:     JSR     PC,WAITRDY              ;WAIT FOR READY
 2925  010014  102403                          BVS     99$
 2926  010016  004767  174074                  JSR     PC,TIMOK
 2927  010022  000401                          BR      100$
 2928
 2929  010024  104400                  99$:    HLT
 2930  010026  104000                  100$:   SCOPE
 2931
 2932                                  ;TEST 013-READ REVERSE SETTLEDOWN
 2933                                  ;THIS TEST MEASURES TIME FROM 'SDWN'=1 TO 'SDWN'=0.
 2934  010030  112737  000013  001122  TST013: MOVB    #13,@#TSTNUM
 2935  010036  012702  010122                  MOV     #4$,R2                  ;SET RETURN PC FROM TIMER
 2936  010042  004767  174766                  JSR     PC,WRITE                ;WRITE A RECORD
 2937  010046  005215                          INC     (R5)                    ;SET 'GO' BIT
 2938  010050  004767  174572                  JSR     PC,WAITRDY
 2939  010054  102435                          BVS     99$
 2940  010056  004767  175006                  JSR     PC,REVRD
 2941  010062  005215                          INC     (R5)                    ;SET 'GO' BIT
 2942
 2943  010064  105711                  1$:     TSTB    (R1)                    ;BRANCH WHEN
 2944  010066  100404                          BMI     2$                      ;READY SETS
 2945  010070  032711  040000                  BIT     #ERR,(R1)
 2946  010074  001025                          BNE     99$
 2947  010076  000772                          BR      1$
```

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                                                                                    B 6
 2948
 2949  010100  032711  000020          2$:     BIT     #SDWN,(R1)
 2950  010104  001004                          BNE     3$
 2951  010106  032711  040000                  BIT     #ERR,(R1)
 2952  010112  001016                          BNE     99$
 2953  010114  000771                          BR      2$
 2954
 2955  010116                          3$:
 2956  010116  004767  173646                  JSR     PC,TIMON                ;TURN TIMER ON
 2957  010122  032711  000020          4$:     BIT     #SDWN,(R1)              ;BRANCH WHEN SWDN = 0
 2958  010126  001402                          BEQ     5$
 2959  010130  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
 2960
 2961  010134  004767  174506          5$:     JSR     PC,WAITRDY              ;WAIT FOR READY
 2962  010140  102403                          BVS     99$
 2963  010142  004767  173750                  JSR     PC,TIMOK
 2964  010146  000401                          BR      100$
 2965
 2966  010150  104400                  99$:    HLT
 2967  010152  104000                  100$:   SCOPE
 2968
 2969                                  ;REWIND DRIVE
 2970  010154                          A:
 2971  010154  004767  174572                  JSR     PC,.REWIND              ;REWIND SLAVE
 2972  010160  102401                          BVS     99$                     ;BRANCH IF ERROR ON REWIND
 2973  010162  102002                          BVC     100$
 2974  010164  104400                  99$:    HLT
 2975  010166  000772                          BR      A
 2976  010170                          100$:
 2977
 2978                                  ;TEST 014-TURN AROUND DELAY (FORWARD-REVERSE)
 2979                                  ;THIS TEST MEASURES TIME FROM 'GO'=1 (READ REVERSE) TO 'ACCL'=0
 2980  010170  112737  000014  001122  TST014: MOVB    #14,@#TSTNUM
 2981  010176  012702  010230                  MOV     #2$,R2                  ;SET RETURN PC FROM TIMER
 2982  010202  004767  174626                  JSR     PC,WRITE                ;WRITE A RECORD
 2983  010206  005215                          INC     (R5)                    ;SET 'GO' BIT
 2984  010210  004767  174432                  JSR     PC,WAITRDY
 2985  010214  102420                          BVS     99$
 2986
 2987  010216  004767  174646          1$:     JSR     PC,REVRD                ;READ THE RECORD (REVERSE)
 2988  010222  004767  173542                  JSR     PC,TIMON                ;TURN TIMER ON
 2989  010226  005215                          INC     (R5)                    ;SET 'GO' BIT
 2990
 2991  010230  005765  000032          2$:     TST     TC(R5)                  ;WAIT FOR 'ACCL' = 0
 2992  010234  100002                          BPL     3$
 2993  010236  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
 2994
 2995  010242  004767  174400          3$:     JSR     PC,WAITRDY
 2996  010246  102403                          BVS     99$
 2997  010250  004767  173642                  JSR     PC,TIMOK
 2998  010254  000401                          BR      100$
 2999
 3000  010256  104400                  99$:    HLT
 3001  010260  104000                  100$:   SCOPE
 3002
 3003                                  ;TEST 015- TURN AROUND DELAY (REVERSE-FORWARD)
```

```
 3004
 3005  010262  112737  000015  001122  TST015: MOVB    #15,@#TSTNUM
 3006  010270  012702  010336                  MOV     #2$,R2                  ;SET RETURN PC FROM TIMER
 3007  010274  004767  174534                  JSR     PC,WRITE                ;WRITE A RECORD
 3008  010300  005215                          INC     (R5)                    ;SET 'GO' BIT
 3009  010302  004767  174340                  JSR     PC,WAITRDY              ;WAIT FOR READY
 3010  010306  102426                          BVS     99$
 3011  010310  004767  174554                  JSR     PC,REVRD                ;READ A RECORD IN THE
 3012  010314  005215                          INC     (R5)                    ;SET 'GO' BIT
 3013
 3014  010316  004767  174324                  JSR     PC,WAITRDY
 3015  010322  102420                          BVS     99$
 3016
 3017  010324  004767  174522          1$:     JSR     PC,READ                 ;READ RECORD FORWARD
 3018  010330  004767  173434                  JSR     PC,TIMON                ;TURN TIMER ON
 3019  010334  005215                          INC     (R5)                    ;SET 'GO' BIT
 3020
 3021  010336  005765  000032          2$:     TST     TC(R5)                  ;WAIT FOR 'ACCL' = 0
 3022  010342  100002                          BPL     3$
 3023  010344  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
 3024
 3025  010350  004767  174272          3$:     JSR     PC,WAITRDY
 3026  010354  102403                          BVS     99$
 3027  010356  004767  173534                  JSR     PC,TIMOK
 3028  010362  000401                          BR      100$
 3029
 3030  010364  104400                  99$:    HLT
 3031  010366  104000                  100$:   SCOPE
 3032
 3033                                  ;TEST 016-GAP SIZE (STOP HALF)
 3034  010370  112737  000016  001122  TST016: MOVB    #16,@#TSTNUM
 3035  010376  012702  010434                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
 3036  010402  004767  174426                  JSR     PC,WRITE                ;WRITE A RECORD
 3037  010406  005215                          INC     (R5)                    ;SET 'GO' BIT
 3038  010410  004767  174232                  JSR     PC,WAITRDY
 3039  010414  102421                          BVS     99$
 3040  010416  004767  173732                  JSR     PC,DELAY                ;DELAY 350 MS
 3041  010422  004767  174442                  JSR     PC,REVRD                ;READ REVERSE RECORD
 3042  010426  004767  173336                  JSR     PC,TIMON                ;TURN TIMER ON
 3043  010432  005215                          INC     (R5)                    ;SET 'GO' BIT
 3044
 3045  010434  005710          1$:     TST     (R0)                    ;WAIT FOR FRAME COUNT > 0
 3046  010436  001002                  BNE     2$
 3047  010440  000163  004060          JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
 3048
 3049  010444  004767  174176  2$:     JSR     PC,WAITRDY              ;WAIT FOR READY BIT TO SET
 3050  010450  102403                  BVS     99$
 3051  010452  004767  173440          JSR     PC,TIMOK                ;CHECK TIME
 3052  010456  000401                  BR      100$
 3053
 3054  010460  104400          99$:    HLT
 3055  010462  104000          100$:   SCOPE
 3056
 3057                          ;TEST 017-GAP SIZE (START HALF)
 3058  010464  112737  000017  001122  TST017: MOVB    #17,@#TSTNUM
 3059  010472  012702  010544          MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
```

```
3060  010476  004767  174332          JSR     PC,WRITE                ;WRITE A RECORD
3061  010502  005215                  INC     (R5)                    ;SET 'GO' BIT
3062  010504  004767  174136          JSR     PC,WAITRDY              ;WAIT FOR READY
3063  010510  102427                  BVS     99$
3064  010512  004767  174352          JSR     PC,REVRD                ;READ REVERSE THE RECORD
3065  010516  005215                  INC     (R5)                    ;SET 'GO' BIT
3066  010520  004767  174122          JSR     PC,WAITRDY              ;WAIT FOR READY
3067  010524  102421                  BVS     99$                     ;BRANCH ON ERROR
3068  010526  004767  173622          JSR     PC,DELAY                ;WAIT FOR TAPE MOTION TO STOP
3069  010532  004767  174314          JSR     PC,READ                 ;READ RECORD
3070  010536  004767  173226          JSR     PC,TIMON                ;TURN TIMER ON
3071  010542  005215                  INC     (R5)                    ;SET 'GO' BIT
3072
3073  010544  005710          1$:     TST     (R0)                    ;WAIT FOR FRAME COUNT > 0
3074  010546  001002                  BNE     2$
3075  010550  000163  004060          JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3076
3077  010554  004767  174066  2$:     JSR     PC,WAITRDY              ;WAIT FOR READY
3078  010560  102403                  BVS     99$
3079  010562  004767  173330          JSR     PC,TIMOK                ;CHECK TIME
3080  010566  000401                  BR      100$
3081
3082  010570  104400          99$:    HLT
3083  010572  104000          100$:   SCOPE
3084
3085                          ;TEST 020- GAP SIZE (INTERRECORD)
3086                          ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'FC REG' >0.
3087  010574  112737  000020  001122  TST020: MOVB   #20,@#TSTNUM
3088  010602  012702  010664          MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
3089  010606  004767  174222          JSR     PC,WRITE                ;WRITE A RECORD
3090  010612  005215                  INC     (R5)                    ;SET 'GO' BIT
3091  010614  004767  174026          JSR     PC,WAITRDY              ;WAIT FOR READY
3092  010620  102433                  BVS     99$
3093  010622  004767  174206          JSR     PC,WRITE                ;WRITE SECOND RECORD
3094  010626  005215                  INC     (R5)                    ;SET 'GO' BIT
3095  010630  004767  174012          JSR     PC,WAITRDY              ;WAIT FOR READY
3096  010634  102425                  BVS     99$
3097  010636  004767  174226          JSR     PC,REVRD                ;READ REVERSE SECOND RECORD
3098  010642  005215                  INC     (R5)                    ;SET 'GO' BIT
3099  010644  004767  173776          JSR     PC,WAITRDY              ;WAIT FOR READY
3100  010650  102417                  BVS     99$
3101  010652  004767  174212          JSR     PC,REVRD                ;READ REVERSE FIRST RECORD
3102  010656  004767  173106          JSR     PC,TIMON                ;TURN TIMER ON
3103  010662  005215                  INC     (R5)                    ;SET 'GO' BIT
3104
3105  010664  005710          1$:     TST     (R0)                    ;WAIT FOR FRAME COUNT > 0
3106  010666  001002                  BNE     2$
3107  010670  000163  004060          JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3108
3109  010674  004767  173746  2$:     JSR     PC,WAITRDY              ;WAIT FOR READY
3110  010700  102403                  BVS     99$
3111  010702  004767  173210          JSR     PC,TIMOK
3112  010706  000401                  BR      100$
3113
3114  010710  104400          99$:    HLT
3115  010712  104000          100$:   SCOPE
```

```
3116
3117                                    ;TEST 021- GAP CONSISTANCY
3118                                    ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'FC REG' > 0.
3119                                    ;THE TEST REWINDS THE TAPE,WRITES 17 RECORDS WITH A DELAY FROM 1-16 MS.
3120                                    ;BETWEEN EACH WRITE COMMAND. AFTER THE 17. RECORDS ARE WRITTTEN THE
3121                                    ;PROGRAM READ REVERSES 16 RECORDS. AT THIS POINT THE TAPE IS STOPPED BE-
3122                                    ;TWEEN THE FIRST AND SECOND RECORD. A READ COMMAND IS EXECUTED TO READ
3123                                    ;THE 16 RECORDS WITH THE TIME BETEWEN GO=1 TO FC > 0 STORED IN 'GAPTBL'
3124                                    ;FOR EACH RECORD READ. AFTER 16 RECORDS HAVE BEEN READ THE TIME IS VER-
3125                                    ;IFIED FOR EACH READ. AFTER ALL RECORD TIMES ARE VERIFIED THEY ARE AVER-
3126                                    ;AGED AND PLACED IN THE 'ATIMTBL' (BY SCOPE). THE ABOVE PROCESS IS RE-
3127                                    ;PEATED FOR EACH ITERATION.
3128
3129  010714  112737  000021  001122  TST021: MOVB    #21,a#TSTNUM
3130  010722  012702  011060                 MOV     #4$,R2          ;SET RETURN PC FROM TIMER
3131  010726  004767  174020                 JSR     PC,.REWIND      ;REWIND SLAVE
3132  010732  102530                         BVS     99$             ;BRANCH IF ERROR ON REWIND
3133  010734  005067  170154                 CLR     DELTIM          ;CLEAR VARIABLE DELAY TIME
3134  010740  012700  000021                 MOV     #17.,R0         ;SET # OF RECORDS TO WRITE
3135  010744  004767  174064          1$:    JSR     PC,WRITE        ;WRITE 17. RECORDS
3136  010750  005215                         INC     (R5)            ;SET 'GO' BIT
3137  010752  004767  173670                 JSR     PC,WAITRDY      ;WAIT FOR READY
3138  010756  102516                         BVS     99$
3139  010760  004767  173420                 JSR     PC,DELAYV       ;DELAY BEFORE WRITING,NEXT REC.
3140  010764  062767  000022  170122         ADD     #18.,DELTIM     ;SET NEXT DELAY TIME
3141  010772  005300                         DEC     R0              ;DECREMENT RECORDS WRITTEN COUNT
3142  010774  001363                         BNE     1$
3143
3144  010776  012700  000021                 MOV     #17.,R0         ;SET # OF RECS. TO REVERSE READ
3145  011002  004767  174062          2$:    JSR     PC,REVRD        ;REVERSE READ 17. RECORDS
3146  011006  005215                         INC     (R5)            ;SET 'GO' BIT
3147  011010  004767  173632                 JSR     PC,WAITRDY      ;WAIT FOR READY
3148  011014  102477                         BVS     99$
3149  011016  005300                         DEC     R0              ;DECREMENT RECORD COUNT
3150  011020  001370                         BNE     2$
3151
3152  011022  012700  000020                 MOV     #16.,R0         ;SET # OF RECORDS TO READ
3153  011026  012701  001054                 MOV     #GAPTBL,R1      ;SET PTR TO GAP TABLE FOR TEST
3154  011032  004767  174014                 JSR     PC,READ         ;READ A RECORD
3155  011036  005215                         INC     (R5)            ;SET 'GO' BIT
3156
3157  011040  004767  173602          3$:    JSR     PC,WAITRDY      ;WAIT FOR READY
3158  011044  102463                         BVS     99$
3159  011046  004767  174000                 JSR     PC,READ         ;READ NEXT RECORD
3160  011052  004767  172712                 JSR     PC,TIMON        ;TURN TIMER ON
3161  011056  005215                         INC     (R5)            ;SET 'GO' BIT
3162
3163  011060  005765  000006          4$:    TST     FC(R5)          ;WAIT FOR FRAME COUNT > 0
3164  011064  001002                         BNE     5$
3165  011066  000163  004060                 JMP     TIMER(R3)       ;GO TO TIMER & RETURN VIA R2
3166
3167  011072  004767  173550          5$:    JSR     PC,WAITRDY      ;WAIT FOR READY
3168  011076  102446                         BVS     99$
3169  011100  010421                         MOV     R4,(R1)+        ;STORE TIME IN GAPTBL
3170  011102  005300                         DEC     R0              ;DECREMENT # OF RECORDS READ
3171  011104  001355                         BNE     3$
```

```
3172
3173  011106  105037  001120                CLRB    @#GAP                   ;SET GAP # 0
3174  011112  012700  000020                MOV     #16.,R0
3175  011116  012701  001054                MOV     #GAPTBL,R1
3176
3177  011122  012104                6$:     MOV     (R1)+,R4                ;GET GAP TICK COUNT
3178  011124  004767  173076                JSR     PC,GAPOK                ;CHECK TIME
3179  011130  105237  001120                INCB    @#GAP                   ;INCREMENT GAP #
3180  011134  122737  000020  001120        CMPB    #16.,@#GAP              ;BRANCH IF ALL GAPS NOT CHECKED
3181  011142  001367                        BNE     6$
3182
3183  011144  012700  000020                MOV     #16.,R0                 ;SETUP TO AVERAGE GAP SIZES
3184  011150  012701  001054                MOV     #GAPTBL,R1              ;SET PTR TO TABLE
3185  011154  005002                        CLR     R2                      ;CLEAR 'SUM' REGISTERS
3186  011156  005003                        CLR     R3
3187  011160  062102                7$:     ADD     (R1)+,R2                ;ADD ALL GAP SIZES TOGETHER
3188  011162  005503                        ADC     R3
3189  011164  005300                        DEC     R0
3190  011166  001374                        BNE     7$
3191  011170  012700  000004                MOV     #4,R0                   ;NOW DIVIDE BY 16.
3192  011174  006203                8$:     ASR     R3                      ;BY SHIFTING 4 PLACES RIGHT
3193  011176  006002                        ROR     R2
3194  011200  005300                        DEC     R0
3195  011202  001374                        BNE     8$
3196  011204  010204                        MOV     R2,R4                   ;MOVE AVERAGED TIMES TO R4
3197  011206  004767  172704                JSR     PC,TIMOK                ;CHECK AVERAGED TIMES
3198  011212  000401                        BR      100$
3199
3200  011214  104400                99$:    HLT
3201  011216  104000                100$:   SCOPE
3202
3203                                ;TEST 022-DUMMY TEST
3204                                ;THIS TEST MEASURES NOTHING
3205  011220  112737  000022  001122' TST022: MOVB   #22,@#TSTNUM
3206
3207                                ;TEST 023-DATA TIME (200BPI)
3208                                ;THIS TEST MEASURES TIME FROM 'FC REG' CHANGES TO 'RDY'=1.
3209  011226  112737  000023  001122  TST023: MOVB   #23,@#TSTNUM
3210  011234  012702  011306                MOV     #3$,R2                  ;SET RETURN PC FROM TIMER
3211  011240  004767  173506                JSR     PC,.REWIND              ;REWIND SLAVE
3212  011244  102437                        BVS     99$                     ;BRANCH IF ERROR ON REWIND
3213  011246  004367  173716                JSR     R3,TMCMD                ;WRITE 800 WORD RECORD
3214  011252  015176                        .WORD   WTBUF                   ;SET WRITE BUFFER ADDRESS
3215  011254  176340                        .WORD   -800.                   ;WORD COUNT
3216  011256  174700                        .WORD   -1600.                  ;FRAME COUNT
3217  011260  000060                        .WORD   WFWD                    ;WRITE COMMAND
3218  011262  005215                        INC     (R5)                    ;SET 'GO' BIT
3219
3220  011264  022710  174700          1$:   CMP     #-1600.,(R0)            ;WAIT FOR FRAME COUNT TO CHANGE
3221  011270  001004                        BNE     2$
3222  011272  032711  040000                BIT     #ERR,(R1)               ;MONITOR ERROR BIT
3223  011276  001022                        BNE     99$
3224  011300  000771                        BR      1$
3225
3226  011302                        2$:
3227  011302  004767  172462                JSR     PC,TIMON                ;TURN TIMER ON
```

```
3228  011306  105711                  3$:     TSTB    (R1)                    ;WAIT FOR READY TO SET
3229  011310  100402                          BMI     4$
3230  011312  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3231  011316  012700  000003            4$:   MOV     #3,R0                   ;SET TO DIVIDE BY 8
3232  011322  006204                    5$:   ASR     R4                      ;BY SHIFTING RIGHT 3 PLACES
3233  011324  005300                          DEC     R0
3234  011326  001375                          BNE     5$
3235  011330  004767  173312                  JSR     PC,WAITRDY
3236  011334  102403                          BVS     99$
3237  011336  004767  172554                  JSR     PC,TIMOK                ;CHECK TIME
3238  011342  000401                          BR      100$
3239
3240  011344  104400                  99$:    HLT
3241  011346  104000                  100$:   SCOPE
3242
3243                                  ;TEST 024-DATA TIME (556BPI)
3244  011350  112737  000024  001122 TST024: MOVB    #24,@#TSTNUM
3245  011356  012702  011436                  MOV     #3$,R2                  ;SET RETURN PC FROM TIMER
3246  011362  004767  173364                  JSR     PC,.REWIND              ;REWIND SLAVE
3247  011366  102442                          BVS     99$                     ;BRANCH IF ERROR ON REWIND
3248  011370  052765  000700  000032        BIS     #BPI556+NORM11,TC(R5)   ;LOAD TAPE CONTROL REGISTER
3249  011376  004367  173566                  JSR     R3,TMCMD                ;WRITE 2224. WORD RECORD
3250  011402  015176                          .WORD   WTBUF
3251  011404  173520                          .WORD   -2224.
3252  011406  167240                          .WORD   -4448.
3253  011410  000060                          .WORD   WFWD
3254  011412  005215                          INC     (R5)                    ;SET 'GO' BIT
3255
3256  011414  022710  167240          1$:     CMP     #-4448.,(R0)            ;BRANCH WHEN WRITING BEGINS
3257  011420  001004                          BNE     2$
3258  011422  032711  040000                  BIT     #ERR,(R1)               ;MONITOR ERROR BIT
3259  011426  001022                          BNE     99$
3260  011430  000771                          BR      1$
3261
3262  011432                          2$:
3263  011432  004767  172332                  JSR     PC,TIMON                ;TURN TIMER ON
3264  011436  105711                  3$:     TSTB    (R1)                    ;BRANCH WHEN READY SETS
3265  011440  100402                          BMI     4$
3266  011442  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3267
3268  011446  012700  000003            4$:   MOV     #3,R0                   ;SET SHIFT COUNT
3269  011452  006204                    5$:   ASR     R4
3270  011454  005300                          DEC     R0
3271  011456  001375                          BNE     5$
3272  011460  004767  173162                  JSR     PC,WAITRDY
3273  011464  102403                          BVS     99$
3274  011466  004767  172424                  JSR     PC,TIMOK                ;CHECK TIME
3275  011472  000401                          BR      100$
3276
3277  011474  104400                  99$:    HLT
3278  011476  104000                  100$:   SCOPE
3279
3280                                  ;TEST 025-DATA TIME (800BPI)
3281  011500  112737  000025  001122 TST025: MOVB    #025,@#TSTNUM
3282  011506  012702  011566                  MOV     #3$,R2                  ;SET RETURN PC FROM TIMER
3283  011512  004767  173234                  JSR     PC,.REWIND              ;REWIND SLAVE
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 3284  011516  102442                      BVS     99$                     ;BRANCH IF ERROR ON REWIND
 3285  011520  052765  001300  000032      BIS     #BPI800+NORM11,TC(R5)   ;SET 800 BPI
 3286  011526  004367  173436              JSR     R3,TMCMD                ;WRITE 3200. WORD RECORD
 3287  011532  015176                      .WORD   WTBUF
 3288  011534  171600                      .WORD   -3200.
 3289  011536  163400                      .WORD   -6400.
 3290  011540  000060                      .WORD   WFWD
 3291  011542  005215                      INC     (R5)                    ;SET 'GO' BIT
 3292
 3293  011544  022710  163400          1$: CMP     #-6400.,(R0)            ;WAIT FOR WRITING TO START
 3294  011550  001004                      BNE     2$
 3295  011552  032711  040000              BIT     #ERR,(R1)               ;MONITOR ERROR BIT
 3296  011556  001022                      BNE     99$
 3297  011560  000771                      BR      1$
 3298
 3299  011562                          2$:
 3300  011562  004767  172202              JSR     PC,TIMON                ;TURN TIMER ON
 3301  011566  105711                  3$: TSTB    (R1)                    ;BRANCH WHEN READY SETS
 3302  011570  100402                      BMI     4$
 3303  011572  000163  004060              JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
 3304
 3305  011576  012700  000003          4$: MOV     #3,R0                   ;SET SHIFT COUNT
 3306  011602  006204                  5$: ASR     R4
 3307  011604  005300                      DEC     R0
 3308  011606  001375                      BNE     5$
 3309  011610  004767  173032              JSR     PC,WAITRDY
 3310  011614  102403                      BVS     99$
 3311  011616  004767  172274              JSR     PC,TIMOK                ;CHECK TIME
 3312  011622  000401                      BR      100$
 3313
 3314  011624  104400                  99$: HLT
 3315  011626  104000                  100$: SCOPE
 3316
 3317                                  ;TEST 026-DATA TIME (1600BPI)
 3318  011630  112737  000026  001122  TST026: MOVB   #026,a#TSTNUM
 3319  011636  105737  001127              TSTB    a#NRZFLG                ;BRANCH IF DRIVE 'NRZ ONLY'
 3320  011642  001046                      BNE     TST027
 3321  011644  012702  011724              MOV     #3$,R2                  ;SET RETURN PC FROM TIMER
 3322  011650  004767  173076              JSR     PC,.REWIND              ;REWIND SLAVE
 3323  011654  102437                      BVS     99$                     ;BRANCH IF ERROR ON REWIND
 3324  011656  052765  002300  000032      BIS.    #PE1600+NORM11,TC(R5)   ;SET 1600 BPI
 3325  011664  004367  173300              JSR     R3,TMCMD                ;WRITE 3200. WORD RECORD
 3326  011670  015176                      .WORD   WTBUF
 3327  011672  171600                      .WORD   -3200.
 3328  011674  163400                      .WORD   -6400.
 3329  011676  000060                      .WORD   WFWD
 3330  011700  005215                      INC     (R5)                    ;SET 'GO' BIT
 3331
 3332  011702  022710  163400          1$: CMP     #-6400.,(R0)            ;BRANCH WHEN WRITING STARTS
 3333  011706  001004                      BNE     2$
 3334  011710  032711  040000              BIT     #ERR,(R1)               ;MONITOR ERROR BIT
 3335  011714  001017                      BNE     99$
 3336  011716  000771                      BR      1$
 3337
 3338  011720                          2$:
 3339  011720  004767  172044              JSR     PC,TIMON                ;TURN TIMER ON
```

```
3340  011724  105711                  3$:     TSTB    (R1)                    ;BRANCH WHEN READY SETS
3341  011726  100402                          BMI     4$
3342  011730  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3343
3344  011734  006204                  4$:     ASR     R4                      ;DIVIDE TIME BY 4
3345  011736  006204                          ASR     R4
3346  011740  004767  172702                  JSR     PC,WAITRDY
3347  011744  102403                          BVS     99$
3348  011746  004767  172144                  JSR     PC,TIMOK                ;CHECK TIME
3349  011752  000401                          BR      100$
3350
3351  011754  104400                  99$:    HLT
3352  011756  104000                  100$:   SCOPE
3353
3354                                  ;TEST 027-ERASE
3355                                  ;THIS TST MEASURES TIME FROM 'GO'=1 TO 'RDY'=1.
3356  011760  112737  000027  001122  TST027: MOVB    #27,@#TSTNUM
3357  011766  012702  012014                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
3358  011772  004337  005170                  JSR     R3,@#TMCMD
3359  011776  000000                          .WORD   0
3360  012000  000000                          .WORD   0
3361  012002  000000                          .WORD   0
3362  012004  000024                          .WORD   ERASE
3363  012006  004767  171756                  JSR     PC,TIMON                ;TURN TIMER ON
3364  012012  005215                          INC     (R5)                    ;SET 'GO' BIT
3365
3366  012014  105711                  1$:     TSTB    (R1)                    ;BRANCH WHEN READY SETS
3367  012016  100402                          BMI     2$
3368  012020  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3369
3370  012024  004767  172616          2$:     JSR     PC,WAITRDY
3371  012030  102403                          BVS     99$
3372  012032  004767  172060                  JSR     PC,TIMOK
3373  012036  000401                          BR      100$
3374
3375  012040  104400                  99$:    HLT
3376  012042  104000                  100$:   SCOPE
3377
3378                                  ;TEST-030 TAPE MARK
3379                                  ;THIS TEST MEASURES TIME FROM 'GO'=1 TO 'RDY'=1.
3380  012044  112737  000030  001122  TST030: MOVB    #30,@#TSTNUM
3381  012052  012702  012114                  MOV     #1$,R2                  ;SET RETURN PC FROM TIMER
3382  012056  004767  172752                  JSR     PC,WRITE                ;WRITE A RECORD
3383  012062  005215                          INC     (R5)                    ;SET 'GO' BIT
3384  012064  004767  172556                  JSR     PC,WAITRDY
3385  012070  102423                          BVS     99$
3386  012072  004337  005170                  JSR     R3,@#TMCMD
3387  012076  000000                          .WORD   0
3388  012100  000000                          .WORD   0
3389  012102  000000                          .WORD   0
3390  012104  000026                          .WORD   WFMK
3391  012106  004767  171656                  JSR     PC,TIMON                ;TURN TIMER ON
3392  012112  005215                          INC     (R5)                    ;SET 'GO' BIT
3393
3394  012114  105711                  1$:     TSTB    (R1)                    ;BRANCH WHEN READY SETS
3395  012116  100402                          BMI     2$
```

```
3396  012120  000163  004060                JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3397
3398  012124  004767  172516          2$:   JSR     PC,WAITRDY
3399  012130  102403                        BVS     99$
3400  012132  004767  171760                JSR     PC,TIMOK
3401  012136  000401                        BR      100$
3402
3403  012140  104400                  99$:  HLT
3404  012142                          100$:
3405  012142  004767  172604                JSR     PC,.REWIND              ;REWIND SLAVE
3406  012146  102774                        BVS     99$                     ;BRANCH IF ERROR ON REWIND
3407  012150  104000                        SCOPE
3408
3409  012152  012700  000012          FINISH: MOV   #10.,R0                 ;SET LINE FEED COUNT
3410  012156  000004  001374          1$:   TYPE,CRLF
3411  012162  005300                        DEC     R0
3412  012164  001374                        BNE     1$
3413  012166  032777  000100  166604        BIT     #SW06,@SWR
3414  012174  001410                        BEQ     2$
3415  012176  113700  001004                MOVB    @#DRVNUM,R0
3416  012202  113701  001005                MOVB    @#SLVNUM,R1
3417  012206  113702  001006                MOVB    @#SLVPTR,R2
3418  012212  000137  006540                JMP     @#TYPHDR
3419  012216  105237  001005          2$:   INCB    @#SLVNUM                ;SET NEXT SLAVE #
3420  012222  005237  001006                INC     @#SLVPTR                ;AND ITS POINTER
3421  012226  122737  000010  001005        CMPB    #8.,@#SLVNUM            ;BRANCH IF LAST SLAVE (7)
3422  012234  001402                        BEQ     3$
3423  012236  000137  006314                JMP     @#BEGIN                 ;BEGIN TEST ON NEXT SLAVE
3424  012242  105037  001005          3$:   CLRB    @#SLVNUM                ;SET SLAVE #0
3425  012246  105237  001004                INCB    @#DRVNUM                ;AND INCREMENT DRIVE #
3426  012252  122737  000010  001004        CMPB    #8.,@#DRVNUM            ;AND CHECK IF LAST DRIVE
3427  012260  001402                        BEQ     END
3428  012262  000137  006314                JMP     @#BEGIN
3429
3430  012266  105737  001125          END:  TSTB    @#UNTFND                ;BRANCH IF A UNIT WAS FOUND
3431  012272  001004                        BNE     1$
3432  012274  000004  013377                TYPE,E.UNIT
3433  012300  000137  005340                JMP     @#INIT
3434  012304  000000                  1$:   HALT
3435  012306  000005                        RESET
3436  012310  000137  005340                JMP     @#INIT                  ;RESTART
3437                                  ;SKEW TAPE TIMING TESTS
3438                                  ;THE FOLLOWING TESTS REQUIRE A SPECIALLY WRITTEN 800 BPI SKEW TAPE
3439  012314  012737  012322  001002  SKEWTST:MOV   #TST031,@#SCPADR          ;SET SCOPE POINTER
3440
3441                                  ;TEST 031- SKEW TAPE SPEED TEST-FORWARD
3442                                  ;THIS TEST READS 32" OF TAPE (26400.-800. = 25600. FRAMES),THEN
3443                                  ;DIVIDES TIME BY 32. TO GET TIME TO READ 1" (800. FRAMES) OF TAPE.
3444  012322  112737  000031  001122  TST031: MOVB   #31,@#TSTNUM
3445  012330  012702  012406                MOV     #2$,R2                  ;SET RETURN PC FROM TIMER
3446  012334  004767  172412                JSR     PC,.REWIND              ;REWIND SLAVE
3447  012340  102441                        BVS     99$                     ;BRANCH IF ERROR ON REWIND
3448  012342  052765  001300  000032        BIS     #BPI800+NORM11,TC(R5)   ;SET 800 BPI
3449  012350  052765  000010  000010        BIS     #BAI,CS2(R5)            ;INHIBIT BUS ADDRESS INCREMENT
3450  012356  004337  005170                JSR     R3,@#TMCMD              ;READ 32" OF TAPE-FORWARD
3451  012362  015176                        .WORD   RDBUF
```

```
3452  012364  177777                          .WORD   -1.
3453  012366  063440                  10$:    .WORD   26400.                  ;FRAME COUNT
3454  012370  000070                          .WORD   RDFWD
3455  012372  005215                          INC     (R5)                    ;SET 'GO' BIT
3456
3457  012374  022710  001440          1$:     CMP     #800.,(R0)              ;WAIT FOR FIRST 800 FRAMES
3458  012400  101375                          BHI     1$                      ;TO BE READ
3459
3460  012402  004767  171362                  JSR     PC,TIMON                ;TURN TIMER ON
3461  012406  023710  012366          2$:     CMP     @#10$,(R0)              ;WAIT FOR READING TO FINISH
3462  012412  103402                          BLO     3$
3463  012414  000163  004060                  JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2
3464
3465  012420  012700  000005          3$:     MOV     #5,R0                   ;DIVIDE TIME BY 32.
3466  012424  006204                  4$:     ASR     R4
3467  012426  005300                          DEC     R0
3468  012430  001375                          BNE     4$
3469  012432  004767  172152                  JSR     PC,RHINIT               ;INIT DRIVE
3470  012436  004767  171454                  JSR     PC,TIMOK                ;CHECK TIME
3471  012442  000401                          BR      100$
3472
3473  012444  104400                  99$:    HLT
3474  012446  104000                  100$:   SCOPE
3475
3476                                  ;TEST 032-SKEW TAPE SPEED TEST-REVERSE
3477                                  ;THIS TEST READS FORWARD 40" (32000. FRAMES) OF TAPE, THEN READS REVERSE
3478                                  ;32" (26400.-800. = 25600. FRAMES) OF TAPE. THE TIME IS THEN DIVIDED BY
3479                                  ;32. TO GET TIME TO READ 1" (800. FRAMES) OF TAPE.
3480  012450  112737  000032  001122  TST032: MOVB    #32,@#TSTNUM
3481  012456  012702  012604                  MOV     #3$,R2                  ;SET RETURN PC FROM TIMER
3482  012462  004767  172264                  JSR     PC,.REWIND              ;REWIND SLAVE
3483  012466  102465                          BVS     99$                     ;BRANCH IF ERROR ON REWIND
3484  012470  052765  001300  000032          BIS     #BPI800+NORM11,TC(R5)
3485  012476  052765  000010  000010          BIS     #BAI,CS2(R5)
3486  012504  004337  005170                  JSR     R3,@#TMCMD              ;READ FORWARD 32000. FRAMES
3487  012510  015176                          .WORD   RDBUF
3488  012512  177777                          .WORD   -1.                     ;WORD COUNT
3489  012514  076400                  10$:    .WORD   32000.                  ;FRAME COUNT
3490  012516  000070                          .WORD   RDFWD                   ;READ FORWARD
3491  012520  005215                          INC     (R5)                    ;SET 'GO' BIT
3492
3493  012522  023710  012514          1$:     CMP     @#10$,(R0)
3494  012526  101375                          BHI     1$
3495
3496  012530  004767  172054                  JSR     PC,RHINIT               ;INIT DRIVE
3497  012534  004767  171614                  JSR     PC,DELAY                ;WAIT FOR TAPE MOTION TO STOP
3498  012540  052765  001300  000032          BIS     #BPI800+NORM11,TC(R5)   ;SET 800 BPI
3499  012546  052765  000010  000010          BIS     #BAI,CS2(R5)            ;INHIBIT BUS ADDRESS INCRENENT
3500  012554  004337  005170                  JSR     R3,@#TMCMD              ;READ REVERSE 32" OF TAPE
3501  012560  015176                          .WORD   RDBUF                   ;READ BUFFER
3502  012562  177777                          .WORD   -1.                     ;WORD COUNT
3503  012564  063440                  11$:    .WORD   26400.                  ;FRAME COUNT
3504  012566  000076                          .WORD   RDREV                   ;READ REVERSE
3505  012570  005215                          INC     (R5)                    ;SET 'GO' BIT
3506
3507  012572  022710  001440          2$:     CMP     #800.,(R0)              ;WAIT FOR FIRST 800 FRAMES
```

```
                                        BHI     2$                      ;TO BE READ
                                        JSR     PC,TIMON                ;TURN TIMER ON
                                3$:     CMP     @#11$,(R0)              ;WAIT FOR ALL FRAMES TO BE READ
                                        BLO     4$
                                        JMP     TIMER(R3)               ;GO TO TIMER & RETURN VIA R2

                                4$:     MOV     #5,R0                   ;DIVIDE TIME BY 32.
                                5$:     ASR     R4
                                        DEC     R0
                                        BNE     5$
                                        JSR     PC,RHINIT
                                        JSR     PC,TIMOK
                                        BR      100$

                                99$:    HLT
                                100$:
                                        JSR     PC,.REWIND              ;REWIND SLAVE
                                        BVS     99$                     ;BRANCH IF ERROR ON REWIND
                                        SCOPE

                                        JMP     @#FINISH



                                        .SBTTL  PROGRAM MESSAGES
                                ;OPERATOR INSTRUCTIONS
012660 005015 052524 032464     M.NAM:  .ASCIZ  <CR><LF>"TU45 DRIVE FUNCTION TIMER (CZTULA0)'
012666 042040 044522 042526
012674 043040 047125 052103
012702 047511 020116 044524
012710 042515 020122 041450
012716 052132 046125 030101
012724 000051
012726 005015 054524 042520     I.REG:  .ASCIZ  <CR><LF>'TYPE FIRST ADDRESS OF CONTROLLER  '
012734 043040 051111 052123                                  '
012742 040440 042104 042522
012750 051523 047440 020106
012756 047503 052116 047522
012764 046114 051105 020040
012772    000
012773    124 050131 020105     I.DRVS: .ASCIZ  %TYPE TM02 DRIVE #'S TO BE TESTED %
013000 046524 031060 042040
013006 044522 042526 021440
013014 051447 052040 020117
013022 042502 052040 051505
013030 042524 020104    000
013035    106 051117 052040     I.SLVS: .ASCII  'FOR TM02 DRIVE '
013042 030115 020062 051104
013050 053111 020105
013054 026460 052040 050131     I.DRV:  .ASCIZ  %0- TYPE SLAVE #'S TO BE TESTED %
013062 020105 046123 053101
013070 020105 023443 020123
013076 047524 041040 020105
013104 042524 052123 042105
013112 000040
```

```
 3564  013114  050123  042505  020104  I.SKEW: .ASCIZ  'SPEED TESTS ONLY? (YES/NO = 1/0)'
 3565  013122  042524  052123  020123
 3566  013130  047117  054514  020077
 3567  013136  054450  051505  047057
 3568  013144  020117  020075  027461
 3569  013152  024460     000
 3570  013155     116  055122  047440  I.NRZ:  .ASCIZ  'NRZ ONLY? (YES/NO = 1/0)'
 3571  013162  046116  037531  024040
 3572  013170  042531  027523  047516
 3573  013176  036440  030440  030057
 3574  013204  000051
 3575  013206  005015  047105  020104  M.EOT:  .ASCIZ  <CR><LF>'END OF TAPE'<CR><LF>
 3576  013214  043117  052040  050101
 3577  013222  006505  000012
 3578
 3579                                  ;ERROR MESSAGES
 3580  013226  005015  051124  050101  E.TRP4: .ASCIZ  <CR><LF>'TRAPPED TO 4'
 3581  013234  042520  020104  047524
 3582  013242  032040     000
 3583  013245     116  020117  047503  E.NCON: .ASCIZ  'NO CONTROLLER AT ADDRESS SPECIFIED'<CR><LF>
 3584  013252  052116  047522  046114
 3585  013260  051105  040440  020124
 3586  013266  042101  051104  051505
 3587  013274  020123  050123  041505
 3588  013302  043111  042511  006504
 3589  013310  000012
 3590  013312  046524  031060  042040  E.NDRV: .ASCIZ  'TM02 DRIVE '
 3591  013320  044522  042526  000040
 3592  013326  051104  053111  020105  E.NSLV: .ASCII  'DRIVE '
 3593  013334  020060  046123  053101  E.DRV:  .ASCII  '0 SLAVE '
 3594  013342  020105
 3595  013344  020060  047516  020124  E.NAVA: .ASCIZ  '0 NOT AVAILABLE FOR TEST'<CR><LF>
 3596  013352  053101  044501  040514
 3597  013360  046102  020105  047506
 3598  013366  020122  042524  052123
 3599  013374  005015     000
 3600  013377     116  020117  046524  E.UNIT: .ASCIZ  'NO TM02/TU45 UNIT FOUND TO TEST'<CR><LF>
 3601  013404  031060  052057  032125
 3602  013412  020065  047125  052111
 3603  013420  043040  052517  042116
 3604  013426  052040  020117  042524
 3605  013434  052123  005015     000
 3606  013441     123  043117  020124  E.SFT:  .ASCIZ  'SOFT ERROR (DATA)'<CR><LF>
 3607  013446  051105  047522  020122
 3608  013454  042050  052101  024501
 3609  013462  005015     000
 3610  013465     124  051505  020124  E.HDR:  .ASCIZ  'TEST # '
 3611  013472  020043     000
 3612  013475     040  042504  044526  E.HDR1: .ASCII  ' DEVICE ERROR'<CR><LF>
 3613  013502  042503  042440  051122
 3614  013510  051117  005015
 3615  013514  051503  004461  041527          .ASCIZ  'CS1'<HT>'WC'<HT>'BA'<HT>'FC'<HT>'CS2'<HT>'DS'<HT>'ER'<HT>'TC'<CR><LF>
 3616  013522  041011  004501  041506
 3617  013530  041411  031123  042011
 3618  013536  004523  051105  052011
 3619  013544  006503  000012
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 3620  013550  047440  052125  047440  E.HDR2: .ASCIZ  ' OUT OF RANGE ERROR'<CR><LF>
 3621  013556  020106  040522  043516
 3622  013564  020105  051105  047522
 3623  013572  006522  000012
 3624  013576  005015  044524  042515  E.TIMOV:        .ASCIZ  <CR><LF>'TIMER OVERFLOWED'<CR><LF>
 3625  013604  020122  053117  051105
 3626  013612  046106  053517  042105
 3627  013620  005015     000
 3628  013623     015  052012  046511  E.TIMEX:        .ASCIZ  <CR><LF>'TIME EXPIRED WAITING FOR RDY'<CR><LF>
 3629  013630  020105  054105  044520
 3630  013636  042522  020104  040527
 3631  013644  052111  047111  020107
 3632  013652  047506  020122  042122
 3633  013660  006531  000012
 3634  013664  043440  050101  021440  E.GAP:  .ASCIZ  ' GAP # '
 3635  013672  000040
 3636
 3637                                  ;TIME DOCUMENT LINES
 3638  013674  025052  025052  025052  L.HDR1: .ASCIZ  '*************************************************************************
 3639  013702  025052  025052  025052
 3640  013710  025052  025052  025052
 3641  013716  025052  025052  025052
 3642  013724  025052  025052  025052
 3643  013732  025052  025052  025052
 3644  013740  025052  025052  025052
 3645  013746  025052  025052  025052
 3646  013754  025052  025052  025052
 3647  013762  025052  025052  025052
 3648  013770  025052  025052  025052
 3649  013776  025052  025052  025052
 3650  014004  005015     000
 3651  014007     052  052040  030115  L.HDR2: .ASCII  '* TM02 DRIVE FUNCTION TIMES- DRIVE # '
 3652  014014  020062  051104  053111
 3653  014022  020105  052506  041516
 3654  014030  044524  047117  052040
 3655  014036  046511  051505  020055
 3656  014044  051104  053111  020105
 3657  014052  020043
 3658  014054  020060  046123  053101  L.DRV:  .ASCII  '0 SLAVE # '
 3659  014062  020105  020043
 3660  014066  020060     040          L.SLV:  .ASCII  '0  '
 3661  014071     071  041440  040510  L.CHAN: .ASCIZ  '9 CHAN. SER # '
 3662  014076  027116  051440  051105
 3663  014104  021440  000040
 3664  014110  006440  025012  005015  L.HDR3: .ASCII  ' '<CR><LF>'*'<CR><LF>
 3665  014116  020052  052506  041516          .ASCIZ  '* FUNCTION'<HT><HT>'TIME(SPECIFICATION)'<HT>'TIME(ACTUAL)'<CR><LF>
 3666  014124  044524  047117  004411
 3667  014132  044524  042515  051450
 3668  014140  042520  044503  044506
 3669  014146  040503  044524  047117
 3670  014154  004451  044524  042515
 3671  014162  040450  052103  040525
 3672  014170  024514  005015     000
 3673
 3674  014175     122  047101  042507  L.RNG:  .ASCIZ  'RANGE=<'
 3675  014202  036075     000
```

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 3676  014205     101  052103  040525  L.ACT:  .ASCIZ  'ACTUAL='
 3677  014212  036514     000
 3678
 3679                                  ;TEST DESCRIPTOR HEADERS
 3680  014215     052  053440  044522  A.T001: .ASCIZ  '* WRITE FROM BOT'<HT>
 3681  014222  042524  043040  047522
 3682  014230  020115  047502  004524
 3683  014236     000
 3684  014237     052  053440  044522  A.T002: .ASCIZ  '* WRITE START'<HT><HT>
 3685  014244  042524  051440  040524
 3686  014252  052122  004411     000
 3687  014257     052  053440  044522  A.T003: .ASCIZ  '* WRITE SHUTDOWN'<HT>
 3688  014264  042524  051440  052510
 3689  014272  042124  053517  004516
 3690  014300     000
 3691  014301     052  053440  044522  A.T004: .ASCIZ  '* WRITE SETTLEDOWN'<HT>
 3692  014306  042524  051440  052105
 3693  014314  046124  042105  053517
 3694  014322  004516     000
 3695  014325     052  051040  040505  A.T005: .ASCIZ  '* READ FROM BOT'<HT><HT>
 3696  014332  020104  051106  046517
 3697  014340  041040  052117  004411
 3698  014346     000
 3699  014347     052  051040  040505  A.T006: .ASCIZ  '* READ START'<HT><HT>
 3700  014354  020104  052123  051101
 3701  014362  004524  000011
 3702  014366  020052  042522  042101  A.T007: .ASCIZ  '* READ SHUTDOWN'<HT><HT>
 3703  014374  051440  052510  042124
 3704  014402  053517  004516  000011
 3705  014410  020052  042522  042101  A.T010: .ASCIZ  '* READ SETTLEDOWN'<HT>
 3706  014416  051440  052105  046124
 3707  014424  042105  053517  004516
 3708  014432     000
 3709  014433     052  051040  040505  A.T011: .ASCIZ  '* READ REV START'<HT>
 3710  014440  020104  042522  020126
 3711  014446  052123  051101  004524
 3712  014454     000
 3713  014455     052  051040  040505  A.T012: .ASCIZ  '* READ REV SHUTDOWN'<HT>
 3714  014462  020104  042522  020126
 3715  014470  044123  052125  047504
 3716  014476  047127  000011
 3717  014502  020052  042522  042101  A.T013: .ASCIZ  '* READ REV SETTLEDOWN'<HT>
 3718  014510  051040  053105  051440
 3719  014516  052105  046124  042105
 3720  014524  053517  004516     000
 3721  014531     052  052040  051125  A.T014: .ASCIZ  '* TURN AROUND DELAY F-R'<HT>
 3722  014536  020116  051101  052517
 3723  014544  042116  042040  046105
 3724  014552  054501  043040  051055
 3725  014560  000011
 3726  014562  020052  052524  047122  A.T015: .ASCIZ  '* TURN AROUND DELAY R-F'<HT>
 3727  014570  040440  047522  047125
 3728  014576  020104  042504  040514
 3729  014604  020131  026522  004506
 3730  014612     000
 3731  014613     052  043440  050101  A.T016: .ASCIZ  '* GAP SIZE-STOP HALF'<HT>
```

```
 3732  014620  051440  055111  026505
 3733  014626  052123  050117  044040
 3734  014634  046101  004506     000
 3735  014641     052  043440  050101  A.T017: .ASCIZ  '* GAP SIZE-START HALF'<HT>
 3736  014646  051440  055111  026505
 3737  014654  052123  051101  020124
 3738  014662  040510  043114  000011
 3739  014670  020052  040507  020120  A.T020: .ASCIZ  '* GAP SIZE-INTERRECORD'<HT>
 3740  014676  044523  042532  044455
 3741  014704  052116  051105  042522
 3742  014712  047503  042122  000011
 3743  014720  020052  040507  020120  A.T021: .ASCIZ  '* GAP CONSISTANCY'<HT>
 3744  014726  047503  051516  051511
 3745  014734  040524  041516  004531
 3746  014742     000
 3747  014743     052  042040  052101  A.T023: .ASCIZ  '* DATA TIME-200BPI'<HT>
 3748  014750  020101  044524  042515
 3749  014756  031055  030060  050102
 3750  014764  004511     000
 3751  014767     052  042040  052101  A.T024: .ASCIZ  '* DATA TIME-556BPI'<HT>
 3752  014774  020101  044524  042515
 3753  015002  032455  033065  050102
 3754  015010  004511     000
 3755  015013     052  042040  052101  A.T025: .ASCIZ  '* DATA TIME-800BPI'<HT>
 3756  015020  020101  044524  042515
 3757  015026  034055  030060  050102
 3758  015034  004511     000
 3759  015037     052  042040  052101  A.T026: .ASCIZ  '* DATA TIME-1600BPI'<HT>
 3760  015044  020101  044524  042515
 3761  015052  030455  030066  041060
 3762  015060  044520  000011
 3763  015064  020052  051105  051501  A.T027: .ASCIZ  '* ERASE GAP TIME'<HT>
 3764  015072  020105  040507  020120
 3765  015100  044524  042515  000011
 3766  015106  020052  051127  052111  A.T030: .ASCIZ  '* WRITE FILE MARK'<HT>
 3767  015114  020105  044506  042514
 3768  015122  046440  051101  004513
 3769  015130     000
 3770  015131     052  052040  050101  A.T031: .ASCIZ  '* TAPE SPEED-FWD'<HT>
 3771  015136  020105  050123  042505
 3772  015144  026504  053506  004504
 3773  015152     000
 3774  015153     052  052040  050101  A.T032: .ASCIZ  '* TAPE SPEED-REV'<HT>
 3775  015160  020105  050123  042505
 3776  015166  026504  042522  004526
 3777  015174     000
 3778          015176                          .EVEN
 3779          015176                  RDBUF=.
 3780          015176                  WTBUF=.
 3781  015176  000200                  .BLKW   128.
 3782          000001                  .END                    ;THAT'S ALL FOLKS!
```

```
A       010154
ACCL  = 100000
ANGTAB  001412
AS    = 000016
ASFLG   001130
ATA   = 100000
ATIME   001012
ATIMTB  001014
A.T001  014215
A.T002  014237
A.T003  014257
A.T004  014301
A.T005  014325
A.T006  014347
A.T007  014366
A.T010  014410
A.T011  014433
A.T012  014455
A.T013  014502
A.T014  014531
A.T015  014562
A.T016  014613
A.T017  014641
A.T020  014670
A.T021  014720
A.T023  014743
A.T024  014767
A.T025  015013
A.T026  015037
A.T027  015064
A.T030  015106
A.T031  015131
A.T032  015153
A16   = 000400
A17   = 001000
BA    = 000004
BAI   = 000010
BEGIN   006314
BELL    001403
BKSLSH  001377
BOT   = 000002
BPI200= 000000
BPI556= 000400
BPI800= 001000
BPTVEC= 000014
CDM11 = 000320
CHKDRV  005620
CHKSLV  006124
CH7   = 010000
CLR   = 000040
CNTRLC= 000003
CNTRLO= 000017
CNTRLU= 000025
CNVDEC  002362
CNVOCT  002254
CNVTAO  002712
CNVTD   002374
CNVTO   002266
CR    = 000015
CRLF    001374
CSITM = 002000
CS1   = 000000
CS2   = 000010
DASH    001405
DB    = 000022
DCONST  002470
DELAY   004354
DELAYV  004404
DELTIM  001114
DIGTAB  001132
DISPLA= 177570
DIVIDE  004442
DLT   = 100000
DPR   = 000400
DRIVES  005470
DRVAVA  004532
DRVNUM  001004
DRVTBL  001154
DRY   = 000200
DRYCLR= 000010
DS    = 000012
DT    = 000026
DTE   = 010000
DVA   = 004000
DV0   = 000000
DV1   = 000001
DV2   = 000002
DV3   = 000003
DV4   = 000004
DV5   = 000005
DV6   = 000006
DV7   = 000007
ECHO    001401
EMTVEC= 000030
END     012266
EOT   = 002000
ER    = 000014
ERASE = 000024
ERFLG   001123
ERR   = 040000
ERRTRP  003302
ERRVEC= 000004
E.DRV   013334
E.GAP   013664
E.HDR   013465
E.HDR1  013475
E.HDR2  013550
E.NAVA  013344
E.NCON  013245
E.NDRV  013312
E.NSLV  013326
E.SFT   013441
E.TIME  013623
E.TIMO  013576
E.TRP4  013226
E.UNIT  013377
FC    = 000006
FCE   = 001000
FINISH  012152
FMT   = 000020
FPEVEC= 000244
FRMCNT= 177400
FWDSPC  005106
GAP     001120
GAPOK   004226
GAPTBL  001054
GO    = 000001
GTIMTB  001572
HLT   = 104400
HSWR  = 177570
HT    = 000011
IDB   = 000010
IE    = 000100
ILF   = 000001
ILR   = 000002
INBUF   001264
INCVAE= 000100
INIT    005340
IOTVEC= 000020
IR    = 000100
ITCNT   001121
I.DRV   013054
I.DRVS  012773
I.NRZ   013155
I.REG   012726
I.SKEW  013114
I.SLVS  013035
LF    = 000012
LKS   = 177546
LKVEC = 000100
LPB   = 177516
LPS   = 177514
L.ACT   014205
L.CHAN  014071
L.DRV   014054
L.HDR1  013674
L.HDR2  014007
L.HDR3  014110
L.RNG   014175
L.SLV   014066
MCPE  = 020000
MDPE  = 000400
MMVEC = 000250
MOL   = 010000
MR    = 000024
MXF   = 001000
M.EOT   013206
M.NAM   012660
NAMPTR  001672
NED   = 010000
NEF   = 004000
NEM   = 004000
NOP   = 000000
NORM11= 000300
NRZFLG  001127
NSG   = 000400
OCTALO  001116
ODIGIT  001144
OPI   = 020000
OR    = 000200
OSC   = 000100
OUTBUF= 005340
OUTGAP  002600
OUTSPC  002504
PARVEC= 000114
PAT   = 000020
PEFLRC= 000200
PES   = 000040
PE1600= 002000
PFVEC = 000024
PGE   = 002000
PIP   = 020000
PIRQ  = 177772
PIRVEC= 000240
PLKCSR= 172540
PLKVEC= 000104
PRGFLG  001124
PSEL  = 002000
PSW   = 177776
PUBLIS  003000
RDBUF = 015176
RDFWD = 000070
RDREV = 000076
RDY   = 000200
READ    005052
RESVEC= 000010
REVRD   005070
RHINIT  004610
RMR   = 000004
RWD   = 000006
RWDOFF= 000002
R10   =%000000
R11   =%000001
R12   =%000002
R13   =%000003
R14   =%000004
R15   =%000005
SC    = 100000
SCOPE = 104000
SCPADR  001002
SDWN  = 000020
SKEWTS  012314
SLA   = 000001
SLAVES  005720
SLR   = 177774
SLVAVA  004560
SLVNUM  001005
SLVPTR  001006
SLVTBL  001164
SN    = 000030
SNPT    005210
SPACE   001410
SPACE2  001407
SPCFWD= 000030
SPCREV= 000032
SPR   = 002000
SSC   = 000100
STIMTB  001416
STKPTR= 000600
SWR     001000
SW06  = 000100
SW07  = 000200
SW08  = 000400
SW09  = 001000
SW10  = 002000
SW11  = 004000
SW13  = 020000
SW14  = 040000
SW15  = 100000
TAP   = 040000
TBITVE= 000014
TC    = 000032
TIMER   004060
TIMERR  004070
TIMER0  004104
TIMER1  004034
TIMOK   004116
TIMON   003770
TKB   = 177562
TKISR   003240
TKS   = 177560
TKVEC = 000060
TMBASE  001010
TMCMD   005170
TMCS1 = 172440
```

```
TMK    = 000004          TST010  007502          TST027  011760          WC     = 000002          $HT    = 000011
TPB    = 177566          TST011  007622          TST030  012044          WCE    = 040000          $NULL   001760
TPS    = 177564          TST012  007720          TST031  012322          WCHKF  = 000050          $TKFLG  001763
TPVEC  = 000064          TST013  010030          TST032  012450          WCHKR  = 000056          $TPB    001766
TRAPVE= 000034           TST014  010170          TYPDEC  002370          WFMK   = 000026          $TPFLG  001762
TRE    = 040000          TST015  010262          TYPE   = 000004         WFWD   = 000060          $TPS    001764
TRTVEC= 000014           TST016  010370          TYPFLG  001126          WRDCNT= 177600           .      = 015576
TSTNUM  001122           TST017  010464          TYPHDR  006540          WRITE   005034           .HLT    003304
TST001  006672           TST020  010574          TYPOCT  002262          WRL    = 004000          .INPUT  003126
TST002  006756           TST021  010714          UBREAK= 177770          WRT.BK  005126           .RESTO  002232
TST003  007034           TST022  011220          UNS    = 040000         WTBUF  = 015176          .REWIN  004752
TST004  007124           TST023  011226          UNTFND  001125          $CHARC  001770           .SAVE   002210
TST005  007232           TST024  011350          UPE    = 020000         $CNTRL  001771           .SCOPE  003552
TST006  007316           TST025  011500          WAITRD  004646          $CRLF   001772           .TYPE   001776
TST007  007402           TST026  011630          WAITTI  004650          $FILL   001761

. ABS.  015576     000


 ERRORS DETECTED:  0

 ,CZTULA.SEQ/SOL_CZTULA.P11
 RUN-TIME: 18 37 2 SECONDS
 RUN-TIME RATIO: 92/58=1.5
 CORE USED:  5K  (10 PAGES)
```