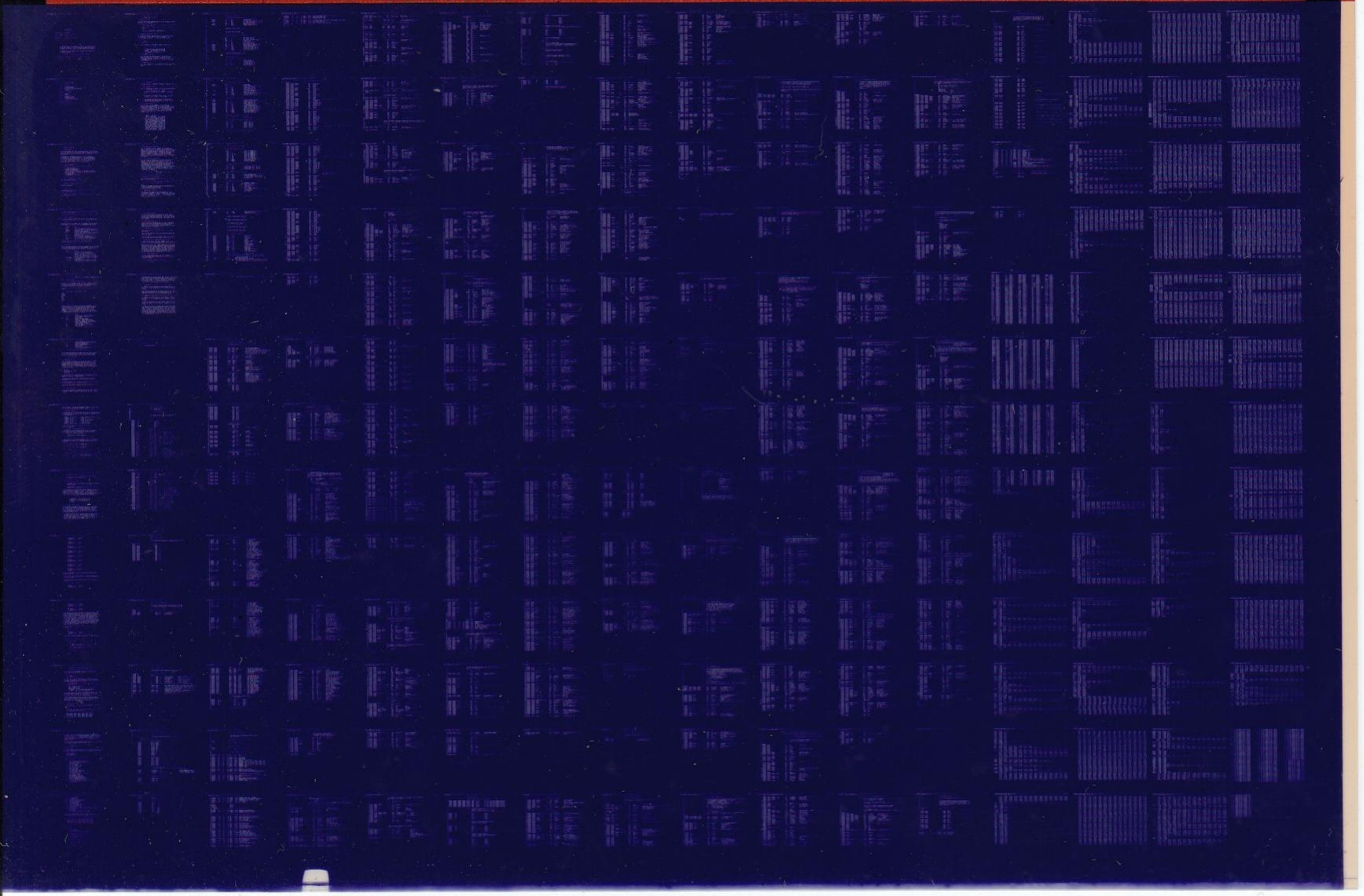
RP07

FCTNL TEST
CZRJLA0

AH-F959A-MC
FICHE 1 OF 1



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.REM @
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IDENTIFICATION

PRODUCT CODE: AC-F958A-MC

PRODUCT NAME: CZRJLA0 RP07 FCTNL TEST

PRODUCT DATE: JANUARY 1, 1983

MAINTAINER: CX DIAGNOSTIC ENGINEERING

AUTHOR: MIKE LEAVITT


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1.0 GENERAL INFORMATION

1.1 PROGRAM ABSTRACT

THE RP07 FUNCTIONAL DRIVE TEST CONTAINS A SERIES OF TESTS THAT WILL VERIFY THAT THE DISK IS CAPABLE OF PERFORMING SEEKS, THAT THE SEEKS AND ACCESS TIMES ARE WITHIN TOLERANCE, THAT THE ADDRESSING CIRCUITRY OPERATES PROPERLY, AND THAT WRITE AND READ DATA CAPABILITIES ARE FUNCTIONAL.

THIS DIAGNOSTIC HAS BEEN WRITTEN FOR USE WITH THE DIAGNOSTIC RUNTIME SERVICES SOFTWARE (SUPERVISOR). THESE SERVICES PROVIDE THE INTERFACE TO THE OPERATOR AND TO THE SOFTWARE ENVIRONMENT. THIS PROGRAM CAN BE USED WITH XXDP+, ACT, APT, SLIDE AND PAPER TAPE. FOR A COMPLETE DESCRIPTION OF THE RUNTIME SERVICES, REFER TO THE XXDP+ USER'S MANUAL. THERE IS A BRIEF DESCRIPTION OF THE RUNTIME SERVICES IN SECTION 2 OF THIS DOCUMENT.

1.2 SYSTEM REQUIREMENTS

THIS PROGRAM WILL REQUIRE THE FOLLOWING SYSTEM HARDWARE:

1. AN XXDP+ LOAD MEDIUM
2. A CONSOLE KEYBOARD/PRINTER
3. 28K WORDS OF MAIN MEMORY
4. A PDP-11 PROCESSOR WHICH HAS THE THROUGHPUT CAPABILITY EQUAL TO AT LEAST 2.2 MBYTES/SEC FOR OPERATION IN NON-INTERLEAVED MODE OR 1.3 MBYTES/SECOND FOR OPERATION IN INTERLEAVED MODE.
5. ONE RH70 OR RH11 CONTROLLER
6. A PROGRAMMABLE CLOCK (KW11-P)

1.3 RELATED DOCUMENTS AND STANDARDS

XXDP+ USER'S MANUAL (CHQUS)
RP07 PURCHASE SPECIFICATIONS (A-PS-3015478-0-0)

1.4 DIAGNOSTIC HIERARCY PREREQUISITES

RP07 FRONT END DIAGNOSTIC,
RP07 PDP11 FORMATTER.

1.5 RESTRICTIONS

THIS PROGRAM WILL NOT BE ABLE TO RUN ANY OF THE AVAILABLE RP07 RESIDENT MICRODIAGNOSTICS.

THIS PROGRAM WILL NOT RUN ON LSI-11 CPU'S.

THE COMMANDS: NOP, DIAGNOSTIC, FORMAT TRACK, AND READ/WRITE TRACK DESCRIPTOR ARE NOT USED.

IF A KW11-P SYSTEM CLOCK IS NOT INSTALLED ON THE SYSTEM, THE TIMING TESTS WILL NOT BE EXECUTED.

THE PROGRAM DOES NOT PROVIDE MODULE CALLOUT IN THE ERROR PRINTOUT.

2.0 OPERATING INSTRUCTIONS

THIS SECTION CONTAINS A BRIEF DESCRIPTION OF THE RUNTIME SERVICES. FOR DETAILED INFORMATION, REFER TO THE XXDP+ USER'S MANUAL (CHQUS).

2.1 COMMANDS

THERE ARE ELEVEN LEGAL COMMANDS FOR THE DIAGNOSTIC RUNTIME SERVICES (SUPERVISOR). THIS SECTION LISTS THE COMMANDS AND GIVES A VERY BRIEF DESCRIPTION OF THEM. THE XXDP+ USER'S MANUAL HAS MORE DETAILS.

COMMAND	EFFECT
START	START THE DIAGNOSTIC FROM AN INITIAL STATE
RESTART	START THE DIAGNOSTIC WITHOUT INITIALIZING
CONTINUE	CONTINUE AT TEST THAT WAS INTERRUPTED (AFTER ^C)
PROCEED	CONTINUE FROM AN ERROR HALT
EXIT	RETURN TO XXDP+ MONITOR (XXDP+ OPERATION ONLY!)
ADD	ACTIVATE A UNIT FOR TESTING (ALL UNITS ARE CONSIDERED TO BE ACTIVE AT START TIME
DROP	DEACTIVATE A UNIT
PRINT	PRINT STATISTICAL INFORMATION (IF IMPLEMENTED BY THE DIAGNOSTIC - SECTION 4.0)
DISPLAY	TYPE A LIST OF ALL DEVICE INFORMATION
FLAGS	TYPE THE STATE OF ALL FLAGS (SEE SECTION 2.3)
ZFLAGS	CLEAR ALL FLAGS (SEE SECTION 2.3)

A COMMAND CAN BE RECOGNIZED BY THE FIRST THREE CHARACTERS. SO YOU MAY, FOR EXAMPLE, TYPE "STA" INSTEAD OF "START".

2.2 SWITCHES

THERE ARE SEVERAL SWITCHES WHICH ARE USED TO MODIFY SUPERVISOR OPERATION. THESE SWITCHES ARE APPENDED TO THE LEGAL COMMANDS. ALL OF THE LEGAL SWITCHES ARE TABULATED BELOW WITH A BRIEF DESCRIPTION OF EACH. IN THE DESCRIPTIONS BELOW, A DECIMAL NUMBER .S DESIGNATED BY "DDDDD".

SWITCH	EFFECT
/TESTS:LIST	EXECUTE ONLY THOSE TESTS SPECIFIED IN THE LIST. LIST IS A STRING OF TEST NUMBERS, FOR EXAMPLE - /TESTS:1:5:7-10. THIS LIST WILL CAUSE TESTS 1,5,7,8,9,10 TO BE RUN. ALL OTHER TESTS WILL NOT BE RUN.
/PASS:DDDDD	EXECUTE DDDDD PASSES (DDDDD = 1 TO 64000)
/FLAGS:FLGS	SET SPECIFIED FLAGS. FLAGS ARE DESCRIBED IN SECTION 2.3.
/EOP:DDDDD	REPORT END OF PASS MESSAGE AFTER EVERY DDDDD PASSES ONLY. (DDDDD = 1 TO 64000)
/UNITS:LIST	TEST/ADD/DROP ONLY THOSE UNITS SPECIFIED

IN THE LIST. LIST EXAMPLE - /UNITS:0:5:10-12
USE UNITS 0,5,10,11,12 (UNIT NUMBERS = 0-63)

EXAMPLE OF SWITCH USAGE.

START/TESTS:1-5/PASS:1000/EOP:100

THE EFFECT OF THIS COMMAND WILL BE: 1) TESTS 1 THROUGH 5 WILL BE EXECUTED, 2) ALL UNITS WILL TESTED 1000 TIMES AND 3) THE END OF PASS MESSAGES WILL BE PRINTED AFTER EACH 100 PASSES ONLY. A SWITCH CAN BE RECOGNIZED BY THE FIRST THREE CHARACTERS. YOU MAY, FOR EXAMPLE, TYPE "/TES:1-5" INSTEAD OF "/TESTS:1-5".

BELOW IS A TABLE THAT SPECIFIES WHICH SWITCHES CAN BE USED BY EACH COMMAND.

	TESTS	PASS	FLAGS	EOP	UNITS
START	X	X	X	X	X
RESTART	X	X	X	X	X
CONTINUE		X	X	X	
PROCEED			X		
DROP					X
ADD					X
PRINT					
DISPLAY					X
FLAGS					
ZFLAGS					
EXIT					

2.3 FLAGS

FLAGS ARE USED TO SET UP CERTAIN OPERATIONAL PARAMETERS SUCH AS LOOPING ON ERROR. ALL FLAGS ARE CLEARED AT STARTUP AND REMAIN CLEARED UNTIL EXPLICITLY SET USING THE FLAGS SWITCH. FLAGS ARE ALSO CLEARED AFTER A START COMMAND UNLESS SET USING THE FLAG SWITCH. THE ZFLAGS COMMAND MAY ALSO BE USED TO CLEAR ALL FLAGS. WITH THE EXCEPTION OF THE START AND ZFLAGS COMMANDS, NO COMMANDS AFFECT THE STATE OF THE FLAGS; THEY REMAIN SET OR CLEARED AS SPECIFIED BY THE LAST FLAG SWITCH.

FLAG	EFFECT
HOE	HALT ON ERROR - CONTROL IS RETURNED TO RUNTIME SERVICES COMMAND MODE
LOE	LOOP ON ERROR
IER*	INHIBIT ALL ERROR REPORTS
IBR*	INHIBIT ALL ERROR REPORTS EXCEPT FIRST LEVEL (FIRST LEVEL CONTAINS ERROR TYPE, NUMBER, PC, TEST AND UNIT)
IXR*	INHIBIT EXTENDED ERROR REPORTS (THOSE CALLED BY PRINTX MACRO'S)
PRI	DIRECT MESSAGES TO LINE PRINTER
PNT	PRINT TEST NUMBER AS TEST EXECUTES
BOE	"BELL" ON ERROR
UAM	UNATTENDED MODE (NO MANUAL INTERVENTION)

ISR	INHIBIT STATISTICAL REPORTS (DOES NOT APPLY TO DIAGNOSTICS WHICH DO NOT SUPPORT STATISTICAL REPORTING)
IDR	INHIBIT PROGRAM DROPPING OF UNITS
ADR	EXECUTE AUTODROP CODE
LOT	LOOP ON TEST
EVL	EXECUTE EVALUATION (ON DIAGNOSTICS WHICH HAVE EVALUATION SUPPORT)

* ERROR MESSAGES ARE DESCRIBED IN SECTION 3.1

SEE THE XXDP+ USER'S MANUAL FOR MORE DETAILS ON FLAGS. YOU MAY SPECIFY MORE THAN ONE FLAG WITH THE FLAG SWITCH. FOR EXAMPLE, TO CAUSE THE PROGRAM TO LOOP ON ERROR, INHIBIT ERROR REPORTS AND TYPE A "BELL" ON ERROR, YOU MAY USE THE FOLLOWING STRING:

```
/FLAGS:LOE:IER:BOE
```

2.4 HARDWARE QUESTIONS

WHEN A DIAGNOSTIC IS STARTED, THE RUNTIME SERVICES WILL PROMPT THE USER FOR HARDWARE INFORMATION BY TYPING "CHANGE HW (L) ?" YOU MUST ANSWER "Y" AFTER A START COMMAND UNLESS THE HARDWARE INFORMATION HAS BEEN "PRELOADED" USING THE SETUP UTILITY (SEE CHAPTER 6 OF THE XXDP+ USER'S MANUAL). WHEN YOU ANSWER THIS QUESTION WITH A "Y", THE RUNTIME SERVICES WILL ASK FOR THE NUMBER OF UNITS (IN DECIMAL). YOU WILL THEN BE ASKED THE FOLLOWING QUESTIONS FOR EACH UNIT.

```
    UNIT 0
    RPCS1 ADRS (O)  176700 ?
    VECTOR ADRS (O)  254 ?
    BR LEVEL (O)  5 ?
    DRIVE # (O)  0 ?
```

THE 1ST QUESTION "RPCS1 ADRS" REQUIRES THAT THE USER INPUT THE ADDRESS OF RPCS1 OF THE CONTROLLER WHICH IS CONNECTED TO THE DRIVE UNDER TEST. DEFAULT IS 176700 (OCTAL).

THE 2ND QUESTION "VECTOR ADRS" REQUIRES THE USER TO INPUT THE INTERRUPT VECTOR ADDRESS OF THE RHXX CONTROLLER. DEFAULT IS 254 (OCTAL).

THE 3RD QUESTION "BR LEVEL" REQUIRES THE USER TO INPUT THE CONTROLLER INTERRUPT PRIORITY LEVEL. DEFAULT IS LEVEL 5.

THE 4TH QUESTION "DRIVE #" REQUIRES THE USER TO SPECIFY THE DRIVE NUMBER OF THE DRIVE TO BE TESTED. DEFAULT IS 0 (OCTAL).

2.5 SOFTWARE QUESTIONS

AFTER YOU HAVE ANSWERED THE HARDWARE QUESTIONS OR AFTER A RESTART OR CONTINUE COMMAND, THE RUNTIME SERVICES WILL ASK FOR SOFTWARE PARAMETERS. THESE PARAMETERS WILL GOVERN SOME DIAGNOSTIC SPECIFIC

OPERATION MODES. YOU WILL BE PROMPTED BY "CHANGE SW (L) ?", IF YOU WISH TO CHANGE ANY PARAMETERS, ANSWER BY TYPING "Y". THE SOFTWARE QUESTIONS AND THE DEFAULT VALUES ARE DESCRIBED AS FOLLOWS:

CHANGE DRIVE PARAMETER (L) N ?

IF THE RESPONSE TO THE PREVIOUS QUESTION IS 'N' THE FOLLOWING DRIVE PARAMETER QUESTIONS WILL BE SKIPPED AND PROGRAM WILL PROCEED AS NORMAL. A 'Y' RESPONSE WILL ALLOW THE USER TO ANSWER THE FOLLOWING DRIVE PARAMETER QUESTIONS.

```
STARTING  CYL (D)  0 ?       **(TESTS 2-4,6-8,11,13,14,17,18)
ENDING    CYL (D)  629 ?     **(TESTS 2-4,6,8,10,14,17,18)
INCREMENT CYL (D)  1 ?       **(TESTS 2)
STARTING  TRK (D)  0 ?       **(TESTS 2-7,11,13,16,17)
ENDING    TRK (D)  31 ?      **(TESTS 3-6,11,14,16-18)
INCREMENT TRK (D)  1 ?       **(TESTS 11,16,17)
STARTING  SEC (D)  0 ?       **(TESTS 2,5-7,13)
ENDING    SEC (D)  49 ?      **(TESTS 5,6,14,18)
DATA  PATTERN (O)  030221 ?  **(TESTS 16,17,18)
```

IF THE FIELD VERSION OF THIS PROGRAM IS BEING RUN, THE FOLLOWING QUESTION WILL BE ASKED.

DO YOU WANT TO WRITE ANYWHERE ON MEDIA (L) N ?

IF THE RESPONSE TO THE PREVIOUS QUESTION IS 'N', THE FOLLOWING QUESTION WILL BE SKIPPED AND PROGRAM WILL PROCEED AS NORMAL. A 'Y' RESPONSE WILL PRINT THE FOLLOWING WARNING MESSAGE TO THE OUTPUT DEVICE AND ASK THE FOLLOWING QUESTION.

```
    ' CUSTOMER DATA WILL BE OVERWRITTEN !
    -------------------------------------
CONTINUE (L)  ?
                              **(TESTS 17,18)
```

IF THE RESPONSE TO THE PREVIOUS QUESTION IS 'N', THE FOLLOWING QUESTION WILL BE SKIPPED AND THE PROGRAM WILL NOT ALLOW TESTS 17-18 TO BE SELECTED FOR TESTING. A 'Y' RESPONSE WILL ASK THE FOLLOWING QUESTION.

```
USE RANDOM DATA PATTERNS FOR RANDOM WRITE TEST (L) N ?
                              **(TESTS 18)

PERFORM READ HEADER & DATA DURING SEEKS (L) Y ?
                              **(TESTS 2-6)

TYPE TIME REPORTS (L) N ?
                              **(TESTS 7-10,14,18)

INHIBIT SOFTWARE TIMEOUTS (L) N ?
                              **(ALL TESTS)

TIMING TESTS, STALL BETWEEN SEEKS: RANDOM INSTEAD OF 2 MSEC (L) N ?
                              **(TESTS 7-10,14,18)

STALL AFTER EVERY DRIVE FUNCTION IN NON-TIMING TESTS (L) N ?
```

```
                                        **(TESTS 1-6,11,13,14-18)

    *USE RANDOM STALL TIMES (L) N ?
                                        **(TESTS 1-6,11,13,14-18)

    *  THAT QUESTION IS ASKED WHEN YES IS ANSWERED TO THE QUESTION.
    ** INDICATES NOT PART OF THE DIALOGJE.
```

STALL DEFINITIONS

THERE ARE TWO DISTINCT STALLS :

1. SELECTABLE STALL, VIA SOFTWARE (SW) DIALOGUE: 10. MSEC OR RANDOM (1-64 MSEC) STALL TIME AFTER EVERY DRIVE FUNCTION IN NON-TIMING TESTS.

2. NON-SELECTABLE, 2 MSEC OR RANDOM STALL BETWEEN SEEKS IN TIMING TESTS 8. THRU 10.

A 'N' RESPONSE TO THE SUPERVISOR QUESTION "CHANGE SW (L)?" WILL ASSUME THE ASSIGNED SOFTWARE (SW) DEFAULT CONDITIONS: REPEATS = 1, STARTING CYLINDER = 0, ENDING CYLINDER = 629, STARTING TRACK = 0, ENDING TRACK = 31, INCREMENT TRACK = 1, STARTING SECTOR = 0, ENDING SECTOR = 49, PATTERN = 030221, WRITE ON ALL CYLINDERS WITHIN SPECIFIED LIMITS, RUN TESTS 1-18, DO READ HEADER AND DATA COMMAND IN SEEK TESTS 2-6, NO STALL, NO TIME REPORTS, SOFTWARE TIMEOUTS ENABLED.

NOTE

IF RUNNING THE FIELD VERSION OF THIS PROGRAM, TESTS 17 AND 18 WILL ONLY BE RUN WHEN THE "WRITE DATA ANYWHERE ON THE MEDIA" OPTION IS SELECTED BY THE OPERATOR.

2.6 EXTENDED P-TABLE DIALOGUE

WHEN YOU ANSWER THE HARDWARE QUESTIONS, YOU ARE BUILDING ENTRIES IN A TABLE THAT DESCRIBES THE DEVICES UNDER TEST. THE SIMPLEST WAY TO BUILD THIS TABLE IS TO ANSWER ALL QUESTIONS FOR EACH UNIT TO BE TESTED. IF YOU HAVE A MULTIPLEXED DEVICE SUCH AS A MASS STORAGE CONTROLLER WITH SEVERAL DRIVES OR A COMMUNICATION DEVICE WITH SEVERAL LINES, THIS BECOMES TEDIOUS SINCE MOST OF THE ANSWERS ARE REPETITIOUS.

TO ILLUSTRATE A MORE EFFICIENT METHOD, SUPPOSE YOU ARE TESTING A FICTIONAL DEVICE, THE XY11. SUPPOSE THIS DEVICE CONSISTS OF A CONTROL MODULE WITH EIGHT UNITS (SUB-DEVICES) ATTACHED TO IT. THESE UNITS ARE DESCRIBED BY THE OCTAL NUMBERS 0 THROUGH 7. THERE IS ONE HARDWARE PARAMETER THAT CAN VARY AMONG UNITS CALLED THE Q-FACTOR. THIS Q-FACTOR MAY BE 0 OR 1. BELOW IS A SIMPLE WAY TO BUILD A TABLE FOR ONE XY11 WITH EIGHT UNITS.

```
        # UNITS (D) ?  8<CR>

        UNIT 1
```

```
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  0<CR>
        Q-FACTOR (O) 0 ?  1<CR>

        UNIT 2
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  1<CR>
        Q-FACTOR (O) 1 ?  0<CR>

        UNIT 3
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  2<CR>
        Q-FACTOR (O) 0 ?  <CR>

        UNIT 4
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  3<CR>
        Q-FACTOR (O) 0 ?  <CR>

        UNIT 5
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  4<CR>
        Q-FACTOR (O) 0 ?  <CR>

        UNIT 6
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  5<CR>
        Q-FACTOR (O) 0 ?  <CR>

        UNIT 7
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  6<CR>
        Q-FACTOR (O) 0 ?  1<CR>

        UNIT 8
        CSR ADDRESS (O)  160000<CR>
        SUB-DEVICE # (O) ?  7<CR>
        Q-FACTOR (O) 1 ?  <CR>
```

NOTICE THAT THE DEFAULT VALUE FOR THE Q-FACTOR CHANGES WHEN A NON-DEFAULT RESPONSE IS GIVEN. BE CAREFUL WHEN SPECIFYING MULTIPLE UNITS!

AS YOU CAN SEE FROM THE ABOVE EXAMPLE, THE HARDWARE PARAMETERS DO NOT VARY SIGNIFICANTLY FROM UNIT TO UNIT. THE PROCEDURE SHOWN IS NOT VERY EFFICIENT.

THE RUNTIME SERVICES CAN TAKE MULTIPLE UNIT SPECIFICATIONS HOWEVER. LET'S BUILD THE SAME TABLE USING THE MULTIPLE SPECIFICATION FEATURE.

```
        # UNITS (D) ?  8<CR>

        UNIT 1
        CSR ADDRESS (O) ?  160000<CR>
        SUB-DEVICE # (O) ?  0,1<CR>
        Q-FACTOR (O) 0 ?  1,0<CR>
```

```
UNIT 3
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  2-5<CR>
Q-FACTOR (O) 0 ?  0<CR>

UNIT 7
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  6,7<CR>
Q-FACTOR (O) 0 ?  1<CR>
```

AS YOU CAN SEE IN THE ABOVE DIALOGUE, THE RUNTIME SERVICES WILL BUILD AS MANY ENTRIES AS IT CAN WITH THE INFORMATION GIVEN IN ANY ONE PASS THROUGH THE QUESTIONS. IN THE FIRST PASS, TWO ENTRIES ARE BUILT SINCE TWO SUB-DEVICES AND Q-FACTORS WERE SPECIFIED. THE SERVICES ASSUME THAT THE CSR ADDRESS IS 160000 FOR BOTH SINCE IT WAS SPECIFIED ONLY ONCE. IN THE SECOND PASS, FOUR ENTRIES WERE BUILT. THIS IS BECAUSE FOUR SUB-DEVICES WERE SPECIFIED. THE "-" CONSTRUCT TELLS THE RUNTIME SERVICES TO INCREMENT THE DATA FROM THE FIRST NUMBER TO THE SECOND. IN THIS CASE, SUB-DEVICES 2, 3, 4 AND 5 WERE SPECIFIED. (IF THE SUB-DEVICE WERE SPECIFIED BY ADDRESSES, THE INCREMENT WOULD BE BY 2 SINCE ADDRESSES MUST BE ON AN EVEN BOUNDARY.) THE CSR ADDRESSES AND Q-FACTORS FOR THE FOUR ENTRIES ARE ASSUMED TO BE 160000 AND 0 RESPECTIVELY SINCE THEY WERE ONLY SPECIFIED ONCE. THE LAST TWO UNITS ARE SPECIFIED IN THE THIRD PASS.

THE WHOLE PROCESS COULD HAVE BEEN ACCOMPLISHED IN ONE PASS AS SHOWN BELOW.

```
# UNITS (D) ?  8<CR>

UNIT 1
CSR ADDRESS (O) ?  160000<CR>
SUB-DEVICE # (O) ?  0-7<CR>
Q-FACTOR (O) 0 ?  0,1,0,,,,1,1<CR>
```

AS YOU CAN SEE FROM THIS EXAMPLE, NULL REPLIES (COMMAS ENCLOSING A NULL FIELD) TELL THE RUNTIME SERVICES TO REPEAT THE LAST REPLY.

2.7 QUICK START-UP PROCEDURE (XXDP+)

TO START-UP THIS PROGRAM:

1. BOOT XXDP+
2. GIVE THE DATE AND ANSWER THE LSI AND 50HZ (IF THERE IS A CLOCK) QUESTIONS
3. TYPE "R NAME", WHERE NAME IS THE NAME OF THE BIN OR BIC FILE FOR THIS PROGRAM
4. TYPE "START"
5. ANSWER THE "CHANGE HW" QUESTION WITH "Y"

6. ANSWER ALL THE HARDWARF QUESTIONS

7. ANSWER THE ''CHANGE SW'' QUESTION WITH ''N''

WHEN YOU FOLLOW THIS PROCEDURE YOU WILL BE USING ONLY THE DEFAULTS FOR FLAGS AND SOFTWARE PARAMETERS. THESE DEFAULTS ARE DESCRIBED IN SECTIONS 2.3 AND 2.5.

3.0 ERROR INFORMATION

3.1 TYPES OF ERROR MESSAGES

THERE ARE THREE LEVELS OF ERROR MESSAGES THAT MAY BE ISSUED BY A DIAGNOSTIC: GENERAL, BASIC AND EXTENDED. GENERAL ERROR MESSAGES ARE ALWAYS PRINTED UNLESS THE ''IER'' FLAG IS SET (SECTION 2.3). THE GENERAL ERROR MESSAGE IS OF THE FORM:

```
NAME  TYPE  NUMBER  ON UNIT NUMBER  TST NUMBER PC:XXXXXX
ERROR MESSAGE
```

```
.WHERE; NAME = DIAGNOSTIC NAME
        TYPE = ERROR TYPE (SYS FATAL, DEV FATAL, HARD OR SOFT)
        NUMBER = ERROR NUMBER
        UNIT NUMBER = 0 - N (N IS LAST UNIT IN PTABLE)
        TST NUMBER = TEST AND SUBTEST WHERE ERROR OCCURRED
        PC:XXXXXX = ADDRESS OF ERROR MESSAGE CALL
```

BASIC ERROR MESSAGES ARE MESSAGES THAT CONTAIN SOME ADDITIONAL INFORMATION ABOUT THE ERROR. THESE ARE ALWAYS PRINTED UNLESS THE ''IER'' OR ''IBR'' FLAGS ARE SET (SECTION 2.3). THESE MESSAGES ARE PRINTED AFTER THE ASSOCIATED GENERAL MESSAGE.

EXTENDED ERROR MESSAGES CONTAIN SUPPLEMENTARY ERROR INFORMATION SUCH AS REGISTER CONTENTS OR GOOD/BAD DATA. THESE ARE ALWAYS PRINTED UNLESS THE ''IER'', ''IBR'' OR ''IXR'' FLAGS ARE SET (SECTION 2.3). THESE MESSAGES ARE PRINTED AFTER THE ASSOCIATED GENERAL ERROR MESSAGE AND ANY ASSOCIATED BASIC ERROR MESSAGES.

3.2 ERROR PRINTOUT

THE ERROR PRINTOUT WILL CONTAIN A ONE LINE ERROR DESCRIPTION FOLLOWED BY COLUMN HEADINGS AND COLUMNS OF REGISTER CONTENTS IN OCTAL.

EXAMPLE:

```
CZRXXX  HRD  ERR  00XXX  ON UNITXX  TSTXX  SUBXX  PCXXXXX
RP07 ADDRESSING ERROR (IAE AOE)
CYL XXX.  TRK XX.  SEC XX.     RPER2  (HEX) XXXX

DRIVE  RPCS1  RPWC   RPBA   RPDA   RPCS2  RPDS
XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
RPER1  RPAS   RPLA   RPDB   RPMR1  RPDT   RPSN
XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
RP0F   RPDC   RPCC   RPER2  RPER3  RPEC1  RPEC2
XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
```

THE FIRST LINE OF THE ERROR MESSAGE IS PRODUCED BY THE DIAGNOSTIC SUPERVISOR. THERE ARE SEVEN ITEMS REPRESENTED IN THE FIRST LINE OF OUTPUT. THEY ARE: 1) THE MAINDEC NUMBER, 2) THE TYPE OF ERROR, IE: HARD, DEVICE FATAL, 3) THE ERROR MESSAGE NUMBER, 4) THE FAILING LOGICAL UNIT NUMBER, 5) THE NUMBER OF THE FAILING TEST, 6) THE NUMBER OF THE FAILING SUB-TEST, 7) THE ACTUAL PROGRAM COUNT OF THE FAILURE MESSAGE.

THE SECOND LINE PRODUCES INFORMATION ABOUT THE SPECIFIC FAILURE MODE. THE BALANCE OF THE ERROR REPORT CONTAINS REGISTER STATUS TO AID THE F.E. IN FAULT DETECTION AND POSSIBLE ISOLATION.

3.3 SPECIFIC ERROR MESSAGES

INIT CODE ERRORS

ON A START COMMAND OR ON A NEW PASS, THE DRIVE AVAILIBILITY IS CHECKED IN THE INIT CODE, BEFORE RUNNING THE TESTS. A DRIVE NOT AVAILABLE IS APPROPRIATELY REPORTED AND THE CURRENT PASS ABORTED FOR THAT UNIT:

```
DRIVE N UNSAFE
DRIVE N NON-EXISTENT
DRIVE N OFF-LINE
DRIVE N NOT A RP07
```

WHERE 'N' IS THE DRIVE NUMBER THAT FAILED

NUMBERED ERROR LIST

```
 1:   RHXX CONTROL BUS PARITY ERROR MCPE=1
 2:   RHXX DATA BUS PARITY ERROR MDPE=1
 3:   RHXX ILLEGAL CONDITIONS SET (NED,NEM,PGE,MXF)
 4:   WRITE CHECK ERROR
 5:   DATA LATE ERROR
 6:   DRIVE PROGRAMMING ERROR (PGE)
 7:   LOSTS BIT CLOCK (LBC)
11:   WRITE CLOCK FAILS
12:   WRITE LOCK ERROR
13:   DATA ERROR (DCK)
14:   DRIVE BUS PARITY ERROR (DPE)
15:   ILLEGAL CONDITIONS SET (ILF,ILR,RMR)
16:   ADDRESSING ERROR (IAE,AOE)
17:   SEEK ERROR (SKI,LCE)
20:   CLOCK (KW11-P) OVERFLOW IN TIMING TEST
21:   EARLY WARNING (EWN)
22:   READ AND WRITE HEAD FAILS
23:   DATA FORMAT BIT ERROR (FER)
24:   HEADER INFORMATION ERROR (HCE)
25:   DRIVE HAS BECOME NON-EXISTENT                          (1)
26:   DRIVE HAS NOT RESPONDED TO PORT REQUEST
27:   SOFTWARE TIMEOUT ON THIS DRIVE
30:   FATAL MASSBUS PARITY ERROR (MCPE=1 OR PAR=1)           (1)
31:   OFFLINE OR UNSAFE DRIVE REQUESTED                      (1)
32:   WRITE-READY UNSAFE
```

```
33:  DC POWER UNSAFE
34:  INDEX UNSAFE
35:  PROCESSOR HANDSHAKE FAILURE
36:  DRIVE OFF-LINE OR NOT A RP07                                  (1)
41:  OPERATION INCOMPLETE (OPI)
42:  IMPROPER HEADER DATA                                          (2)
43:  ECC LOGIC FAILURE
44:  MISC DRIVE ERROR: RPER1, RPER2, RPER3
45:  DRIVE TIMING ERROR (DTE)
46:  HEADER CRC ERROR (HCRC)
47.  UNCORRECTABLE ECC ERROR
50:  LAST BLOCK TFR LBT NOT SET WHEN READING LAST SECTOR            (4)
51:  AD OVFL AOE NOT SET WHEN READING FAST LAST SECTOR              (4)
52:  HARD ERROR -                                                  (3)
53:  SOFT ERROR -                                                  (3)
54:  OM OF RPDS NOT SET ON OFFSET CMD                              (4)
55:  OM OF RPDS NOT RESET ON RET CENTER CMD                        (4)

MOST OF THE NUMBERED ERRORS ABOVE WILL ALSO CAUSE A DUMP OF THE
FORMAT BELOW, CONSISTING OF 2 PARTS, A BASIC, THEN AN EXTENDED
ERROR MESSAGE, BOTH CONTROLLED BY IBR AND IXR FLAGS:

    CYL XXX.  TRK XX.  SEC XX.     RPER2  (HEX) XXXX

    DRIVE  RPCS1  RPWC   RPBA   RPDA   RPCS2  RPDS
    XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
    RPER1  RPAS   RPLA   RPDB   RPMR1  RPDT   RPSN
    XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
    RPOF   RPDC   RPCC   RPER2  RPER3  RPEC1  RPEC2
    XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX

EXCEPTIONS:

    (1)  DRIVE N

    (2)  DRV CYL TRK SEC
         XXX XXX XXX XXX
         GDCYL GDTRK GDSEC BDCYL BDTRK BDSEC
         XXX   XXX   XXX   XXX   XXX   XXX

    (3)  # OF OPERATIONS WITH A LOST REVOLUTION:  XXXX
         XXXX OPERATIONS TIMED

         ALLOWABLE OPERATION TIME LIMIT
         MAX= XXXXX US

    (4)  NO ADDITIONAL MESSAGES

    (5)  TIMING TESTS 7, 14, 18:

         UNRECOVERABLE SEARCH ERROR
         ABORT TEST

         SEARCH FAILED AFTER 16 RETRIES
         ABORT TEST
```

(6) TIMING TESTS 8-10, 14, 18:

POSITION ERROR: ABORT TEST

3.4 ERROR TYPE

THE FIRST LINE OF ERROR MESSAGES PRODUCED BY THE DIAGNOSTIC SUPERVISOR IDENTIFIES THE TYPE OF ERROR REPORTED. THEY ARE CLASSIFIED BY THE DIAGNOSTICS IN 3 CATEGORIES:

1. 'SFT' - SOFT: THE FIRST LOST DISC REVOLUTION IN THE ADDRESS MARK DETECTION TESTS.
2. 'HRD' - HARD: ALL ERRORS, EXCEPT DEVICE FATAL ERRORS AND SOFT ERRORS.
3. 'DVC FTL' - DEVICE FATAL: AN ERROR THAT FAILS THE DEVICE; DEVICE NOT READY, NON-EXISTENT OR NOT AN RP07.

4.0 PERFORMANCE AND PROGRESS REPORTS

AT THE END OF EACH PASS, THE PASS COUNT IS GIVEN ALONG WITH THE TOTAL NUMBER OF ERRORS REPORTED SINCE THE DIAGNOSTIC WAS STARTED. THE "EOP" SWITCH CAN BE USED TO CONTROL HOW OFTEN THE END OF PASS MESSAGE IS PRINTED. SECTION 2.2 DESCRIBES SWITCHES.

5.0 TEST SUMMARIES

TEST 1: RECAL TEST

THIS TEST EXECUTES A RECALIBRATE COMMAND, THEN EXECUTES A READ HEADER AND DATA COMMAND TO VERIFY CORRECT POSITION.

NOTE

IN SEEK TESTS 2-6, SEEK POSITIONING IS VERIFIED VIA READ HEADER AND DATA COMMAND, UNSUPERSEDED BY SOFTWARE (SW) DIALOGUE, IN WHICH CASE SEEK POSITIONING IS NOT VERIFIED.

TEST 2: INCREMENTAL SEEK TEST

THIS TEST EXECUTES FORWARD SEEKS TO ADVANCE THE FIRST(STARTING) CYLINDER ADDRESS TO THE LAST(ENDING) CYLINDER ADDRESS INCREMENTALLY. WHEN THE LAST(ENDING) CYLINDER IS REACHED, THE TEST IS REPEATED IN THE REVERSE DIRECTION. THE INCREMENT/DECREMENT VALUE IS 1 BY DEFAULT, CHANGEABLE VIA SW DIALOGUE.

TEST 3: RANDOM SEEK TEST

THIS TEST EXECUTES 1024. SEEK OPERATIONS RANDOMLY BETWEEN THE GIVEN FIRST(STARTING) CYLINDER ADDRESS AND LAST(ENDING) CYLINDER ADDRESS.

TEST 4: RECAL/RANDOM SEEK TEST

THIS TEST EXECUTES A RECALIBRATE COMMAND, FOLLOWED BY A SEEK TO A RANDOMLY SELECTED CYLINDER. THIS SEQUENCE IS REPEATED 10. TIMES.

TEST 5: SEEK DIFFERENTIAL TEST

THIS TEST CONSISTS OF 3 SUBTESTS TO TEST THE HEAD POSITIONER AND SERVO SYSTEM RESPONSE TO 3 UNIQUE DIFFERENTIAL SEEK PROFILES:

1. 6 CYLINDER DIFFERENTIAL SEEK: FORCES A SLEW RATE CHANGE BY SEEKING FROM CYLINDER 0 TO 5, 1 TO 6, 2 TO 7, ... 624 TO 629, TO TEST THE POSITIONAL LOGIC.

2. 33 CYLINDER DIFFERENTIAL SEEK: WORST CASE SEEK OVERSHOOT TEST, FORCED BY SEEKING FROM CYLINDER 0 TO 32, 1 TO 33, 2 TO 34, ... 597 TO 629.

3. 400 CYLINDER DIFFERENTIAL SEEK: FORCES MAXIMUM ACCELERATION AND DECELERATION OF CARRIAGE ASSEMBLY, FORCED BY SEEKING FROM CYLINDER 0 TO 399, 1 TO 400, 2 TO 401, ... 230 TO 629.

TEST 6: OSCILLATING SEEK TEST

THIS TEST SHALL EXECUTE A SERIES OF SEEK OPERATIONS TO CAUSE AN OSCILLATING MOVEMENT OF THE HEAD POSITIONER. THAT MOVEMENT SHALL RESULT FROM SEEKING TO THE FOLLOWING PATTERN OF DESIRED CYLINDERS: FROM THE MAXIMUM DISTANCE SEEK OF CYLINDER 0 TO LAST(ENDING) CYLINDER (LC), FROM CYLINDER 1 TO LC-1, FROM CYLINDER 2 TO LC-2, ... DOWN TO THE MEDIAN CYLINDER, THEN, REVERSING THE ORDER OF THOSE SEEKS FROM THE MEDIAN CYLINDER BACK UP TO THE MAXIMUM DISTANCE SEEK OF CYLINDER 0 TO LC.

NOTE

THE TESTS NUMBERED 7-10., 14., 18. CONTAIN TIMING TESTS. THEY REQUIRE THAT A KW11P P-CLOCK BE INSTALLED ON THE SYSTEM IN-ORDER TO RUN. AT THE COMPLETION OF EACH OF THE TIMING TESTS, THE MAXIMUM AND THE MINIMUM TIMES, AND THE AVERAGE SEEK TIME FOR EACH TEST ARE CHECKED AGAINST THE TOLERANCES GIVEN BY THE ENGINEERING SPECS. THE PROGRAM WILL PRINT THE MEASURED TIMES ONLY IF THEY ARE OVER THE TIMING TOLERANCES, PROVIDED THE PRINT WAS REQUESTED VIA SOTWARE (SW) DIALOGUE. IF A SYSTEM CLOCK IS NOT FOUND TO BE PRESENT, TIMING TESTS WILL NOT BE EXECUTED. THE OPERATOR WILL BE NOTIFIED VIA A MESSAGE.

TEST 7: ROTATIONAL SPEED TIMING TEST

THIS TEST EXECUTES A SEARCH COMMAND TO CYLINDER FC, TRACK FT AND SECTOR FS. AS SOON AS THE SEARCH OPERATION IS DONE, THE TEST SETS THE "GO" BIT TO EXECUTE ANOTHER SEARCH COMMAND WITH THE SAME RHXX/RP07 REGISTER CONTENTS. THE TIME INTERVAL IS MEASURED AGAINST A TOLERANCE OF 16.515 MSEC +-3%. REPEAT THIS SEQUENCE 10 TIMES. IN CASE ANY RECOVERABLE READ ERROR EXISTS, THE PROGRAM WILL EXECUTE THE SEARCH COMMAND 16 TIMES. IF THE RETRY SEQUENCE FAILS THE PROGRAM WILL ABORT THE TEST, GENERATING A MESSAGE TELLING WHY THE PROGRAM WAS ABORTED.

TEST 8: ONE CYLINDER SEEK TIMING TEST

THIS TEST EXECUTES FORWARD SEEK FROM THE FIRST(STARING) CYLINDER TO THE FIRST(STARTING) CYLINDER + 1 AND THE OPERATION IS TIMED AGAINST A TOLERANCE OF 5 MSEC.. AFTER EXECUTING THE TEST CYCLE, THE FIRST(STARING) CYLINDER ADDRESS IS INCREMENTED BY ONE. THIS PROCEDURE CONTINUES UNTIL THE FIRST(STARTING) CYLINDER ADDRESS REACHES 629 THE USER SPECIFIED ENDING CYLINDER, THEN THE TEST IS REPEATED IN THE REVERSE DIRECTION. DO THIS SEQUENCE TWICE. THE AVERAGE ONE CYLINDER SEEK TIME WILL BE COMPUTED AND REPORTED WHEN THE "TYPE TIME REPORTS (L)" QUESTION IS RESPONDED TO IN THE AFFIRMATIVE. THE AVERAGE SEEK TIME FOR A SINGLE CYLINDER SEEK IS COMPUTED PER FORMULA:

$$T\ (AVG) = \frac{T1 + T2 + \ldots T629 + T629 + \ldots T2 + T1}{629 + 629}$$

WHERE TX IS THE SINGLE CYLINDER SEEK TIME.

TEST 9: AVERAGE SEEK TIME MEASUREMENT

THIS TEST WILL MEASURE THE AVERAGE SEEK TIME BY USING THE FOLLOWING CALCULATION:

$$T\ (AVG) = \frac{2 \times [\ (T1 \times 629) + (T2 \times 628) + \ldots + (T629 \times 1)]}{629 \times 629}$$

WHERE:
THE TX IS THE FORWARD (REVERSE) SEEK TIME FROM CYLINDER 0 TO CYLINDER X (CYLINDER X TO CYLINDER 0). THE NUMBER 2X629 IS THE TOTAL NUMBER OF SEEKS EXECUTED.
AVERAGE SEEK TIME TOLERANCE IS 23 MSEC.

TEST 10: MAXIMUM SEEK TIMING TEST

THIS TEST EXECUTES FORWARD SEEK FROM CYLINDER 0 TO THE LAST(ENDING) CYLINDER, THEN A REVERSE SEEK FROM THE LAST(ENDING) CYLINDER TO CYLINDER 0. BOTH SEEKS ARE TIMED AGAINST A TOLERANCE OF 46 MSEC.. A TOTAL NUMBER OF 1024 SEEKS WILL BE EXECUTED TO CALCULATE THE MAXIMUM SEEK TIME(512 FORWARD, 512 REVERSE).

TEST 11: MID TRANSFER SEEK TEST

THIS TEST EXECUTES READ DATA COMMANDS FOR EVERY TRACK ON THE FIRST (STARTING) CYLINDER, WITH WORD COUNT BEING SET TO EQUAL A FULL TRACK PLUS ONE SECTOR. THIS TEST ENSURES THAT EACH READ HEAD WORKS PROPERLY AND ALSO ENSURES THAT THE SPIRAL READ DATA OPERATION, REQUIRING A MID-TRANSFER SEEK, WORKS PROPERLY.

TEST 12: ERROR REGISTER BIT TEST

EXECUTE A READ DATA COMMAND ON THE LAST USER ADDRESSABLE SECTOR, TESTING FOR THE ASSERTION OF LAST BLOCK TRANSFERRED (LBT) BIT OF THE STATUS REG RPDS. REISSUE READ DATA COMMAND TO LAST SECTOR WITH A WORD COUNT GREATER THAN 256 WORDS, TESTING FOR THE ASSERTION OF THE ADDRESS OVERFLOW ERROR (AOE) BIT OF THE ERROR REG. RPER1.

TEST 13: OFFSET/RETURN TO CENTER LINE TEST

VERIFY THAT THE OFFSET AND RETURN TO CENTER LINE COMMAND WORK PROPERLY.

ISSUE AN OFFSET COMMAND, PROCESS THE ATTENTION INTERRUPT AND CHECK FOR ERRORS, VERIFY THE ASSERTION OF THE OFFSET MODE (OM) BIT OF RPDS.

ISSUE A RETURN TO CENTER LINE COMMAND, PROCESS THE ATTENTION INTERRUPT AND CHECK FOR ERRORS, VERIFY THE RESETTING OF OM.

TEST 14: RANDOM READ TEST / ADDRESS MARK DETECTION TEST

IF THERE IS NO P-CLOCK, THIS TEST RANDOMLY SELECTS A SECTOR, THEN EXECUTES A READ DATA COMMAND TO THIS SECTOR TO VERIFY THAT NO DATA TRANSFER ERROR OCCURS. REPEAT 1024 TIMES.

IF THERE IS A P-CLOCK, THE ADDRESS MARK DETECTION TIMING TEST VERIFIES THAT DATA CAN BE READ CORRECTLY WITHIN THE SAME REVOLUTION AS A SECTOR DETECTION. THE TEST RANDOMLY SELECTS A SECTOR, SEARCHES FOR THE PRECEDING LOGICAL SECTOR, THEN READS THE SELECTED SECTOR. THE TIME INTERVAL SEARCH DONE - READ DONE IS MEASURED AND CHECKED TO BE WITHIN THE SAME DISC REVOLUTION. REPEAT THIS SEQUENCE 1024 TIMES. AT THE END OF THE TEST, AN ERROR MESSAGE SHALL INDICATE THE NUMBER OF OPERATIONS WITH A REVOLUTION LOST, IF ANY.

TEST 15: FE CYLINDER ADDRESS TEST

THIS TEST EXECUTES READ-HEADER AND DATA COMMANDS TO VERIFY THE ADDRESSING OF SECTOR 0 ON ALL TRACKS OF THE FIRST FE CYLINDER, THEN EXECUTES AN EXPLICIT SEEK TO ACCESS THE SECOND FE CYLINDER.

TEST 16: FE CYLINDER WRITE AND WRITE-CHECK TEST

THIS TEST WILL WRITE ON THE FIRST FE CYLINDER FROM THE

FIRST(STARTING) TO THE LAST(ENDING) TRACK TO VERIFY THAT THE DRIVE CAN WRITE DATA WITHOUT DETECTABLE ERROR. THE TEST WRITES THE DEFAULT DATA PATTERN 030221 OR A USER SPECIFIED DATA PATTERN ONTO THE MEDIA, FOLLOWED BY EXECUTING A WRITE-CHECK COMMAND. THE TEST CHANGES THE DATA PATTERN TO ITS COMPLEMENT VALUE AND REPEATS THE TEST CYCLE. THE WORD COUNT IS SET TO DO TWO HALF TRACK DATA TRANSFERS.

TEST 17: WRITE TEST

IF RUNNING THE FIELD VERSION OF THIS PROGRAM, THIS TEST IS ONLY RUN IF THE "WRITE DATA ANYWHERE ON THE MEDIA" OPTION IS SELECTED BY THE OPERATOR, IN THE SOFTWARE PARAMETER QUESTIONS.

THIS TEST WRITES DATA AND WRITE CHECKS DATA ON EVERY TRACK FROM THE FIRST(STARTING) TO LAST(ENDING) TRACK OF THE FIRST (STARTING) CYLINDER FC AND THE LAST(ENDING) CYLINDER. THE WORD COUNT IS SET TO DO TWO HALF TRACK DATA TRANSFERS.

TEST 18: RANDOM WRITE TEST /ADDRESS MARK DETECTION TEST

IF RUNNING THE FIELD VERSION OF THIS PROGRAM, THIS TEST IS ONLY RUN IF THE "WRITE DATA ANYWHERE ON THE MEDIA" OPTION IS SELECTED BY THE OPERATOR, IN THE SOFTWARE PARAMETER QUESTIONS.

IF THERE IS NO P-CLOCK, THIS TEST WRITES DATA AND WRITE CHECKS DATA RANDOMLY ON THE MEDIA, WITH A TRANSFER SIZE OF 1 SECTOR, 1024 TIMES. THE DATA PATTERN IS RANDOM OR A SPECIFIED PATTERN.

IF THERE IS A P-CLOCK, THE ADDRESS MARK DETECTION TIMING TEST VERIFIES THAT DATA CAN BE WRITTEN CORRECTLY WITHIN THE SAME REVOLUTION AS A SECTOR DETECTION. THE TEST RANDOMLY SELECTS A SECTOR, SEARCHES FOR THE PRECEDING SECOND LOGICAL SECTOR, THEN WRITES THE SELECTED SECTOR. THE TIME INTERVAL SEARCH DONE - WRITE DONE IS MEASURED AND CHECKED TO BE WITHIN THE SAME DISC REVOLUTION. A WRITE CHECK DATA IS THEN ISSUED ON THE SELECTED SECTOR. REPEAT 1024 TIMES. AT THE END OF THE TEST, AN ERROR MESSAGE SHALL INDICATE THE NUMBER OF OPERATIONS WITH A REVOLUTION LOST, IF ANY.

```
.REM @

        VERSION (CZRJL-A-0)

            1.  THIS VERSION IS THE STARTING POINT FOR CX DIAGNOSTIC SUPPORT OF
                THE RP07 DISK DRIVE.

@
```

```
      1                         ;*LAST REVISION 01-JAN-83
      2
    270                         .TITLE  CZRJLA0 RP07 FCTNL TEST
    272                         .SBTTL  PROGRAM HEADER
    298
    300 000000                          .ENABL  AMA,ABS
    301         002000          .       =       2000
    303
    305                         ;++
    306                         ; THE PROGRAM HEADER IS THE INTERFACE BETWEEN
    307                         ; THE DIAGNOSTIC PROGRAM AND THE SUPERVISOR.
    308                         ;--
    309
    311
    319
    323 002000                  L$NAME::                ;DIAGNOSTIC NAME
        002000      103                 .ASCII /C/
        002001      132                 .ASCII /Z/
        002002      122                 .ASCII /R/
        002003      112                 .ASCII /J/
        002004      114                 .ASCII /L/
        002005      000                 .BYTE   0
        002006      000                 .BYTE   0
        002007      000                 .BYTE   0
        002010                  L$REV::                 ;REVISION LEVEL
        002010      101                 .ASCII  /A/
        002011                  L$DEPO::                ;0
        002011      060                 .ASCII  /0/
        002012                  L$UNIT::                ;NUMBER OF UNITS
        002012  000001                  .WORD   T$PTHV
        002014                  L$TIML::                ;LONGEST TEST TIME
        002014  000060                  .WORD   60
        002016                  L$HPCP::                ;POINTER TO H.W. QUES.
        002016  041026                  .WORD   L$HARD
        002020                  L$SPCP::                ;POINTER TO S.W. QUES.
        002020  041144                  .WORD   L$SOFT
        002022                  L$HPTP::                ;PTR. TO DEF. H.W. PTABLE
        002022  002172                  .WORD   L$HW
        002024                  L$SPTP::                ;PTR. TO S.W. PTABLE
        002024  002204                  .WORD   L$SW
        002026                  L$LADP::                ;DIAG. END ADDRESS
        002026  074614                  .WORD   L$LAST
        002030                  L$STA::                 ;RESERVED FOR APT STATS
        002030  000000                  .WORD   0
        002032                  L$CO::
        002032  000000                  .WORD   0
        002034                  L$DTYP::                ;DIAGNOSTIC TYPE
        002034  000000                  .WORD   0
        002036                  L$APT::                 ;APT EXPANSION
        002036  000000                  .WORD   0
        002040                  L$DTP::                 ;PTR. TO DISPATCH TABLE
        002040  002124                  .WORD   L$DISPATCH
        002042                  L$PRIO::                ;DIAGNOSTIC RUN PRIORITY
        002042  000000                  .WORD   0
        002044                  L$ENVI::                ;FLAGS DESCRIBE HOW IT WAS SETUP
        002044  000000                  .WORD   0
        002046                  L$EXP1::                ;EXPANSION WORD
```

```
002046  000000                  .WORD   0
002050                  L$MREV::                ;SVC REV AND EDIT #
002050     003                  .BYTE   C$REVISION
002051     003                  .BYTE   C$EDIT
002052                  L$EF::                  ;DIAG. EVENT FLAGS
002052  000000                  .WORD   0
002054  000000                  .WORD   0
002056                  L$SPC::
002056  000000                  .WORD   0
002060                  L$DEVP::                ; POINTER TO DEVICE TYPE LIST
002060  003020                  .WORD   L$DVTYP
002062                  L$REPP::                ;PTR. TO REPORT CODE
002062  000000                  .WORD   0
002064                  L$EXP4::
002064  000000                  .WORD   0
002066                  L$EXP5::
002066  000000                  .WORD   0
002070                  L$AUT::                 ;PTR. TO ADD UNIT CODE
002070  000000                  .WORD   0
002072                  L$DUT::                 ;PTR. TO DROP UNIT CODE
002072  000000                  .WORD   0
002074                  L$LUN::                 ;LUN FOR EXERCISERS TO FILL
002074  000000                  .WORD   0
002076                  L$DESP::                ;POINTER TO DIAG. DESCRIPTION
002076  003026                  .WORD   L$DESC
002100                  L$LOAD::                ;GENERATE SPECIAL AUTOLOAD EMT
002100  104035                  EMT     E$LOAD
002102                  L$ETP::                 ;POINTER TO ERRTBL
002102  000000                  .WORD   0
002104                  L$ICP::                 ;PTR. TO INIT CODE
002104  025460                  .WORD   L$INIT
002106                  L$CCP::                 ;PTR. TO CLEAN-UP CODE
002106  026504                  .WORD   L$CLEAN
002110                  L$ACP::                 ;PTR. TO AUTO CODE
002110  026502                  .WORD   L$AUTO
002112                  L$PRT::                 ;PTR. TO PROTECT TABLE
002112  025452                  .WORD   L$PROT
002114                  L$TEST::                ;TEST NUMBER
002114  000000                  .WORD   0
002116                  L$DLY::                 ;DELAY COUNT
002116  000000                  .WORD   0
002120                  L$HIME::                ;PTR. TO HIGH MEM
002120  000000                  .WORD   0
325
```

```
                        .SBTTL  DISPATCH TABLE

                        ;++
                        ; THE DISPATCH TABLE CONTAINS THE STAR ING ADDRESS OF EACH TEST.
                        ; IT IS USED BY THE SUPERVISOR TO DISPATCH TO EACH TEST.
                        ;--

002122  000022                  .WORD   18
002124                  L$DISPATCH::
002124  026610                  .WORD   T1
002126  026660                  .WORD   T2
002130  026766                  .WORD   T3
002132  027220                  .WORD   T4
002134  027434                  .WORD   T5
002136  027664                  .WORD   T6
002140  027772                  .WORD   T7
002142  031050                  .WORD   T8
002144  032040                  .WORD   T9
002146  032756                  .WORD   T10
002150  033632                  .WORD   T11
002152  034036                  .WORD   T12
002154  034264                  .WORD   T13
002156  034454                  .WORD   T14
002160  035772                  .WORD   T15
002162  036250                  .WORD   T16
002164  036636                  .WORD   T17
002166  037160                  .WORD   T18

```

```
                                .SBTTL  DEFAULT HARDWARE P-TABLE

                                ;++
                                ; THE DEFAULT HARDWARE P-TABLE CONTAINS DEFAULT VALUES OF
                                ; THE TEST-DEVICE PARAMETERS.  THE STRUCTURE OF THIS TABLE
                                ; IS IDENTICAL TO THE STRUCTURE OF THE HARDWARE P-TABLES.
                                ;--

 002170  000004                        .WORD   L10000-L$HW/2
 002172                         L$HW::
 002172                         DFPTBL::
 002172  176700                         .WORD 176700    ;RPCS1 BASE REGISTER ADDRESS
 002174  000254                         .WORD 254       ;VECTOR ADDRESS
 002176  000240                         .WORD 240       ;BR LEVEL 5 DEVICE
 002200  000000                         .WORD 0         ;DRIVE NUMBER

 002202                         L10000:
```

```
                                .SBTTL  SOFTWARE P-TABLE

                                ;++
                                ; THE SOFTWARE P-TABLE CONTAINS THE VALUES OF THE PROGRAM
                                ; PARAMETERS THAT CAN BE CHANGED BY THE OPERATOR.
                                ;--

002202  000016                          .WORD   L10001-L$SW/2
002204                          L$SW::
002204                          SFPTBL::
002204  000000                  FC:     .WORD   0       ;FIRST CYLINDER         ;TESTS: 2-4,6-8,11,13,14,17,18
002206  001165                  LC:     .WORD   629.    ;LAST  CYLINDER         ;TESTS: 2-4,6,8-10,1',17,18
002210  000001                  IC:     .WORD   1       ;INCREMENT CYLINDER     ;TESTS: 2
002212  000000                  FT:     .WORD   0       ;FIRST TRACK            ;TESTS: 2-7,11,13,16,17
002214  000037                  LT:     .WORD   31.     ;LAST TRACK             ;TESTS: 3-6,11,14,16-18
002216  000001                  IT:     .WORD   1       ;INCREMENT TRACK        ;TESTS: 11,16,17
002220  000000                  FS:     .WORD   0       ;FIRST SECTOR           ;TESTS: 2,5-7,13
002222  000061                  LS:     .WORD   49.     ;LAST SECTOR            ;TESTS: 5,6,14,18
002224  030221                  PAT:    .WORD   030221  ;WRITE DATA PATTERN     ;TESTS: 16-18 (WORST CASE)

002226      001                 REDHDR: .BYTE   1       ;READ HEADER AND DATA CMD FLAG - DEFAULT: YES - SEEK TESTS 2-6
002227      001                 TIMTYP: .BYTE   1       ;TYPE TIME - DEFAULT: YES - TIMING TESTS 7-10,14,18
002230      000                 TIMSTL: .BYTE   0       ;TIMING TESTS,STALL BETWEEN SEEKS: RANDOM INSTEAD OF 2 MSEC
002231      000                 STALLF: .BYTE   0       ;STALL FLAG: AFTER EVERY DRIVE FUNCTION - DEFAULT: NO
                                                        ;NON-TIMING TESTS 1-6,11,14-18
002232      000                 STALRD: .BYTE   0       ;RANDOM STALL FLAG - DEFAULT: NO - PREREQUISITE: STALLF=1
002233      000                 STOFLG: .BYTE   0       ;SOFTWARE TIMEOUT INHIBIT FLAG - DEFAULT: NO - ALL TESTS
002234      000                 RANPAT: .BYTE   0       ;RANDOM WRITE PATTERN - DEFAULT: NO - TEST: 18
002235      000                 WRTALL: .BYTE   0       ;WRITE DATA ALL OVER THE MEDIA FLAG - DEFAULT: NO
                                                        ;TESTS: 17,18
002236      000                 CHANGE: .BYTE   0       ;CHANGE DRIVE PARAMETER FLAG

                                        .EVEN
002240                          L10001:
```

```
                                .SBTTL  GLOBAL EQUATES SECTION


                                ;++
                                ; THE GLOBAL EQUATES SECTION CONTAINS PROGRAM EQUATES THAT
                                ; ARE USED IN MORE THAN ONE TEST.
                                ;--
                                ;
                                ; BIT DIFINITIONS
                                ;
100000                          BIT15== 100000
040000                          BIT14== 40000
020000                          BIT13== 20000
010000                          BIT12== 10000
004000                          BIT11== 4000
002000                          BIT10== 2000
001000                          BIT09== 1000
000400                          BIT08== 400
000200                          BIT07== 200
000100                          BIT06== 100
000040                          BIT05== 40
000020                          BIT04== 20
000010                          BIT03== 10
000004                          BIT02== 4
000002                          BIT01== 2
000001                          BIT00== 1
                                ;
001000                          BIT9==  BIT09
000400                          BIT8==  BIT08
000200                          BIT7==  BIT07
000100                          BIT6==  BIT06
000040                          BIT5==  BIT05
000020                          BIT4==  BIT04
000010                          BIT3==  BIT03
000004                          BIT2==  BIT02
000002                          BIT1==  BIT01
000001                          BIT0==  BIT00
                                ;
                                ; EVENT FLAG DEFINITIONS
                                ;   EF32:EF17 RESERVED FOR SUPERVISOR TO PROGRAM COMMUNICATION
                                ;
000040                          EF.START==      32.                     ; START COMMAND WAS ISSUED
000037                          EF.RESTART==    31.                     ; RESTART COMMAND WAS ISSUED
000036                          EF.CONTINUE==   30.                     ; CONTINUE COMMAND WAS ISSUED
000035                          EF.NEW==        29.                     ; A NEW PASS HAS BEEN STARTED
000034                          EF.PWR==        28.                     ; A POWER-FAIL/POWER-UP OCCURRED
                                ;
                                ;
                                ; PRIORITY LEVEL DEFINITIONS
                                ;
000340                          PRI07== 340
000300                          PRI06== 300
000240                          PRI05== 240
000200                          PRI04== 200
000140                          PRI03== 140
000100                          PRI02== 100
```

GLOBAL EQUATES SECTION

```
000040                  PRIO1== 40
000000                  PRIO0== 0
                        ;
                        ;OPERATOR FLAG BITS
                        ;
000004                  EVL==          4
000010                  LOT==         10
000020                  ADR==         20
000040                  IDU==         40
000100                  ISR==        100
000200                  UAM==        200
000400                  BOE==        400
001000                  PNT==       1000
002000                  PRI==       2000
004000                  IXE==       4000
010000                  IBE==      10000
020000                  IER==      20000
040000                  LOF==      40000
100000                  HCE==     100000
```

```
                                .SBTTL  RHXX REGISTERS
                                ;
                                ;CONTROL AND STATUS REGISTER 1 (RPCS1)
                                ;
000100                          IE      == 100                  ;INTERRUPT ENABLE (BIT #6)
000200                          RDY     == 200                  ;READY (BIT #7)
000400                          A16     == 400                  ;HIGH ORDER BUS ADDRESS BIT (BIT #8)
001000                          A17     == 1000                 ;HIGH ORDER BUS ADDRESS BIT (BIT #9)
                                ;PSEL   == 2000                 ;PORT SELECT (BIT #10)
020000                          MCPE    == 20000                ;MASSBUSS PARITY ERROR (BIT #13)
040000                          TRE     == 40000                ;TRANSFER ERROR (BIT #14)
100000                          MSSC    == 100000               ;SPECIAL CONDITION (BIT #15)
                                ;
                                ;
                                ;WORD COUNT REGISTER (RPWC)
                                ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;
                                ;
                                ;BUS ADDRESS REGISTER (RPBA)
                                ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;
                                ;
                                ;CONTROL AND STATUS REGISTER 2 (RPCS2)
                                ;
                                ;US1     == 1                   ;UNIT SELECT (BIT #0)
                                ;US2     == 2                   ;UNIT SELECT (BIT #1)
                                ;US4     == 4                   ;UNIT SELECT (BIT #2)
                                ;BAI     == 10                  ;BUS ADDRESS INCREMENT INHIBIT (BIT #3)
                                ;MSPAT   == 20                  ;MASSBUS PARITY TEST (BIT #4)
000040                          CLR     == 40                   ;CLEAR (BIT #5)
                                ;IR      == 100                 ;INPUT READY (BIT #6)
                                ;OR      == 200                 ;OUTPUT READY (BIT #7)
000400                          MPE     == 400                  ;MASS BUS PARITY ERROR (BIT #8)
001000                          MXF     == 1000                 ;MISSED TRANSFER ERROR (BIT #9)
002000                          MSPGE   == 2000                 ;PROGRAM ERROR (BIT #10)
004000                          NEM     == 4000                 ;NON EXISTENT MEMORY (BIT #11)
010000                          NED     == 10000                ;NON EXISTENT DRIVE (BIT #12)
020000                          UPE     == 20000                ;UNIBUS PARITY ERROR (BIT #13)
040000                          WCE     == 40000                ;WRITE CHECK ERROR (BIT #14)
100000                          DLT     == 100000               ;DATA LATE (BIT #15)
                                ;
                                ;
                                ;DATA BUFFER REGISTER (RPDB)
                                ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;
                                ;
                                .SBTTL  RP07 REGISTERS
                                ;
                                ;CONTROL AND STATUS 1 REGISTER. (#00)
                                ;
                                ;GO      == 1                   ;GO BIT (BIT #0)
                                ;F1      == 2                   ;FUNCTION CODE BIT #1
                                ;F2      == 4                   ;FUNCTION CODE BIT #2
                                ;F3      == 10                  ;FUNCTION CODE BIT #3
                                ;F4      == 20                  ;FUNCTION CODE BIT #4
                                ;F5      == 40                  ;FUNCTION CODE BIT #5
004000                          DVA     == 4000                 ;DEVICE AVAILABLE (BIT #11)
```

```
                                ;DRIVE STATUS REGISTER (RPDS) (#01)

000001                  OM      == 1                    ;OFFSET MODE
000002                  EWN     == 2                    ;ERROR WARNING
000004                  ILV     == 4                    ;SECTOR INTERLEAVE MODE IS ENABLED TH. H.W
                        ;VV     == 100                  ;VOLUME VALID (BIT #6)
                        ;DRY    == 200                  ;DRIVE READY (BIT #7)
                        ;DPR    == 400                  ;DRIVE PRESENT (BIT #8)
                        ;PGM    == 1000                 ;PROGRAMABLE (BIT #9)
002000                  LST     == 2000                 ;LAST SECTOR TRANSFERRED (BIT #10)
                        ;WRL    == 4000                 ;WRITE LOCK (BIT #11)
                        ;MOL    == 10000                ;MEDIUM ON-LINE (BIT #12)
                        ;PIP    == 20000                ;POSITIONING OPERATION IN PROGRESS (BIT #13)
040000                  ERR     == 40000                ;COMPOSITE ERROR (BIT #14)
100000                  ATA     == 100000               ;ATTENTION ACTIVE (BIT #15)

                                ;ERROR REGISTER #01 (RPER1) (#02)

000001                  ILF     == 1                    ;ILLEGAL FUNCTION (BIT #0)
000002                  ILR     == 2                    ;ILLEGAL REGISTER (BIT #1)
000004                  RMR     == 4                    ;REGISTER MODIFICATION REFUSED (BIT #2)
                        ;PAR    == 10                   ;PARITY ERROR (BIT #3)
000020                  FER     == 20                   ;FORMAT ERROR (BIT #4)
000040                  WCF     == 40                   ;WRITE CLOCK FAIL (BIT #5)
000100                  ECH     == 100                  ;ECC HARD ERROR (BIT #6)
000200                  HCE     == 200                  ;HEADER COMPARE ERROR (BIT #7)
000400                  HCRC    == 400                  ;HEADER CRC ERROR (BIT #8)
001000                  AOE     == 1000                 ;ADDRESS OVERFLOW ERROR (BIT #9)
002000                  IAE     == 2000                 ;INVALID ADDRESS ERROR (BIT #10)
004000                  WLE     == 4000                 ;WRITE LOCK ERROR (BIT #11)
010000                  DTE     == 10000                ;DRIVE TIMING ERROR (BIT #12)
020000                  OPI     == 20000                ;OPERATION INCOMPLETE (BIT #13)
040000                  UNS     == 40000                ;DRIVE UNSAFE (BIT #14)
100000                  DCK     == 100000               ;DATA CHECK ERROR (BIT 15)

                        ;MAINTAINABILITY REGISTER #01 (RPMR1)(#03)

100000                  DMD     == 100000               ;DIAGNOSTIC MODE

                        ;ATTENTION SUMMARY PSEUDO-REGISTER (RPAS) (#04)

                        ;AT0    == 1                    ;DEVICE 0 (BIT #0)
                        ;AT1    == 2                    ;DEVICE 1 (BIT #1)
                        ;AT2    == 4                    ;DEVICE 2 (BIT #2)
                        ;AT3    == 10                   ;DEVICE 3 (BIT #3)
                        ;AT4    == 20                   ;DEVICE 4 (BIT #4)
                        ;AT5    == 40                   ;DEVICE 5 (BIT #5)
                        ;AT6    == 100                  ;DEVICE 6 (BIT #6)
                        ;AT7    == 200                  ;DEVICE 7 (BIT #7)

                        ;DESIRED SECTOR/TRACK ADDRESS REGISTER (RPDA) (#05)
```

```
                                ;(EACH BIT IS CALLED BY BIT NUMBER)


                                ;DRIVE TYPE REGISTER (RPDT) (#06)

                                ;DT00    == 1                   ;DRIVE TYPE NUMBER BIT 1
                                ;DT01    == 2                   ;DRIVE TYPE NUMBER BIT 2
                                ;DT02    == 4                   ;DRIVE TYPE NUMBER BIT 3
                                ;DT03    == 10                  ;DRIVE TYPE NUMBER BIT 4
                                ;DT04    == 20                  ;DRIVE TYPE NUMBER BIT 5
                                ;DT05    == 40                  ;DRIVE TYPE NUMBER BIT 6
                                ;DT06    == 100                 ;DRIVE TYPE NUMBER BIT 7
                                ;DT07    == 200                 ;DRIVE TYPE NUMBER BIT 8
                                ;DT08    == 400                 ;DRIVE TYPE NUMBER BIT 9
                                ;DRQ     == 4000                ;DRIVE REQUEST REQUIRED (BIT #11)
                                ;MOH     == 20000               ;MOVING HEAD (BIT #13)
                                ;TAP     == 40000               ;TAPE DRIVE (BIT #14)
                                ;NBA     == 100000              ;NOT BLOCK ADDRESSED (BIT #15)


                                ;LOOK-AHEAD REGISTER (RPLA) (#07)

                                ;SC0     == 100                 ;SECTOR COUNT FIELD 0 (BIT #6)
                                ;SC1     == 200                 ;SECTOR COUNT FIELD 1 (BIT #7)
                                ;SC2     == 400                 ;SECTOR COUNT FIELD 2 (BIT #8)
                                ;SC3     == 1000                ;SECTOR COUNT FIELD 3 (BIT #9)
                                ;SC4     == 2000                ;SECTOR COUNT FIELD 4 (BIT #10)


                                ;RP07 ERROR REGISTER #02 (RPER2) (#10)

000400                          WRYUNS   == 400                 ;WRITE OFF TRACK CENTER (WRITE UNSAFE)
001000                          WOR      == 1000                ;WRITE OVERRUN ERROR
002000                          RWU1     == 2000                ;W/R UNSAFE ERROR 1 (WRITE ERROR)
004000                          RWU2     == 4000                ;W/R UNSAFE ERROR 2 (READ OR WRITE ERROR)
010000                          RWU3     == 10000               ;W/R UNSAFE ERROR 3 (WRITE ERROR)
100000                          PGE      == 100000              ;PROGRAM ERROR


                                ;RP07 ERROR REGISTER #03 (RPER3)

                                ;DGE     == 1                   ;DIAGNOSTIC COMMAND
000010                          DPE      == 10                  ;DATA PARITY  DURING WRITE
000020                          SDF      == 20                  ;SERDES DATA FAILURE
000040                          DCU      == 40                  ;DC LOW UNSAFE
000100                          IXU      == 100                 ;INDEX PULSE UNSAFE
000200                          DVC      == 200                 ;DRIVE CHECK
000400                          PHF      == 400                 ;TACH CALIBRATE FAILURE
001000                          LCE      == 1000                ;LOST CYLINDER (POSITIONER IN GUARD BAND)
002000                          LBC      == 2000                ;LOST BIT CLOCK
040000                          SKI      == 40000               ;SEEK INCOMPLETE
100000                          BSE      == 100000              ;BAD SECTOR


                                ;OFFSET REGISTER (RPOF) (#11)

002000                          HCI      == 2000                ;HEADER COMPARE INHIBIT (BIT #10)
```

```
                                ;72          004000                  ECI     == 4000                 ;ERROR CORRECTION CODE INHIBIT (BIT #11)
                                ;73          010000                  FMT16   == 10000                ;FORMAT BIT (BIT #12
                                ;74          100000                  CMOD    == 100000               ;COMMAND MODIFIER BIT (BIT #13)
                                ;75
                                ;76
                                ;77                                  ;DESIRED CYLINDER ADDRESS (RPDC) (#12)
                                ;78                                  ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;79
                                ;80
                                ;81                                  ;CURRENT CYLINDER ADDRESS (RPCC) (#13)
                                ;82                                  ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;83
                                ;84
                                ;85                                  ;SERIAL NUMBER REGISTER (RPSN) (#14)
                                ;86                                  ;(EACH IS CALLED BY BIT NUMBER)
                                ;87
                                ;88
                                ;89                                  ;ECC POSITION REGISTER (RPEC1) (#16)
                                ;90                                  ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;91
                                ;92
                                ;93                                  ;ECC PATTERN REGISTER (RPEC2) (#17)
                                ;94                                  ;(EACH BIT IS CALLED BY BIT NUMBER)
                                ;95
                                ;96
                                ;97                                  .SBTTL  RP07 DRIVER COMMANDS
                                ;98
                                ;99          000101                  NOOP    == 101                  ;NO OPERATION
                                ;00          000105                  SEEK    == 105                  ;SEEK
                                ;01          000107                  RECAL   == 107                  ;RECALIBRATE
                                ;02          000111                  DRVCLR  == 111                  ;DRIVE CLEAR
                                ;03          000113                  RELSE   == 113                  ;RELEASE
                                ;04          000115                  OFFSET  == 115                  ;OFFSET
                                ;05          000117                  RTC     == 117                  ;RETURN TO CENTER LINE
                                ;06          000121                  READIN  == 121                  ;READ IN PRESET
                                ;07          000131                  SEARCH  == 131                  ;SEARCH
                                ;08          000135                  DIAG    == 135                  ;DIAGNOSTIC MODE
                                ;09          000143                  ILLCMD  == 143                  ;ILLEGAL COMMAND
                                ;10          000151                  WCKD    == 151                  ;WRITE CHECK DATA
                                ;11          000153                  WCKHD   == 153                  ;WRITE CHECK HEADER AND DATA
                                ;12          000161                  WRTDAT  == 161                  ;WRITE DATA
                                ;13          000163                  FMTRK   == 163                  ;FORMAT TRACK
                                ;14          000165                  WRTTD   == 165                  ;WRITE TRACK DSECRIPTOR
                                ;15          000171                  RDDAT   == 171                  ;READ DATA
                                ;16          000173                  RDHD    == 173                  ;READ HEADER AND DATA
                                ;17          000175                  RDTD    == 175                  ;READ TRACK DSECRIPTOR
                                ;18
                                ;19          177400                  SCTRWC  ==  -256.               ;DEFAULT WORD COUNT
                                ;20
                                ;21                                  ;THE FOLLOWING ARE SPECIAL DRIVER COMMANDS (NOT CONTROLLER COMMANDS)
                                ;22
                                ;23          000141                  GETREG  == 141  ;READ RPCS1, RPWC, RPBA, RPDA AND STORE THEM AT ADDRESS
                                ;24                                                  ;POINTED TO BY 'DPB'+6.
                                ;25          000145                  MAINT   == 145  ;WRITE MAINTENANCE REGISTER RPMR1
                                ;26          000147                  SETFORM == 147  ;SET FORMAT PSEUDO-CMD:  WRITE OFFSET REGISTER.  SETFORM
                                ;27                                                  ;FIRST READS RPOF, EXTRACT ITS LO BYTE, CHANGES ITS HI BYTE
                                ;28                                                  ;PER 'DPB', MERGES BOTH BYTES TO WRITE RPOF.  HENCE SETFORM
```

```
                                        ;WRITES RPOF WITH HI BYTE PER 'DPB', LO BYTE UNCHANGED. THE
                                        ;COMMAND OFFSET DOES THE OPPOSITE.
```

```
                        .SBTTL  GLOBAL DATA SECTION

                        ;++
                        ; THE GLOBAL DATA SECTION CONTAINS DATA THAT ARE USED
                        ; IN MORE THAN ONE TEST.
                        ;--

002240  000001          ITCNT:: .WORD   1               ;TEST ITERATION COUNTER
002242  000000          ISRCNT:: .WORD  0               ;INTERRUPT SERVICE COUNTER
002244  002000          XTIMES:: .WORD 1024.            ;TEST ITERATION COUNT;  TESTS 14. & 18.
002246  000000          DOTWO:: .WORD   0               ;USED TO FORCE TWO ITERATIONS OF AN OPERATION
002250  000000          CLKSTA:: .WORD  0               ;CLOCK STATUS (NO CLOCK= 0,KW11-P= 1 OR KW11-L= -1
002252  000000          BYPASS:: .WORD  0               ;BYPASS ROUTE ADR; SET IN CALL ERRABO
                                                        ;CALLERS;  CALL.A/B/C, DRVCAL, SRCH00.
002254  000000          SVSTAT:: .WORD  0               ;STATUS/ERROR INDICATOR IS;  SAVED HERE ON AN ERROR

002256  001165          NC1::    .WORD   629.           ;LAST PHYSICAL CYL
002260  001166          NC2::    .WORD   630.           ;FIRST FE CYL
002262  000037          NT1::    .WORD   31.            ;LAST PHYSICAL TRK
002264  000061          NS1::    .WORD   49.            ;LAST PHYSICAL SEC

002266  000000          CYL.RD:: .WORD  0               ;CYLINDER READ
002270  000000          TRK.RD:: .WORD  0               ;TRACK READ
002272  000000          SEC.RD:: .WORD  0               ;SECTOR READ
002274  000000          CYL.DS:: .WORD  0               ;CYLINDER DESIRED
002276  000000          SEC.DS:: .WORD  0               ;SECTOR DESIRED
002300  000000          TRK.DS:: .WORD  0               ;TRACK DESIRED

002302  000000          TIM.UP:: .WORD  0               ;MINIMUM TIME
002304  000000                   .WORD  0               ;NUMBER OF COUNTS BELOW MIN. LIMIT
002306  000000                   .WORD  0               ;MAXIMUM TIME
002310  000000                   .WORD  0               ;NUMBER OF COUNTS ABOVE MAX. LIMIT
002312  000000  000000           .WORD  0,0             ;TOTAL TIME OF ALL SEEKS
002316  000000                   .WORD  0               ;NUMBER OF SEEKS PERFORMED

002320  000000          TIM.DN:: .WORD  0               ;MINIMUM TIME
002322  000000                   .WORD  0               ;NUMBER OF COUNTS BELOW MIN. LIMIT
002324  000000                   .WORD  0               ;MAXIMUM TIME
002326  000000                   .WORD  0               ;NUMBER OF COUNTS ABOVE MAX. LIMIT
002330  000000  000000           .WORD  0,0             ;TOTAL TIME OF ALL SEEKS
002334  000000                   .WORD  0               ;NUMBER OF SEEKS PERFORMED
002336  000000          TIM.PT:: .WORD  0               ;POINTS TO TABLE OF TIMES
002340  000000          WCEFLG:: .WORD  0               ;FATAL WRITE CHECK ERROR FLAG
002342  000000          DELTA:: .WORD   0               ;MEMORY SIZING SCRATCH LOCATION
002344  163400          TRKWC:: .WORD   -<256.*25.>     ;WORD COUNT FOR HALF A TRACK IN 16 BIT MODE
002346  000012          STALL1:: .WORD  10.             ;10 MILLISECONDS STALL
002350  000012          STALL2:: .WORD  10.             ;10 MILLISECONDS STALL

                        ;BIT TABLE
002352  000001          BITS::   .WORD  BIT00
002354  000002                   .WORD  BIT01
002356  000004                   .WORD  BIT02
002360  000010                   .WORD  BIT03
002362  000020                   .WORD  BIT04
002364  000040                   .WORD  BIT05
002366  000100                   .WORD  BIT06
002370  000200                   .WORD  BIT07
```

```
                                        .WORD   BIT08
                                        .WORD   BIT09
                                        .WORD   BIT10
                                        .WORD   BIT11
                                        .WORD   BIT12
                                        .WORD   BIT13
                                        .WORD   BIT14
                                        .WORD   BIT15
                                        .WORD   BIT00
                                        .WORD   BIT01
                                        .WORD   BIT02
                                        .WORD   BIT03
                                        .WORD   BIT04
                                        .WORD   BIT05
                                        .WORD   BIT06
                                        .WORD   BIT07

                                .SBTTL  TIMING LIMITS

                                ;ROTATIONAL TEST TABLES FOR RP07 DRIVE
                                ;50HZ AND 60HZ TABLE
002432  004605                  T7A::   .WORD   ROTATE
002434  000000                          .WORD   0
002436  003103                          .WORD   1603.           ;LO LIMIT (16.515MS + 3%)
002440  003246                          .WORD   1702.           ;HI LIMIT (16.515MS - 3%)

                                ;SEEK TEST TABLES
002442  004647                  TIMT10: .WORD   ONECYL          ;FORWARD
002444  005115                          .WORD   REV             ;REVERSE
002446  000000                          .WORD   0               ;NO LO LIMIT
002450  000764                          .WORD   500.            ;HI LIMIT (5.0MS)

002452  004721                  TIMT11: .WORD   AVERGE          ;FORWARD
002454  005115                          .WORD   REV             ;REVERSE
002456  000000                          .WORD   0               ;NO LO LIMIT
002460  004374                          .WORD   2300.           ;HI LIMIT (23.0MS)

002462  004766                  TIMT12: .WORD   MXSEEK          ;FORWARD
002464  005115                          .WORD   REV             ;REVERSE
002466  000000                          .WORD   0               ;NO LO LIMIT
002470  010770                          .WORD   4600.           ;HI LIMIT (46.0MS)

002472  005033                  T1420:: .WORD   MARK            ;ADDR MARK TEST
002474  000000                          .WORD   0               ;2ND MSG; NONE
002476  000000                          .WORD   0               ;NO LO LIMIT
002500  003246                          .WORD   1702.           ;HI LIMIT (16.515MS - 3%)


                                ;SPECS. MESSAGE TABLES FOR ROTATIONAL AND TIMING TESTS

                                ;ROTATIONAL MESSAGE AND LO/HI LIMITS
                                ;50HZ AND 60HZ TABLE
002502  005132                  SP7::   .WORD   MSG7X           ;MSG
002504  003103                          .WORD   1603.           ;LO LIMIT (16.515MS + 3%)
002506  003246                          .WORD   1702.           ;HI LIMIT (16.515MS - 3%)

                                ;TIMING TEST MESSAGES AND LO/HI LIMITS
```

```
    115 002510  005132                SP10::  .WORD   MSG10X          ;MSG
    116 002512  000000                        .WORD   0               ;NO LO LIMIT
    117 002514  000764                        .WORD   500.            ;HI LIMIT (5.0MS)
    118
    119 002516  005132                SP11::  .WORD   MSG11X          ;MSG
    120 002520  000000                        .WORD   0               ;NO LO LIMIT
    121 002522  004374                        .WORD   2300.           ;HI LIMIT (23.0MS)
    122
    123 002524  005132                SP12::  .WORD   MSG12X          ;MSG
    124 002526  000000                        .WORD   0               ;NO LO LIMIT
    125 002530  010770                        .WORD   4600.           ;HI LIMIT (46.0MS)
    126
    127 002532  005132                S1420:: .WORD   MSG14X          ;MSG
    128 002534  000000                        .WORD   0               ;NO LO LIMIT
    129 002536  003246                        .WORD   1702.           ;HI LIMIT (16.515MS - 3%)
```

```
                                ;DPB (DRIVE PARAMETER BLOCK)

002540      000         DPB.A:: .BYTE   0               ;(0) DRIVE NUMBER
002541      000                 .BYTE   0               ;(1) OFFSET VALUE OR FMT16, ECI, AND HCI
002542      000                 .BYTE   0               ;(2) COMMAND
002543      000                 .BYTE   0               ;(3) PSEL AND A17 AND A16
002544   000000                 .WORD   0               ;(4) WORD COUNT (MUST BE NEG.)
002546   042610                 .WORD   DBUFF           ;(6) BUFFER ADDRESS OR
                                                        ;REGISTER TABLE POINTER
002550      000                 .BYTE   0               ;(10) SECTOR ADDRESS OR
                                                        ;FIRST REG. INDEX
002551      000                 .BYTE   0               ;(11) TRACK ADDRESS OR
                                                        ;LAST REG. INDEX
002552   000000                 .WORD   0               ;(12) CYLINDER ADDRESS
002554   002744                 .WORD   REG             ;(14) ERROR TABLE POINTER
                                                        ;POINTS TO THE FIRST OF TWENTY
                                                        ;LOCATIONS OF WHERE THE DRIVER
                                                        ;IS TO STORE THE RHXX/RP07
                                                        ;REGISTERS ON AN ERROR. IF LEFT
                                                        ;ZERO REGISTERS ARE NOT SAVED.
002556   000000                 .WORD   0               ;(16) STATUS/ERROR INDICATOR
                                                        ;BIT15=1=>ERROR OCCURRED
                                                        ;BIT07=1=>DONE
                                                        ;BIT14-BIT09 AND BIT06-BIT03
                                                        ;INDICATE TYPE OF ERROR

002560      000         DPB.B:: .BYTE   0               ;(0) DRIVE NUMBER
002561      000                 .BYTE   0               ;(1) OFFSET VALUE OR FMT16, ECI, AND HCI
002562      000                 .BYTE   0               ;(2) COMMAND
002563      000                 .BYTE   0               ;(3) PSEL AND A17 AND A16
002564   177776                 .WORD   -2              ;(4) WORD COUNT (MUST BE NEG.)
002566   042610                 .WORD   DBUFF           ;(6) BUFFER ADDRESS OR
                                                        ;REGISTER TABLE POINTER
002570      000                 .BYTE   0               ;(10) SECTOR ADDRESS OR
                                                        ;FIRST REG. INDEX
002571      000                 .BYTE   0               ;(11) TRACK ADDRESS OR
                                                        ;LAST REG. INDEX
002572   000000                 .WORD   0               ;(12) CYLINDER ADDRESS
002574   002744                 .WORD   REG             ;(14) ERROR TABLE POINTER
                                                        ;POINTS TO THE FIRST OF TWENTY
                                                        ;LOCATIONS OF WHERE THE DRIVER
                                                        ;IS TO STORE THE RHXX/RP07
                                                        ;REGISTERS ON AN ERROR. IF LEFT
                                                        ;ZERO REGISTERS ARE NOT SAVED.
002576   000000                 .WORD   0               ;(16) STATUS/ERROR INDICATOR
                                                        ;BIT15=1=>ERROR OCCURRED
                                                        ;BIT07=1=>DONE
                                                        ;BIT14-BIT09 AND BIT06-BIT03
                                                        ;INDICATE TYPE OF ERROR

002600      000         DPB.C:: .BYTE   0               ;(0) DRIVE NUMBER
002601      000                 .BYTE   0               ;(1) OFFSET VALUE OR FMT16, ECI, AND HCI
002602      000                 .BYTE   0               ;(2) COMMAND
002603      000                 .BYTE   0               ;(3) PSEL AND A17 AND A16
002604   177776                 .WORD   -2              ;(4) WORD COUNT (MUST BE NEG.)
002606   042610                 .WORD   DBUFF           ;(6) BUFFER ADDRESS OR
                                                        ;REGISTER TABLE POINTER
```

```
     58 002610      000                          .BYTE   0               ;(10) SECTOR ADDRESS OR
     59                                                                  ;FIRST REG. INDEX
     60 002611      000                          .BYTE   0               ;(11) TRACK ADDRESS OR
     61                                                                  ;LAST REG. INDEX
     62 002612  000000                           .WORD   0               ;(12) CYLINDER ADDRESS
     63 002614  002744                           .WORD   REG             ;(14) ERROR TABLE POINTER
     64                                                                  ;POINTS TO THE FIRST OF TWENTY
     65                                                                  ;LOCATIONS OF WHERE THE DRIVER
     66                                                                  ;IS TO STORE THE RHXX/RP07
     67                                                                  ;REGISTERS ON AN ERROR. IF LEFT
     68                                                                  ;ZERO REGISTERS ARE NOT SAVED.
     69 002616  000000                           .WORD   0               ;(16) STATUS/ERROR INDICATOR
     70                                                                  ;BIT15=1=>ERROR OCCURRED
     71                                                                  ;BIT07=1=>DONE
     72                                                                  ;BIT14-BIT09 AND BIT06-BIT03
     73                                                                  ;INDICATE TYPE OF ERROR
     74
     75 002620      000          DTADPB::        .BYTE   0               ;(0) DRIVE NUMBER
     76 002621      000                          .BYTE   0               ;(1) OFFSET VALUE OR FMT16, ECT, AND HCI
     77 002622      000                          .BYTE   0               ;(2) COMMAND
     78 002623      000                          .BYTE   0               ;(3) PSEL AND A17 AND A16
     79 002624  000000                           .WORD   0               ;(4) WORD COUNT (MUST BE NEG.)
     80 002626  042610                           .WORD   DBUFF           ;(6) BUFFER ADDRESS OR
     81                                                                  ;REGISTER TABLE POINTER
     82 002630      000                          .BYTE   0               ;(10) SECTOR ADDRESS OR
     83                                                                  ;FIRST REG. INDEX
     84 002631      000                          .BYTE   0               ;(11) TRACK ADDRESS OR
     85                                                                  ;LAST REG. INDEX
     86 002632  000000                           .WORD   0               ;(12) CYLINDER ADDRESS
     87 002634  002744                           .WORD   REG             ;(14) ERROR TABLE POINTER
     88                                                                  ;POINTS TO THE FIRST OF TWENTY
     89                                                                  ;LOCATIONS OF WHERE THE DRIVER
     90                                                                  ;IS TO STORE THE RHXX/RP07
     91                                                                  ;REGISTERS ON AN ERROR. IF LEFT
     92                                                                  ;ZERO REGISTERS ARE NOT SAVED.
     93 002636  000000                           .WORD   0               ;(16) STATUS/ERROR INDICATOR
     94                                                                  ;BIT15=1=>ERROR OCCURRED
     95                                                                  ;BIT07=1=>DONE
     96                                                                  ;BIT14-BIT09 AND BIT06-BIT03
     97                                                                  ;INDICATE TYPE OF ERROR
```

```
 002640  000000                UNIT::  .WORD   0               ;USED TO SELECT A UNIT FOR TEST
 002642  176700                RPADR:: .WORD   176700          ;CONTAINS RPCS1 BASE ADDRESS
 002644  000254  000240        RPVEC:: .WORD   254,5*32.       ;CONTAINS VECTOR ADDRESS & BR LEVEL
 002650  000050                RHEXT:: .WORD   50              ;CONTAINS RH70 OFFSET TO RPBAE
 002652  000000                RHTYPE::.WORD   0               ;CONTAINS RHXX TYPE; RH11= 0, RH70= 1
 002654  000000                DRVNO:: .WORD   0               ;DRIVE NUMBER
 002656  000000                DRVSN:: .WORD   0               ;STORAGE FOR EACH S/N DIGIT

 002660  176700                RPCS1:: .WORD   176700          ;BASE ADDRESS USED FOR THE DRIVE
 002662  176702                RPWC::  .WORD   176702          ;WORD COUNT REGISTER
 002664  176704                RPBA::  .WORD   176704          ;BYTE ADDRESS REGISTER
 002666  176706                RPDA::  .WORD   176706          ;DESIRED SECTOR/TRACK ADDRESS
 002670  176710                RPCS2:: .WORD   176710          ;RP07 STATUS REGISTER
 002672  176712                RPDS::  .WORD   176712          ;RP07 DRIVE STATUS
 002674  176714                RPER1:: .WORD   176714          ;RP07 ERROR REGISTER #1
 002676  176716                RPAS::  .WORD   176716          ;RP07 ATTENTION SUMMARY PSEUDO REGISTER
 002700  176720                RPLA::  .WORD   176720          ;RP07 LOOK AHEAD REGISTER
 002702  176722                RPDB::  .WORD   176722          ;RP07 DATA BUFFER
 002704  176724                RPMR1:: .WORD   176724          ;RP07 MAINTENANCE REGISTER #1
 002706  176726                RPDT::  .WORD   176726          ;DRIVE TYPE REGISTER
 002710  176730                RPSN::  .WORD   176730          ;RP07 SERIAL NUMBER
 002712  176732                RPOF::  .WORD   176732          ;RP07 OFFSET REGISTER
 002714  176734                RPDC::  .WORD   176734          ;RP07 DESIRED CYLINDER
 002716  176736                RPCC::  .WORD   176736          ;RP07 CURRENT CYLINDER
 002720  176740                RPER2:: .WORD   176740          ;RP07 ERROR REGISTER #2
 002722  176742                RPER3:: .WORD   176742          ;RP07 ERROR REGISTER #3
 002724  176744                RPEC1:: .WORD   176744          ;RP07 ERROR POSITION
 002726  176746                RPEC2:: .WORD   176746          ;RP07 ERROR PATTERN
 002730  176750                RPBAE:: .WORD   176750          ;RH70 REGISTER
 002732  176752                RPCS3:: .WORD   176752          ;RH70 REGISTER

                               ;ATTENTION BITS TABLE (ATABIT=8 BYTES)
                                       ;THIS TABLE CONTAINS THE CORRESPONDING BIT TO EACH DRIVES
                                       ;ATTENTION BIT

 002734     001                ATABIT::.BYTE   1       ;DRIVE 0
 002735     002                        .BYTE   2       ;DRIVE 1
 002736     004                        .BYTE   4       ;DRIVE 2
 002737     010                        .BYTE   10      ;DRIVE 3
 002740     020                        .BYTE   20      ;DRIVE 4
 002741     040                        .BYTE   40      ;DRIVE 5
 002742     100                        .BYTE   100     ;DRIVE 6
 002743     200                        .BYTE   200     ;DRIVE 7

                               ; STORAGE FOR DEVICE REGISTERS
                               ;
 002744                        REG::   .BLKW 22.               ;SAVE REGISTERS HERE
```

```
                                .SBTTL  GLOBAL TEXT SECTION

                                ;++
                                ; THE GLOBAL TEXT SECTION CONTAINS FORMAT STATEMENTS,
                                ; MESSAGES, AND ASCII INFORMATION THAT ARE USED IN
                                ; MORE THAN ONE TEST.
                                ;--

                                ;NAMES OF DEVICES SUPPORTED BY PROGRAM
                                ;
003020                          L$DVTYP::
003020  122  120  060                   .ASCIZ  /RP07/
                                        .EVEN

                                ; TEST DESCRIPTION
                                ;
003026                          L$DESC::
003026  122  120  060                   .ASCIZ  /RP07 FUNCTIONAL TEST/
                                        .EVEN

                                ; FORMAT STATEMENTS USED IN PRINT CALLS
                                ;
003054  045  116  000  CRLF::   .ASCIZ  /%N/
003057  045  101  104  DH25A::  .ASCIZ  /%ADRIVE %01%N/
003075  045  101  103  DH44A::  .ASCIZ  /%ACYL %D3%A.  /
003114  045  101  124  DH44B::  .ASCIZ  /%ATRK %D2%A.  /
003133  045  101  123  DH44C::  .ASCIZ  /%ASEC %D2%A.  /
003152  045  101  122  DH44D::  .ASCIZ  /%ARPER2 (HEX) %T%T%T%T/
003201  045  116  045  DH44E::  .ASCIZ  /%N%ADRIVE   RPCS1   RPWC    RPBA    RPDA    RPCS2   RPDS/
003272  045  116  045  DH44F::  .ASCIZ  /%N%06%A  %06%A  %06%A  %06%A  %06%A  %06%A  %06/
003352  045  116  045  DH44G::  .ASCIZ  /%N%ARPER1   RPAS    RPLA    RPDB    RPMR1   RPDT    RPSN/
003443  045  116  045  DH44H::  .ASCIZ  /%N%06%A  %06%A  %06%A  %06%A  %06%A  %06%A  %06/
003523  045  116  045  DH44I::  .ASCIZ  /%N%ARPOF    RPDC    RPCC    RPER2   RPEC    RPEC1   RPEC2/
003615  045  116  045  DH44J::  .ASCIZ  /%N%06%A  %06%A  %06%A  %06%A  %06%A  %06%A  %06%N/
003677  045  101  122  DH44K::  .ASCIZ  /%ARPBAE   RPCS3/
003717  045  116  045  DH44L::  .ASCIZ  /%N%06%A  %06%N/

003736  045  101  104  DH45A::  .ASCIZ  /%ADRV CYL  TRK  SEC%N/
003764  045  117  063  DH45B::  .ASCIZ  /%03%A %D3%A. %D3%A. %D3%A.%N/
004021  045  101  107  DH45C::  .ASCIZ  /%AGDCYL  GDTRK  GDSEC  BDCYL  BDTRK  BDSEC%N/
004076  045  104  063  DH45D::  .ASCIZ  /%D3%A.%S3%D3%A.%S3%D3%A.%S3%D3%A.%S3%D3%A.%S3%D3%A.%N/

004164  045  116  045  DH52A::  .ASCIZ  /%N%ANUMBER OF LOST REVOLUTIONS=%D4%A./

004232  045  116  045  NOCLK::  .ASCIZ  /%N%ANO P-CLOCK, TIMING TESTS WILL NOT BE EXECUTED%N/
004316  045  116  045  DSNMSG::  .ASCIZ /%N%ADRIVE %01%A, PG/
004342  045  124  000  SNDIGT::  .ASCIZ /%T/
004345  045  101  124  WRTENM::  .ASCIZ /%ATEST %D2%A. NOT RUN, NOT ENABLED BY USER%N/
004422  045  101  125  SEAERR::  .ASCIZ /%AUNRECOVERABLE SEARCH ERROR%N/
004461  045  101  123  SEABAD::  .ASCIZ /%ASEARCH FAILED AFTER 16. RETRIES%N/
004525  045  101  101  ABOTST::  .ASCIZ /%AABORT TEST%N/
004544  045  101  120  POSERR::  .ASCIZ /%APOSITION ERROR, TEST ABORTED%N/
```

```
 71 004605  045  116  045  ROTATE:: .ASCIZ /%N%AROTATIONAL SPEED TIMES%N%A * /
 72 004647  045  116  045  ONECYL:: .ASCIZ /%N%AONE CYLINDER SEEK TIMES%N%A * FORWARD/
 73 004721  045  116  045  AVERGE:: .ASCIZ /%N%AAVERAGE SEEK TIMES%N%A * FORWARD/
 74 004766  045  116  045  MXSEEK:: .ASCIZ /%N%AMAXIMUM SEEK TIMES%N%A * FORWARD/
 75 005033  045  116  045  MARK::  .ASCIZ  /%N%AADDRESS MARK DETECT TIMES%N%A * /
 76 005100  045  101  040  FWD::    .ASCIZ /%A * FORWARD
 77 005115  045  101  040  REV::    .ASCIZ /%A * REVERSE/
 78
 79 005132                  MSG7X::
 80 005132                  MSG10X::
 81 005132                  MSG11X::
 82 005132                  MSG14X::
 83 005132  045  101  040  MSG12X:: .ASCIZ /%A * LIMIT(S)/
 84
 85 005160  045  116  045  UNSMSG:: .ASCIZ /%N%ADRIVE %01%A UNSAFE%N/
 86 005201  045  116  045  NEDMSG:: .ASCIZ /%N%ADRIVE %01%A NON-EXISTENT%N/
 87 005240  045  116  045  OFLMSG:: .ASCIZ /%N%ADRIVE %01%A OFF-LINE%N/
 88 005273  045  116  045  NOTMSG:: .ASCIZ /%N%ADRIVE %01%A NOT AN RP07%N/
 89
 90                          .SBTTL  GLOBAL ASCII MESSAGE SECTION
 91
 92 005331  122  110  130  EM1::   .ASCIZ  /RHXX CONTROL BUS PARITY ERROR MCPE=1/
 93 005376  122  110  130  EM2::   .ASCIZ  /RHXX DATA BUS PARITY ERROR MDPE=1/
 94 005440  122  110  130  EM3::   .ASCIZ  /RHXX ILLEGAL CONDITIONS SET (NED,NEM,PGE,MXF)/
 95 005516  127  122  111  EM4::   .ASCIZ  /WRITE CHECK ERROR/
 96 005540  104  101  124  EM5::   .ASCIZ  /DATA LATE ERROR/
 97 005560  104  122  111  EM6::   .ASCIZ  /DRIVE PROGRAMMING ERROR (PGE)/
 98 005616  114  117  123  EM7::   .ASCIZ  /LOSTS BIT CLOCK (LBC)/
 99
100 005644  127  122  111  EM11::  .ASCIZ  /WRITE CLOCK FAILS/
101 005666  127  122  111  EM12::  .ASCIZ  /WRITE LOCK ERROR/
102 005707  104  101  124  EM13::  .ASCIZ  /DATA ERROR (DCK)/
103 005730  104  122  111  EM14::  .ASCIZ  /DRIVE BUS PARITY ERROR (DPE)/
104 005765  111  114  114  EM15::  .ASCIZ  /ILLEGAL CONDITIONS SET (ILF,ILR,RMR)/
105 006032  101  104  104  EM16::  .ASCIZ  /ADDRESSING ERROR (IAE,AOE)/
106 006065  123  105  105  EM17::  .ASCIZ  /SEEK ERROR (SKI,LSE)/
107
108 006112  103  114  117  EM20::  .ASCIZ  @CLOCK (KW11-P) OVERFLOW IN TIMING TEST@
109 006161  105  101  122  EM21::  .ASCIZ  /EARLY WARNING (EWN)/
110 006205  122  105  101  EM22::  .ASCIZ  /READ & WRITE HEAD FAILS/
111 006235  104  101  124  EM23::  .ASCIZ  /DATA FORMAT BIT ERROR (FER)/
112 006271  110  105  101  EM24::  .ASCIZ  /HEADER INFORMATION ERROR (HCE)/
113 006330  104  122  111  EM25::  .ASCIZ  @DRIVE HAS BECOME NON-EXISTENT@
114 006366  104  122  111  EM26::  .ASCIZ  @DRIVE HAS NOT RESPONDED TO PORT REQUEST@
115 006436  123  117  106  EM27::  .ASCIZ  @SOFTWARE TIMEOUT ON THIS DRIVE@
116
117 006475  106  101  124  EM30::  .ASCIZ  @FATAL MASSBUS PARITY ERROR (MCPE=1 OR PAR 1)@
118 006552  117  106  106  EM31::  .ASCIZ  @OFFLINE OR UNSAFE DRIVE REQUESTED@
119 006614  127  122  111  EM32::  .ASCIZ  /WRITE-READY UNSAFE/
120 006637  104  103  040  EM33::  .ASCIZ  /DC POWER UNSAFE/
121 006657  111  116  104  EM34::  .ASCIZ  /INDEX UNSAFE/
122 006674  120  122  117  EM35::  .ASCIZ  /PROCESSOR HANDSHAKE FAILURE/
123 006730  104  122  111  EM36::  .ASCIZ  /DRIVE OFFLINE OR NOT AN RP07/
124
125 006765  117  120  105  EM41::  .ASCIZ  /OPERATION INCOMPLETE (OPI)/
126 007020  111  115  120  EM42::  .ASCIZ  /IMPROPER HEADER DATA/
127 007045  105  103  103  EM43::  .ASCIZ  /ECC LOGIC FAILURE/
```

```
    128 007067      115     111     123  EM44::  .ASCIZ  /MISC DRIVE ERROR; RPER1, RPER2, RPER3/
    129 007135      104     122     111  EM45::  .ASCIZ  /DRIVE TIMING ERROR (DTE)/
    130 007166      110     105     101  EM46::  .ASCIZ  /HEADER CRC ERROR (HCRC)/
    131 007216      125     116     103  EM47::  .ASCIZ  /UNCORRECTABLE ECC ERROR/
    132
    133 007246      114     101     123  EM50::  .ASCIZ  /LAST BLOCK TRANSF 'LBT' NOT SET AFTER READING LAST SECTOR/
    134 007340      101     104     122  EM51::  .ASCIZ  /ADRS OVERFLOW BIT 'AOE' NOT SET AFTER READING LAST SECTOR/
    135 007432      114     117     123  EM52::  .ASCIZ  /LOST REVOLUTION ERROR/
    136 007460      122     120     104  EM54::  .ASCIZ  /RPDS, 'OM' NOT SET ON OFFSET CMD/
    137 007521      122     120     104  EM55::  .ASCIZ  /RPDS, 'OM' NOT RESET ON RETURN-TO-CENTER-LINE CMD/
    138
    139                                  .EVEN
    153
    154
```

```
                                .SBTTL  GLOBAL ERROR REPORT SECTION

                                DH44::
007604  013746  002266                MOV     CYL.RD,-(SP)
007610  012746  003075                MOV     #DH44A,-(SP)
007614  012746  000002                MOV     #2,-(SP)
007620  010600                        MOV     SP,R0
007622  104414                        TRAP    C$PNTB
007624  062706  000006                ADD     #6,SP
007630  013746  002270                MOV     TRK.RD,-(SP)
007634  012746  003114                MOV     #DH44B,-(SP)
007640  012746  000002                MOV     #2,-(SP)
007644  010600                        MOV     SP,R0
007646  104414                        TRAP    C$PNTB
007650  062706  000006                ADD     #6,SP
007654  013746  002272                MOV     SEC.RD,-(SP)
007660  012746  003133                MOV     #DH44C,-(SP)
007664  012746  000002                MOV     #2,-(SP)
007670  010600                        MOV     SP,R0
007672  104414                        TRAP    C$PNTB
007674  062706  000006                ADD     #6,SP
007700  013746  003004                MOV     REG+40,-(SP)    ;PRINT RPER2 ERROR CODE IN HEX
007704  042716  177400                BIC     #177400,(SP)
007710  004737  011430                JSR     PC,OCTHEX
007714  012746  011572                MOV     #PSTACK+6,-(SP)
007720  012746  011570                MOV     #PSTACK+4,-(SP)
007724  012746  011566                MOV     #PSTACK+2,-(SP)
007730  012746  011564                MOV     #PSTACK,-(SP)
007734  012746  003152                MOV     #DH44D,-(SP)
007740  012746  000005                MOV     #5,-(SP)
007744  010600                        MOV     SP,R0
007746  104414                        TRAP    C$PNTB
007750  062706  000014                ADD     #14,SP

                                                ;PRINT 'DRIVE   RPCS1   RPWC    RPBA    RPDA    RPCS2   RPDS'

007754  012746  003201                MOV     #DH44E,-(SP)
007760  012746  000001                MOV     #1,-(SP)
007764  010600                        MOV     SP,R0
007766  104415                        TRAP    C$PNTX
007770  062706  000004                ADD     #4,SP
007774  013746  002756                MOV     REG+12,-(SP)
010000  013746  002754                MOV     REG+10,-(SP)
010004  013746  002752                MOV     REG+06,-(SP)
010010  013746  002750                MOV     REG+04,-(SP)
010014  013746  002746                MOV     REG+02,-(SP)
010020  013746  002744                MOV     REG,-(SP)
010024  013746  002654                MOV     DRVNO,-(SP)
010030  012746  003272                MOV     #DH44F,-(SP)
010034  012746  000010                MOV     #10,-(SP)
010040  010600                        MOV     SP,R0
010042  104415                        TRAP    C$PNTX
010044  062706  000022                ADD     #22,SP

                                                ;PRINT 'RPER1   RPAS    RPLA    RPDB    RPMR1   RPDT    RPSN'

010050  012746  003352                MOV     #DH44G,-(SP)
010054  012746  000001                MOV     #1,-(SP)
010060  010600                        MOV     SP,R0
010062  104415                        TRAP    C$PNTX
010064  062706  000004                ADD     #4,SP
```

```
    16 010070  013746  002774                  MOV     REG+30,-(SP)
       010074  013746  002772                  MOV     REG+26,-(SP)
       010100  013746  002770                  MOV     REG+24,-(SP)
       010104  013746  002766                  MOV     REG+22,-(SP)
       010110  013746  002764                  MOV     REG+20,-(SP)
       010114  013746  002762                  MOV     REG+16,-(SP)
       010120  013746  002760                  MOV     REG+14,-(SP)
       010124  012746  003443                  MOV     #DH44H,-(SP)
       010130  012746  000010                  MOV     #10,-(SP)
       010134  010600                          MOV     SP,R0
       010136  104415                          TRAP    C$PNTX
       010140  062706  000022                  ADD     #22,SP
    17                                                          ;PRINT 'RPOF   RPDC   RPCC   RPER2  RPER3  RPEC1  RPEC2'
    18 010144  012746  003523                  MOV     #DH44I,-(SP)
       010150  012746  000001                  MOV     #1,-(SP)
       010154  010600                          MOV     SP,R0
       010156  104415                          TRAP    C$PNTX
       010160  062706  000004                  ADD     #4,SP
    19 010164  013746  003012                  MOV     REG+46,-(SP)
       010170  013746  003010                  MOV     REG+44,-(SP)
       010174  013746  003006                  MOV     REG+42,-(SP)
       010200  013746  003004                  MOV     REG+40,-(SP)
       010204  013746  003002                  MOV     REG+36,-(SP)
       010210  013746  003000                  MOV     REG+34,-(SP)
       010214  013746  002776                  MOV     REG+32,-(SP)
       010220  012746  003615                  MOV     #DH44J,-(SP)
       010224  012746  000010                  MOV     #10,-(SP)
       010230  010600                          MOV     SP,R0
       010232  104415                          TRAP    C$PNTX
       010234  062706  000022                  ADD     #22,SP
    20 010240  005737  002652                  TST     RHTYPE          ;IS IT RH70 CONTROLLER ?
    21 010244  001424                          BEQ     1$              ;BR IF NO
    22                                                          ;PRINT 'RPBAE  RPCS3'
    23 010246  012746  003677                  MOV     #DH44K,-(SP)
       010252  012746  000001                  MOV     #1,-(SP)
       010256  010600                          MOV     SP,R0
       010260  104415                          TRAP    C$PNTX
       010262  062706  000004                  ADD     #4,SP
    24 010266  013746  003016                  MOV     REG+52,-(SP)
       010272  013746  003014                  MOV     REG+50,-(SP)
       010276  012746  003717                  MOV     #DH44L,-(SP)
       010302  012746  000003                  MOV     #3,-(SP)
       010306  010600                          MOV     SP,R0
       010310  104415                          TRAP    C$PNTX
       010312  062706  000010                  ADD     #10,SP
    25 010316                          1$:                  ;CR-LF
    26 010316  012746  003054                  MOV     #CRLF,-(SP)
       010322  012746  000001                  MOV     #1,-(SP)
       010326  010600                          MOV     SP,R0
       010330  104414                          TRAP    C$PNTB
       010332  062706  000004                  ADD     #4,SP
    27 010336                          L10002:
       010336  104423                          TRAP    C$MSG
    28
    29 010340                          DH45::
    30 010340  012746  003736                  MOV     #DH45A,-(SP)
       010344  012746  000001                  MOV     #1,-(SP)
```

```
         010350  010600                          MOV     SP,R0
         010352  104414                          TRAP    C$PNTB
         010354  062706  000004                  ADD     #4,SP
      31 010360  013746  002276                  MOV     SEC.DS,-(SP)
         010364  013746  002300                  MOV     TRK.DS,-(SP)
         010370  013746  002274                  MOV     CYL.DS,-(SP)
         010374  013746  002654                  MOV     DRVNO,-(SP)
         010400  012746  003764                  MOV     #DH45B,-(SP)
         010404  012746  000005                  MOV     #5,-(SP)
         010410  010600                          MOV     SP,R0
         010412  104414                          TRAP    C$PNTB
         010414  062706  000014                  ADD     #14,SP
      32 010420  012746  004021                  MOV     #DH45C,-(SP)
         010424  012746  000001                  MOV     #1,-(SP)
         010430  010600                          MOV     SP,R0
         010432  104415                          TRAP    C$PNTX
         010434  062706  000004                  ADD     #4,SP
      33 010440  013746  002272                  MOV     SEC.RD,-(SP)
         010444  013746  002270                  MOV     TRK.RD,-(SP)
         010450  013746  002266                  MOV     CYL.RD,-(SP)
         010454  013746  002276                  MOV     SEC.DS,-(SP)
         010460  013746  002300                  MOV     TRK.DS,-(SP)
         010464  013746  002274                  MOV     CYL.DS,-(SP)
         010470  012746  004076                  MOV     #DH45D,-(SP)
         010474  012746  000007                  MOV     #7,-(SP)
         010500  010600                          MOV     SP,R0
         010502  104415                          TRAP    C$PNTX
         010504  062706  000020                  ADD     #20,SP
      34                                                          ;CR-LF
      35 010510  012746  003054                  MOV     #CRLF,-(SP)
         010514  012746  000001                  MOV     #1,-(SP)
         010520  010600                          MOV     SP,R0
         010522  104414                          TRAP    C$PNTB
         010524  062706  000004                  ADD     #4,SP
      36 010530                          L10003:
         010530  104423                          TRAP    C$MSG
      37
      38 010532                          DH52::
      39 010532  013746  002310                  MOV     TIM.UP+6,-(SP)
         010536  012746  004164                  MOV     #DH52A,-(SP)
         010542  012746  000002                  MOV     #2,-(SP)
         010546  010600                          MOV     SP,R0
         010550  104414                          TRAP    C$PNTB
         010552  062706  000006                  ADD     #6,SP
      40                                                          ;CR-LF
      41 010556  012746  003054                  MOV     #CRLF,-(SP)
         010562  012746  000001                  MOV     #1,-(SP)
         010566  010600                          MOV     SP,R0
         010570  104414                          TRAP    C$PNTB
         010572  062706  000004                  ADD     #4,SP
      42 010576                          L10004:
         010576  104423                          TRAP    C$MSG
      43
      44 010600                          DH25::
      45 010600  013746  002654                  MOV     DRVNO,-(SP)
         010604  012746  003057                  MOV     #DH25A,-(SP)
         010610  012746  000002                  MOV     #2,-(SP)
```

```
        010614  010600                          MOV     SP,R0
        010616  104414                          TRAP    C$PNTB
        010620  062706  000006                  ADD     #6,SP
    46                                                          ;CR-LF
    47  010624  012746  003054                  MOV     #CRLF,-(SP)
        010630  012746  000001                  MOV     #1,-(SP)
        010634  010600                          MOV     SP,R0
        010636  104414                          TRAP    C$PNTB
        010640  062706  000004                  ADD     #4,SP
    48  010644                          L10005:
        010644  104423                          TRAP    C$MSG
    49
```

```
                                .SBTTL  GLOBAL SUBROUTINES SECTION

                                ;*SAVE R0-R5
                                ;*CALL:
                                ;*      JSR     PC,SAVREG
010646                          SAVREG:
010646  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
010650  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
010652  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
010654  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
010656  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
010660  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
010662  016646  000020                  MOV     20(SP),-(SP)    ;;SAVE PUSHED PARAMETER
010666  016646  000020                  MOV     20(SP),-(SP)    ;;SAVE PC OF MAIN FLOW
010672  016646  000020                  MOV     20(SP),-(SP)    ;;SAVE PC OF SAVREG CALL
010676  000207                          RTS     PC

                                ;*RESTORE R0-R5
                                ;*CALL:
                                ;*      JSR     PC,RESREG
010700                          RESREG:
010700  012666  000020                  MOV     (SP)+,20(SP)    ;;RESTORE PC OF RESREG CALL
010704  012666  000020                  MOV     (SP)+,20(SP)    ;;RESTORE PC OF MAIN FLOW
010710  012666  000020                  MOV     (SP)+,20(SP)    ;;RESTORE PUSHED PARAMETER
010714  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
010716  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
010720  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
010722  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
010724  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
010726  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
010730  000207                          RTS     PC
```

```
                                        ;AUTO SIZE FOR RH70 CONTROLLER AND DETERMINE IF IT IS JUMPERED FOR 22 OR
                                        ;32 REGISTERS
                                        ;CALL
                                        ;       JSR     PC,SIZE70       ;CALL ROUTINE
                                        ;
                                        ;R5 MUST CONTAIN POINTER TO NEW RPCS1 BASE ADDRESS

 010732  005037  002650       SIZE70: CLR     RHEXT           ;CLEAR RPBAE OFFSET
 010736  005037  002652               CLR     RHTYPE          ;CLEAR RHXX TYPE REGISTER (RH11)
 010742  013746  000004               MOV     ERRVEC,-(SP)    ;SAVE CONTENTS OF ERROR VECTOR
 010746  012737  011016  000004       MOV     #2$,ERRVEC      ;SETUP 'TRAP' RETURN ADDRESS
 010754  011500               MOV     (R5),R0         ;GET RPCS1 ADDRESS
 010756  062700  000050               ADD     #50,R0          ;GET REGISTER OFFSET FOR RH70
 010762  012702  000012               MOV     #10.,R2         ;GET NUMBER OF REGISTERS TO CHECK
 010766  005720               TST     (R0)+           ;TRAP IF NOT A VALID RPBAE
 010770  005720               TST     (R0)+           ;TRAP IF NOT A VALID RPCS3
 010772  012737  000050  002650       MOV     #50,RHEXT       ;LOAD OFFSET FOR RPBAE (22 REGISTER RH)
 011000  005720       1$:     TST     (R0)+           ;TRAP IF NOT A VALID REGISTER
 011002  005302               DEC     R2              ;DONE WITH ALL 32 REGISTERS ?
 011004  001375               BNE     1$              ;BR IF NO
 011006  012737  000074  002650       MOV     #74,RHEXT       ;LOAD OFFSET FOR RPBAE (32 REGISTER RH)
 011014  000403               BR      3$
 011016  012716  011024       2$:     MOV     #3$,(SP)        ;SETUP RETURN ADDRESS
 011022  000002               RTI

 011024  011500       3$:     MOV     (R5),R0         ;GET RPCS1 REGISTER
 011026  013702  002650               MOV     RHEXT,R2        ;GET RPBAE REGISTER OFFSET
 011032  001415               BEQ     4$              ;BR IF NONE
 011034  060002               ADD     R0,R2           ;GET RPBAE REGISTER
 011036  052710  001400               BIS     #A17!A16,(R0)   ;SET EXTENDED ADDRESS BITS IN RPCS1
 011042  022712  000003               CMP     #3,(R2)         ;ARE THE EXTENDED BITS SET IN RPBAE ?
 011046  001007               BNE     4$              ;BR IF NO
 011050  005012               CLR     (R2)            ;CLEAR EXTENDED ADDRESS BITS IN RPBAE
 011052  011046               MOV     (R0),-(SP)      ;SAVE RPCS1 REG CONTENTS
 011054  042726  176377               BIC     #^C<A17!A16>,(SP)+      ;ARE THE EXTEND BITS CLEAR IN RPCS1 ?
 011060  001002               BNE     4$              ;BR IF NO
 011062  005237  002652               INC     RHTYPE          ;SET RHXX TYPE REGISTER (RH70)
 011066  012637  000004       4$:     MOV     (SP)+,ERRVEC    ;RESTORE CONTENTS OF ERROR VECTOR
 011072  000207               RTS     PC
```

```
                                ;       INTEGER DIVIDE ROUTINE
                                ;*THIS ROUTINE WILL DIVIDE A 32-BIT TWO'S COMPLEMENT INTEGER
                                ;*DIVIDEND BY A 16-BIT TWO'S COMPLEMENT INTEGER DIVISOR GIVING
                                ;*A 16-BIT TWO'S COMPLEMENT INTEGER QUOTIENT AND A 16-BIT REMAINDER.
                                ;*DIVISION WILL BE PERFORMED SO THAT THE REMAINDER IS OF THE
                                ;*SAVE SIGN AS THE DIVIDEND.
                                ;*CALL:
                                ;*      MOV     LOW DIVIDEND,-(SP)      ;;THE HIGH DIVIDEND MUST BE < 1/2
                                ;*      MOV     HIGH DIVIDEND,-(SP)     ; AS LARGE AS THE DIVISOR
                                ;*      MOV     DIVISOR,-(SP)
                                ;*      JSR     PC,$DIV
                                ;*      RETURN                          ;;QUOTIENT & REMAINDER ARE ON THE STACK
                                ;*      "V"=0   IMPLIES NO ERROR
                                ;*      "V"=1   IMPLIES ERROR OCCURRED
                                ;*              "C"=0   DIVIDE OVERFLOW OCCURRED
                                ;*              "C"=1   ATTEMPTED TO DIVIDE BY ZERO
                                ;*
                                ;*
                                ;*      STACK   NO ERROR        OVERFLOW        DIVIDE BY ZERO
                                ;*      -----   --------        --------        --------------
                                ;*      TOP     REMAINDER       ALL ZEROS       ALL ONES
                                ;*      +2      QUOTIENT        ALL ZEROS       ALL ONES

011074  005046                  $DIV:   CLR     -(SP)   ;;CLEAR DIV STATUS WORD: RESERVED TO SET C AND V BITS
011076  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
011100  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
011102  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
011104  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
011106  005046                          CLR     -(SP)           ;;SAVE A PLACE FOR SIGNS
011110  012746  000021                  MOV     #17.,-(SP)      ;;SETUP THE ITERATION COUNTER
011114  016601  000024                  MOV     24(SP),R1       ;;PICKUP THE DIVIDEND
011120  016600  000022                  MOV     22(SP),R0
011124  100005                          BPL     1$              ;;CHECK THE SIGN
011126  105366  000003                  DECB    3(SP)           ;;KEEP TRACK OF THE SIGN
011132  005400                          NEG     R0              ;;AND NEGATE THE ORIGINAL
011134  005401                          NEG     R1              ;;NUMBER
011136  005600                          SBC     R0
011140  016602  000020          1$:     MOV     20(SP),R2       ;;PICKUP THE DIVISOR
011144  002407                          BLT     2$              ;;CHECK THE SIGN
011146  003011                          BGT     3$              ;;DIVISOR OF 0 IS A NO-NO
011150  052766  000003  000014          BIS     #3,14(SP)       ;;SET "V" & "C" IN DIV STAT WORD
011156  012700  177777                  MOV     #-1,R0          ;;SET REMAINDER TO ALL ONES
011162  000424                          BR      7$              ;;EXIT
011164  005266  000002          2$:     INC     2(SP)           ;;KEEP TRACK OF DIVISORS SIGN
011170  000401                          BR      4$
011172  005402                  3$:     NEG     R2              ;;NEGATE THE ORIGINAL NUMBER
011174  000241                  4$:     CLC                     ;;CLEAR "C" IN PSW
011176  000405                          BR      6$              ;;START FORMING QUOTIENT
011200  006100                  5$:     ROL     R0              ;;POSITION MSB'S
011202  010003                          MOV     R0,R3           ;;COPY
011204  060203                          ADD     R2,R3           ;;COMPARE DIVIDEND & DIVISOR
011206  103001                          BCC     6$              ;;BR IF DIVIDEND > DIVISOR
011210  010300                          MOV     R3,R0           ;;REMAINDER AFTER THIS LOOP
011212  006101                  6$:     ROL     R1              ;;QUOTIENT BIT ENTERS HERE
011214  005316                          DEC     (SP)            ;;DONE?
011216  001370                          BNE     5$              ;;BR IF NO
```

```
 58 011220  005701                          TST     R1              ;;OVERFLOW?
 59 011222  100005                          BPL     8$              ;;BR IF NO
 60 011224  052766  000002  000014          BIS     #2,14(SP)       ;;SET "V" IN DIV STATUS WORD
 61 011232  005000                          CLR     R0              ;;SET REMAINDER TO ALL ZEROS
 62 011234  010001                  7$:     MOV     R0,R1           ;;COPY REMAINDER INTO QUOTIENT
 63 011236  005726                  8$:     TST     (SP)+           ;;CLEAR COUNTER FROM STACK
 64 011240  005716                          TST     (SP)            ;;REMAINDER SIGN CORRECTION NEEDED?
 65 011242  002004                          BGE     9$              ;;BR IF NO
 66 011244  005400                          NEG     R0              ;;NEGATE REMAINDER
 67 011246  105066  000001                  CLRB    1(SP)           ;;CLEAR SIGN
 68 011252  005316                          DEC     (SP)            ;;BUT DON'T FORGET QUOTIENT
 69 011254  005726                  9$:     TST     (SP)+           ;;QUOTIENT SIGN CORRECTION NEEDED?
 70 011256  001401                          BEQ     10$             ;;BR IF NO
 71 011260  005401                          NEG     R1              ;;NEGATE QUOTIENT
 72 011262  010166  000020          10$:    MOV     R1,20(SP)       ;;RETURN QUOTIENT AND
 73 011266  010066  000016                  MOV     R0,16(SP)       ;;REMAINDER TO USER
 74 011272  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
 75 011274  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
 76 011276  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
 77 011300  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
 78 011302  006226                          ASR     (SP)+           ;;COPY C IN PSW PER C IN DIV STAT WORD
 79 011304  000242                          CLV                     ;;CLEAR V IN PSW
 80 011306  001401                          BEQ     11$             ;;V=0 IN DIV STAT WORD, EXIT
 81 011310  000262                          SEV                     ;;V=1 IN DIV STAT WORD, COPY V IN PSW
 82 011312  012616                  11$:    MOV     (SP)+,(SP)      ;;MOVE RETURN ADR UP ONE PLACE, OVERRIDING DIVISOR
 83 011314  000207                          RTS     PC              ;;RETURN WITH SP POINTING TO REMAINDER
```

```
                                ;       INTEGER MULTIPLY ROUTINE
                                ;
                                ;*CALL
                                ;*      MOV     MULTIPLER,-(SP)
                                ;*      MOV     MULTIPLICAND,-(SP)
                                ;*      JSR     PC,$MULT
                                ;*      RETURN                  ;;PRODUCT IS ON THE STACK
                                ;*
                                ;*      STACK   PRODUCT
                                ;*      -----   -------
                                ;*      TOP     LSB'S
                                ;*      +2      MSB'S
                                $MULT:  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
                                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
                                        MOV     R2,-(SP)        ;;PUSH R2 ON STACK
                                        CLR     -(SP)           ;;CLEAR THE SIGN KEY
011324  016601  000012                  MOV     12(SP),R1       ;;GET THE MULTIPLICAND
011332  100002                          BPL     1$              ;;BR IF PLUS
011334  005216                          INC     (SP)            ;;SET THE SIGN KEY
011336  005401                          NEG     R1              ;;MAKE THE MULTIPLICAND POSTIVE
011340  016602  000014            1$:   MOV     14(SP),R2       ;;GET THE MULTIPLIER
011344  100002                          BPL     2$              ;;BR IF PLUS
011346  005316                          DEC     (SP)            ;;UPDATE THE SIGN KEY
011350  005402                          NEG     R2              ;;MAKE THE MULTIPLIER POSTIVE
011352  012746  000021            2$:   MOV     #17.,-(SP)      ;;SET THE LOOP COUNT
011356  005000                          CLR     R0              ;;SETUP FOR THE MULTIPLY LOOP
011360  103001                    3$:   BCC     4$              ;;DON'T ADD IF MULTIPLICAND = 0
011362  060200                          ADD     R2,R0
011364  006000                    4$:   ROR     R0              ;;POSITION THE PARITIAL PRODUCT AND
011366  006001                          ROR     R1              ;;THE MULTIPLICAND
011370  005316                          DEC     (SP)            ;;HAS ALL BITS OF THE MULTIPLICAND BEEN DONE?
011372  001372                          BNE     3$              ;;BR IF NO
011374  022616                          CMP     (SP)+,(SP)      ;;SHOULD PRODUCT BE NEGATIVE?
011376  001403                          BEQ     5$              ;;GO TO EXIT IF NO
011400  005400                          NEG     R0              ;;YES--SO MAKE IT SO
011402  005401                          NEG     R1
011404  005600                          SBC     R0
011406  005726                    5$:   TST     (SP)+           ;;CLEAR SIGN INFO. OFF OF STACK
011410  010066  000012                  MOV     R0,12(SP)       ;;PUT THE PRODUCT ON THE STACK (MSB'S)
011414  010166  000010                  MOV     R1,10(SP)       ;;LSB'S
011420  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
011422  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
011424  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
011426  000207                          RTS     PC
```

```
                                ;OCTAL TO HEXADECIMAL CONVERSION ROUTINE
                                ;
011430  010146          OCTHEX: MOV     R1,-(SP)        ;SAVE R1
011432  010246                  MOV     R2,-(SP)        ;SAVE R2
011434  012700  011564          MOV     #PSTACK,R0      ;SET UP THE BUFFER ADDRESS
011440  012702  000004          MOV     #4,R2           ;GET THE ITERATION VALUES
011444  012701  000004  1$:     MOV     #4,R1           ;AND DUPLICATE FOR TWO LOOPS
011450  005010                  CLR     (R0)            ;INITIALIZE THE BUFFER
011452  006310          2$:     ASL     (R0)            ;MOVE THE PREVIOUS BIT(S) OVER
011454  000241                  CLC                     ;CARRY = 0
011456  006366  000006          ASL     6(SP)           ;ROTATE A BIT FROM THE TEST VALUE
011462  103002                  BCC     3$              ;IF ZERO, SKIP NEXT INSTRUCTION
011464  052710  000001          BIS     #BIT0,(R0)      ;MARK THE BIT AS BEING SET
011470  005301          3$:     DEC     R1              ;ONE LESS ITERATION TO GO
011472  003367                  BGT     2$              ;BUT NOT DONE UNTIL = 0!
011474  005720                  TST     (R0)+           ;NEXT BUFFER LOCATION
011476  005302                  DEC     R2              ;ONE LESS ITERATION TO-GO
011500  003361                  BGT     1$              ;IF NOT ZERO, KEEP GOING!
011502  012702  000004          MOV     #4,R2           ;GET THE NEW ITERATION COUNT
011506  012700  011564          MOV     #PSTACK,R0      ;AND GET THE BUFFER ADDRESS AGAIN
011512  005710          4$:     TST     (R0)            ;CONTENTS ZERO?
011514  003005                  BGT     5$              ;IF NOT, SKIP NEXT
011516  012720  000060          MOV     #60,(R0)+       ;SET THIS CHARACTER = NULL
011522  005302                  DEC     R2              ;ONE LESS CHARACTER TO GO
011524  003372                  BGT     4$              ;IF NOT ZERO, KEEP GOING
011526  000412                  BR      8$              ;DONE, RETURN!
011530  021027  000011  5$:     CMP     (R0),#11        ;ALPHA OR NUMERIC CHARACTER?
011534  101003                  BHI     6$              ;IF > 11, ALPHA!
011536  062720  000060          ADD     #60,(R0)+       ;MAKE NUMERIC ASCII
011542  000402                  BR      7$              ;AND GO-ON
011544  062720  000067  6$:     ADD     #55.,(R0)+      ;MAKE HEX ASCII
011550  005302          7$:     DEC     R2              ;ONE LESS ITERATION TO-GO
011552  003366                  BGT     5$              ;ONE LESS ITERATION, IF NOT ZERO
011554  012602          8$:     MOV     (SP)+,R2        ;RESTORE R2
011556  012601                  MOV     (SP)+,R1        ;AND R1
011560  012616                  MOV     (SP)+,(SP)      ;MOVE STACK OVER INPUT VALUE
011562  000207                  RTS     PC              ;AND RETURN

011564          PSTACK: .BLKW   10.     ;SOTWARE PSEUDO STACK
```

```
                                        ;SUBR TO GENERATE A PSEUDO RANDOM NUMBER
                                        ;THE NUMBER IS RETURNED IN $RP1
                                        ;THERE ARE 3 SEED VALUES THAT CAN BE SAVED
                                        ;TO GENERATE THE PSEUDO RANDOM NUMBER

011610  010046              RAND:   MOV     R0,-(SP)        ;SAVE R0
011612  013700  011672              MOV     $RP1,R0         ;GET A SEED
011616  000241                      CLC                     ;
011620  005337  011670              DEC     $RNCON  ;
011624  006100                      ROL     R0
011626  006100                      ROL     R0
011630  063700  011670              ADD     $RNCON,R0
011634  063700  011674              ADD     $RP2,R0
011640  010037  011672              MOV     R0,$RP1
011644  006100                      ROL     R0
011646  006100                      ROL     R0
011650  063700  011674              ADD     $RP2,R0
011654  006100                      ROL     R0
011656  006100                      ROL     R0
011660  010037  011674              MOV     R0,$RP2
011664  012600                      MOV     (SP)+,R0        ;RESTORE R0
011666  000207                      RTS     PC

011670  000000              $RNCON: 0
011672  001233              $RP1:   1233
011674  007622              $RP2:   7622
```

```
                                ;DETERMINE IF THERE IS A CLOCK ON SYSTEM. START THE CLOCK. "CLKSTA" WILL
                                ;INDICATE THE CLOCK TYPE.
                                ;        0= NO CLOCK
                                ;       +1= KW11-P
                                ;       -1= KW11-L
                                ;
                                ;THIS ROUTINE WILL ALSO SETUP "TICKMS" (TIME PER CLOCK TICK IN MILLISECONDS)
                                ;AND "TICKUS" (TIME PER CLOCK TICK IN MICROSECONDS) AS PER LINE FREQUENCY.
                                ;CALL
                                ;       JSR     PC,ST.CLK       ;START THE CLOCK
                                ;       RETURN

011676  005037  002250          ST.CLK: CLR     CLKSTA          ;ASSUME "NO CLOCK"
011702  005037  012142                  CLR     HERTZ           ;ASSUME "UNKNOWN" HERTZ
                                                                ;IS THERE A P-CLOCK PRESENT ?
011706  012700  000120                  MOV     #'P,R0
011712  104462                          TRAP    C$CLCK
011714  010005                          MOV     R0,R5
                                                                ;GO TO 1$ IF NO
011716  103031                          BCC     1$

                                        ;SET P-CLOCK P-TABLE & START P-CLOCK

011720  010537  012116                  MOV     R5,PCLKTB       ;SAVE P-CLOCK TABLE ADDRESS
011724  011537  012120                  MOV     (R5),PKCS       ;GET 'CSR' ADDRESS
011730  011537  012122                  MOV     (R5),PKB        ;MAKE PKB ADDRESS BY
011734  062737  000002  012122          ADD     #2,PKB          ;ADDING 2
011742  012537  012124                  MOV     (R5)+,PKC       ;MAKE PKC ADDRESS BY
011746  062737  000004  012124          ADD     #4,PKC          ;ADDING 4
011754  005725                          TST     (R5)+           ;SKIP OVER 'BR LEVEL'
011756  012537  012126                  MOV     (R5)+,PKV       ;GET 'VECTOR' ADDRESS
011762  012537  012142                  MOV     (R5)+,HERTZ     ;GET 'HERTZ' LINE FREQUENCY
011766  012737  000001  002250          MOV     #1,CLKSTA       ;SET P-CLOCK FLAG
011774  004737  012144                  JSR     PC,ST.PCLK      ;START P-CLOCK AS A WATCH DOG TIMER
012000  000423                          BR      2$
012002                          1$:                             ;IS THERE A L-CLOCK PRESENT ?
012002  012700  000114                  MOV     #'L,R0
012006  104462                          TRAP    C$CLCK
012010  010005                          MOV     R0,R5
                                                                ;GO TO 3$ IF NO
012012  103036                          BCC     3$

                                        ;SET L-CLOCK P-TABLE, START L-CLOCK

012014  010537  012132                  MOV     R5,LCLKTB       ;SAVE L-CLOCK TABLE ADDRESS
012020  012537  012134                  MOV     (R5)+,LKS       ;GET 'CSR' ADDRESS
012024  005725                          TST     (R5)+           ;SKIP OVER 'BR LEVEL'
012026  012537  012136                  MOV     (R5)+,LKV       ;GET 'VECTOR' ADDRESS
012032  012537  012142                  MOV     (R5)+,HERTZ     ;GET 'HERTZ' LINE FREQUENCY
012036  012737  177777  002250          MOV     #-1,CLKSTA      ;L-CLOCK FLAG
012044  004737  012216                  JSR     PC,ST.LCLK      ;START L-CLOCK AS A WATCH DOG TIMER

                                        ;GET THE CLOCK TICK COUNT

012050  012737  000024  012112  2$:     MOV     #20.,TICKMS     ;ASSUME 20.0 MSEC &
012056  012737  047040  012114          MOV     #20000.,TICKUS  ;20000.0 USEC
012064  023727  012142  000062          CMP     HERTZ,#50.      ;IS IT 50 HERTZ LINE FREQUENCY ?
```

```
012072  001406                          BEQ     3$              ;BR IF YES
012074  012737  000020  012112          MOV     #16.,TICKMS     ;MUST BE 60HZ, 16.666 MSEC &
012102  012737  040432  012114          MOV     #16666.,TICKUS  ;16666.0 USEC
012110  000207                  3$:     RTS     PC
012112  000020                  TICKMS: .WORD   16.             ;16 MILLISECONDS PER CLOCK TICK
012114  040432                  TICKUS: .WORD   16666.          ;16666 MICROSECONDS PER CLOCK TICK

                                ;KW11-P CLOCK TABLE, CSR REG, PKB REG, PKC REG & VEC ADR

012116  000000                  PCLKTB: .WORD   0               ;P-CLK TBL ADR

012120  172540                  PKCS:   .WORD   172540          ;CONTROL & STATUS
012122  172542                  PKB:    .WORD   172542          ;COUNT SET BFR
012124  172544                  PKC:    .WORD   172544          ;COUNTER
012126  000104  000106          PKV:    .WORD   104,106         ;VECTOR

                                ;KW11-L CLOCK TABLE, CSR REG & VEC ADR

012132  000000                  LCLKTB: .WORD   0               ;L-CLK TBL ADR

012134  177546                  LKS:    .WORD   177546          ;CONTROL & STATUS
012136  000100  000102          LKV:    .WORD   100,102         ;VECTOR

012142  000000                  HERTZ:   WORD   0               ;60 HZ. OR 50 HZ. LINE FREQUENCY

012144                  ST.PCLK:
012144  105737  002233          TSTB    STOFLG          ;ALLOW SOFTWARE TIMECUTS ?
012150  001021                  BNE     1$              ;NO--BRANCH
                                                        ;SETUP VECTOR FOR P-CLOCK
012152  012746  000300          MOV     #PRI06,-(SP)
012156  012746  012312          MOV     #KWSRV,-(SP)
012162  013746  012126          MOV     PKV,-(SP)
012166  012746  000003          MOV     #3,-(SP)
012172  104437                  TRAP    C$SVEC
012174  062706  000010          ADD     #10,SP
012200  012777  000001  177714  MOV     #1,@PKB         ;COUNT ONE TICK
012206  012777  000115  177704  MOV     #115,@PKCS      ;"INT.EN.",COUNT DOWN", "MODE 1 (REPEAT)",
                                                        ;"LINE FREQ", AND "RUN"
012214  000207          1$:     RTS     PC              ;RETURN

012216                  ST.LCLK:
012216  105737  002233          TSTB    STOFLG          ;ALLOW SOFTWARE TIMEOUTS ?
012222  001016                  BNE     1$              ;NO--BRANCH
                                                        ;SETUP VECTOR FOR L-CLOCK
012224  012746  000300          MOV     #PRI06,-(SP)
012230  012746  012312          MOV     #KWSRV,-(SP)
012234  013746  012136          MOV     LKV,-(SP)
012240  012746  000003          MOV     #3,-(SP)
012244  104437                  TRAP    C$SVEC
012246  062706  000010          ADD     #10,SP
012252  012777  000100  177654  MOV     #100,@LKS       ;START THE KW11-L
012260  000207          1$:     RTS     PC              ;RETURN

                                ;THIS ROUTINE IS USED TO STOP THE SYSTEM CLOCK
                                ;CALL
                                ;       JSR     PC,STOPCK       ;CALL ROUTINE
```

```
                                ;IS THERE A CLOCK AVAILABLE ?
                                ;BR IF NO
                                ;BR IF L-CLOCK
                                ;STOP THE P-CLOCK
                                ;STOP THE L-CLOCK
                                ;KW11 CLOCK INTERRUPT SERVICE ROUTINE
                                ;TIME PER TICK IN MILLISECONDS
                                ;COUNT THE ELASPED TIME
                                ;THIS SUBROUTINE IS USED TO RELOAD THE CLOCK FOR A 4 SECOND TIMEOUT DURING
                                ;A RECALIBRATE COMMAND
                                ;STOP CLOCK
                                ;SAVE THE OLD CLOCK VECTOR ADDRESS
                                ;SETUP VECTOR FOR P-CLOCK
                                ;4 SEC  DELAY AT LINE FREQ
                                ;RUN AT LINE FREQ, DOWN MODE, IE-1
                                ;WAIT FOR CLK INTER
                                ;STOP CLOCK
                                ;ADJUST FOR RETURN
                                ;RESTORE OLD VECTOR ADDRESS FOR P-CLOCK
                                ;CLEAR CLK BFR COUNT
                                ;ROUTINE TO PROVIDE A 2 MS STALL AFTER A SEEK OPERATION IN THE SEEK TIMING
                                ;TESTS.  THIS STALL IS REQUIRED TO COMPENSATE FOR THE 'ACCESS READY' DELAY
                                ;IN THE RP07.  THIS STALL TIME IS NOT INCLUDED IN THE CALCULATED SEEK TIMES.
                                ;CALL
                                ;       JSR     PC,TWOMS
                                ;       RETURN
                                ;STOP THE P-CLOCK
                                ;SAVE THE OLD CLOCK VECTOR ADDRESS
                                ;SETUP VECTOR FOR P-CLOCK
```

```
        012472  013746  012126                 MOV     PKV,-(SP)
        012476  012746  000003                 MOV     #3,-(SP)
        012502  104437                         TRAP    C$SVEC
        012504  062706  000010                 ADD     #10,SP
156     012510  012777  000310  177404         MOV     #200.,@PKB      ;LOAD THE CLOCK BUFFER
157     012516  105737  002230                 TSTB    TIMSTL          ;RANDOM STALL?
158     012522  001410                         BEQ     1$              ;NO
159     012524  004737  011610                 JSR     PC,RAND         ;YES, FETCH A RANDOM NUMBER
160     012530  013746  011672                 MOV     $RP1,-(SP)      ;GET RANDOM NUMBER
161     012534  042716  173000                 BIC     #^C4777,(SP)    ;LIMIT IT TO 25 MSEC
162     012540  062677  177356                 ADD     (SP)+,@PKB      ;ADD IT TO THE BASIC 2 MSEC STALL
163     012544  012777  000101  177346 1$:     MOV     #101,@PKCS      ;START THE CLOCK
164     012552  000001                         WAIT                    ;WAIT FOR 2 MS
166     012554  042777  000101  177336 2$:     BIC     #101,@PKCS      ;STOP THE P-CLOCK
167     012562  012716  012570                 MOV     #3$,(SP)        ;ADJUST FOR RETURN
168     012566                         L10010:
        012566  000002                         RTI
169     012570                         3$:                             ;RESTORE OLD VECTOR ADDRESS FOR P-CLOCK
170     012570  012746  000300                 MOV     #PRI06,-(SP)
        012574  012646                         MOV     (SP)+,-(SP)
        012576  013746  012126                 MOV     PKV,-(SP)
        012602  012746  000003                 MOV     #3,-(SP)
        012606  104437                         TRAP    C$SVEC
        012610  062706  000010                 ADD     #10,SP
171     012614  005077  177302                 CLR     @PKB            ;SET COUNT = 0
172     012620  000207                         RTS     PC              ;RETURN
176
177                                     ;THIS ROUTINE LOADS A READ HEADER AND DATA COMMAND OR A SEEK COMMAND
178                                     ;INTO DPB.B+2 AND DPB.C+2, DEPENDING ON THE STATE OF REDHDR FLAG
179                                     ;THAT CAN BE ALTERED BY THE OPERATOR.
180                                     ;CALL
181                                     ;       JSR     PC,LDCMD
182                                     ;       RETURN
183
184 012622                              LDCMD:
185     012622  105737  002226                 TSTB    REDHDR          ;DO EXPLICIT SEEKS FOR VERIFYING ?
186     012626  001407                         BEQ     1$              ;NO--BRANCH
187     012630  012737  000173  002562         MOV     #RDHD,DPB.B+2   ;NO--SET UP FOR READ HEADER AND
188     012636  012737  000173  002602         MOV     #RDHD,DPB.C+2   ;DATA COMMAND
189     012644  000406                         BR      2$
190     012646  012737  000105  002562 1$:     MOV     #SEEK,DPB.B+2 ;SETUP FOR SEEK COMMAND
191     012654  012737  000105  002602         MOV     #SEEK,DPB.C+2
192     012662  000207                 2$:     RTS     PC
```

```
 1
 2                                      ;ERROR ANALYSIS ROUTINE
 3                                      ;R0     NOT USED
 4                                      ;R1     DPB ADDRESS
 5                                      ;R2     BASE ADDRESS OF SAVED REG'S TABLE
 6                                      ;R3     TEMP STORAGE
 7                                      ;R4
 8                                      ;R5     LINK AND RET
 9                                      ;
10                                      ;       CALLING SEQ:
11                                      ;       JSR     R5,ERRANY
12                                      ;       DPB
13                                      ;       RET
14
15 012664                              ERRANY:
   012664  010146                              MOV     R1,-(SP)        ;;PUSH R1 ON STACK
   012666  010246                              MOV     R2,-(SP)        ;;PUSH R2 ON STACK
   012670  010346                              MOV     R3,-(SP)        ;;PUSH R3 ON STACK
   012672  010446                              MOV     R4,-(SP)        ;;PUSH R4 ON STACK
16 012674  005037  002254                      CLR     SVSTAT          ;PROGRAM FLAGS: EACH BIT INDICATES ERROR TYPE
17 012700  012501                              MOV     (R5)+,R1        ;DPB ADDRESS
18 012702  016102  000014                      MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
19 012706  016237  000036  002266              MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
20 012714  116237  000006  002272              MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
21 012722  116237  000007  002270              MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
22 012730  126127  000002  000150              CMPB    2(R1),#150      ;IF DATA TFR CMD
23 012736  002402                              BLT     1$
24 012740  004737  014206                      JSR     PC,ADJUST       ;THEN GET THE DECREMENTED SECTOR ADDRESS
25 012744  032762  020000  000000  1$:         BIT     #MCPE,0(R2)     ;MCPE ERROR ?
26 012752  001406                              BEQ     2$              ;BRANCH IF NOT
27 012754  104456                              TRAP    C$ERHRD
   012756  000001                              .WORD   1
   012760  005331                              .WORD   EM1
   012762  007604                              .WORD   DH44
28 012764  000137  014042                      JMP     31$             ;EXIT
29
30 012770  032762  020400  000010  2$:         BIT     #MPE!UPE,10(R2) ;PARITY PROBLEM ?
31 012776  001406                              BEQ     3$              ;BRANCH IF NONE
32 013000  104456                              TRAP    C$ERHRD
   013002  000002                              .WORD   2
   013004  005376                              .WORD   EM2
   013006  007604                              .WORD   DH44
33 013010  000137  014052                      JMP     32$             ;EXIT
34
35 013014  032762  017000  000010  3$:         BIT     #NED!NEM!MSPGE!MXF,10(R2)       ;ILLEGAL CONDITIONS ?
36 013022  001412                              BEQ     4$              ;BRANCH IF NONE
37 013024  032762  040000  000012              BIT     #ERR,12(R2)     ;ANY DRIVE ERROR ?
38 013032  001006                              BNE     4$              ;REPORT THE DRIVE ERROR
39 013034  104456                              TRAP    C$ERHRD
   013036  000003                              .WORD   3
   013040  005440                              .WORD   EM3
   013042  007604                              .WORD   DH44
40 013044  000137  014052                      JMP     32$             ;EXIT
41
42 013050  032762  040000  000010  4$:         BIT     #WCE,10(R2)     ;ANY DATA PATTERN ERROR ?
43 013056  001406                              BEQ     5$              ;BRANCH IF NONE
44 013060  104456                              TRAP    C$ERHRD
```

```
                013062  000004                          .WORD   4
                013064  005516                          .WORD   EM4
                013066  007604                          .WORD   DH44
     45 013070  000137  014052                          JMP     32$             ;EXIT
     46
     47 013074  032762  100000  000010  5$:     BIT     #DLT,10(R2)     ;ANY DATA LATE ERROR ?
     48 013102  001406                          BEQ     6$              ;BRANCH IF NONE
     49 013104  104456                          TRAP    C$ERHRD
                013106  000005                          .WORD   5
                013110  005540                          .WORD   EM5
                013112  007604                          .WORD   DH44
     50 013114  000137  014052                          JMP     32$             ;EXIT
     51
     52 013120  032762  040000  000012  6$:     BIT     #ERR,12(R2)     ;ANY DRIVE ERROR ?
     53 013126  001002                          BNE     7$              ;BRANCH IF ANY
     54 013130  000137  014174                          JMP     43$             ;EXIT
     55
     56 013134  032762  100000  000040  7$:     BIT     #PGE,40(R2)     ;DRIVE PROGRAMMING ERROR ?
     57 013142  001406                          BEQ     8$              ;BRANCH IF NONE
     58 013144  104456                          TRAP    C$ERHRD
                013146  000006                          .WORD   6
                013150  005560                          .WORD   EM6
                013152  007604                          .WORD   DH44
     59 013154  000137  014062                          JMP     33$             ;EXIT
     60
     61 013160  032762  002000  000042  8$:     BIT     #LBC,42(R2)     ;LOST BIT CLOCK ?
     62 013166  001406                          BEQ     9$              ;BRANCH IF NONE
     63 013170  104456                          TRAP    C$ERHRD
                013172  000007                          .WORD   7
                013174  005616                          .WORD   EM7
                013176  007604                          .WORD   DH44
     64 013200  000137  014072                          JMP     34$             ;EXIT
     65
     66 013204  032762  000040  000014  9$:     BIT     #WCF,14(R2)     ;WRITE CLOCK FAILS ?
     67 013212  001406                          BEQ     10$             ;BRANCH IF NONE
     68 013214  104456                          TRAP    C$ERHRD
                013216  000013                          .WORD   11
                013220  005644                          .WORD   EM11
                013222  007604                          .WORD   DH44
     69 013224  000137  014072                          JMP     34$             ;EXIT
     70
     71 013230  032762  004000  000014  10$:    BIT     #WLE,14(R2)     ;WRITE LOCK ERROR ?
     72 013236  001406                          BEQ     11$             ;BRANCH IF NONE
     73 013240  104456                          TRAP    C$ERHRD
                013242  000014                          .WORD   12
                013244  005666                          .WORD   EM12
                013246  007604                          .WORD   DH44
     74 013250  000137  014072                          JMP     34$             ;EXIT
     75
     76 013254  032762  010000  000014  11$:    BIT     #DTE,14(R2)     ;DATA ERROR ON DRIVE ?
     77 013262  001042                          BNE     16$             ;REPORT THE DRIVE TIMING ERROR
     78 013264  032762  100000  000014          BIT     #DCK,14(R2)     ;ANY DATA ERROR ?
     79 013272  001444                          BEQ     17$             ;BRANCH IF NONE
     80 013274  032762  000100  000014          BIT     #ECH,14(R2)     ;ECH SET, THEN RPEC1=10040
     81 013302  001412                          BEQ     13$             ;EXIT IF NOT SET
     82 013304  022762  010040  000044  12$:    CMP     #10040,44(R2)   ;POSITION REG=10040
     83 013312  001012                          BNE     14$             ;REPORT ECC LOGIC FAILURE
```

```
 84 013314  104456                          TRAP    C$ERHRD
    013316  000057                          .WORD   47
    013320  007216                          .WORD   FM47
    013322  007604                          .WORD   DH44
 85 013324  000137  014072                  JMP     34$             ;EXIT
 86
 87 013330  022762  010040  000044  13$:    CMP     #10040,44(R2)   ;LEGICAL POSITION REG CONTENTS ?
 88 013336  101006                          BHI     15$             ;BRANCH IF SO
 89 013340                          14$:
    013340  104456                          TRAP    C$ERHRD
    013342  000053                          .WORD   43
    013344  007045                          .WORD   EM43
    013346  007604                          .WORD   DH44
 90 013350  000137  014072                  JMP     34$             ;EXIT
 91
 92 013354                          15$:
    013354  104456                          TRAP    C$ERHRD
    013356  000015                          .WORD   13
    013360  005707                          .WORD   EM13
    013362  007604                          .WORD   DH44
 93 013364  000137  014072                  JMP     34$             ;EXIT
 94
 95 013370                          16$:
    013370  104456                          TRAP    C$ERHRD
    013372  000055                          .WORD   45
    013374  007135                          .WORD   EM45
    013376  007604                          .WORD   DH44
 96 013400  000137  014072                  JMP     34$             ;EXIT
 97
 98 013404  032762  000010  000042  17$:    BIT     #DPE,42(R2)     ;DRIVE DATA BUS PARITY ?
 99 013412  001406                          BEQ     18$             ;BRANCH IF NONE
100 013414  104456                          TRAP    C$ERHRD
    013416  000016                          .WORD   14
    013420  005730                          .WORD   EM14
    013422  007604                          .WORD   DH44
101 013424  000137  014072                  JMP     34$             ;EXIT
102
103 013430  032762  000007  000014  18$:    BIT     #ILF!ILR!RMR,14(R2)     ;INTERFACE PROBLEM ?
104 013436  001406                          BEQ     19$             ;BRANCH IF NONE
105 013440  104456                          TRAP    C$ERHRD
    013442  000017                          .WORD   15
    013444  005765                          .WORD   EM15
    013446  007604                          .WORD   DH44
106 013450  000137  014102                  JMP     35$             ;EXIT
107
108 013454  032762  003000  000014  19$:    BIT     #IAE!AOE,14(R2) ;POSITION ERROR
109 013462  001406                          BEQ     20$             ;BRANCH IF NONE
110 013464  104456                          TRAP    C$ERHRD
    013466  000020                          .WORD   16
    013470  006032                          .WORD   EM16
    013472  007604                          .WORD   DH44
111 013474  000137  014112                  JMP     36$             ;EXIT
112
113 013500  032762  020000  000014  20$:    BIT     #OPI,14(R2)     ;OPERATION INCOMPLETE ?
114 013506  001406                          BEQ     21$             ;BRANCH IF SO
115 013510  104456                          TRAP    C$ERHRD
    013512  000051                          .WORD   41
```

```
                013514  006765                          .WORD   EM41
                013516  007604                          .WORD   DH44
    116         013520  000137  014112                  JMP     36$             ;EXIT
    117
    118         013524  032762  041000  000042  21$:    BIT     #SKI!LCE,42(R2) ;SERVO OR ACTUATOR SEEK ERROR ?
    119         013532  001406                          BEQ     22$             ;BRANCH IF NONE
    120         013534  104456                          TRAP    C$ERHRD
                013536  000021                          .WORD   17
                013540  006065                          .WORD   EM17
                013542  007604                          .WORD   DH44
    121         013544  000137  014112                  JMP     36$
    122
    123         013550  032762  000002  000012  22$:    BIT     #EWN,12(R2)     ;PROBLEM ?
    124         013556  001406                          BEQ     23$             ;BRANCH IF SO
    125         013560  104456                          TRAP    C$ERHRD
                013562  000025                          .WORD   21
                013564  006161                          .WORD   EM21
                013566  007604                          .WORD   DH44
    126         013570  000137  014122                  JMP     37$             ;EXIT
    127
    128         013574  016203  000014          23$:    MOV     14(R2),R3       ;CHECK IF HEAD MISSING
    129         013600  042703  177057                  BIC     #^C<FER!ECH!HCRC!HCE>,R3         ;CHOP THE REST BITS
    130         013604  022703  000720                  CMP     #FER!ECH!HCRC.HCE,R3             ;MISSING HEAD ?
    131         013610  001006                          BNE     24$             ;BRANCH IF NOT
    132         013612  104456                          TRAP    C$ERHRD
                013614  000026                          .WORD   22
                013616  006205                          .WORD   EM22
                013620  007604                          .WORD   DH44
    133         013622  000137  014132                  JMP     38$             ;EXIT
    134
    135         013626  032762  000020  000014  24$:    BIT     #FER,14(R2)     ;FORMAT ERROR ?
    136         013634  001406                          BEQ     25$             ;BRANCH IF NOT
    137         013636  104456                          TRAP    C$ERHRD
                013640  000027                          .WORD   23
                013642  006235                          .WORD   EM23
                013644  007604                          .WORD   DH44
    138         013646  000137  014132                  JMP     38$             ;EXIT
    139
    140         013652  032762  000600  000014  25$:    BIT     #HCRC!HCE,14(R2)        ;HEADER INFORMATION ERROR ?
    141         013660  001420                          BEQ     27$             ;BRANCH IF NONE
    142         013662  032762  000400  000014          BIT     #HCRC,14(R2)    ;HEADER CRC ERROR ?
    143         013670  001006                          BNE     26$             ;BRACH IF SO
    144         013672  104456                          TRAP    C$ERHRD
                013674  000030                          .WORD   24
                013676  006271                          .WORD   EM24
                013700  007604                          .WORD   DH44
    145         013702  000137  014132                  JMP     38$             ;EXIT
    146
    147         013706                          26$:
                013706  104456                          TRAP    C$ERHRD
                013710  000056                          .WORD   46
                013712  007166                          .WORD   EM46
                013714  007604                          .WORD   DH44
    148         013716  000137  014132                  JMP     38$             ;EXIT
    149
    150         013722  032762  017400  000040  27$:    BIT     #WRYUNS!WOR!RWU1!RWU2!RWU3,40(R2)        ;WRITE AND READ UNSAFE ?
    151         013730  001406                          BEQ     28$             ;BRANCH IF NONE
```

```
152 013732  104456                        TRAP    C$ERHRD
    013734  000040                        .WORD   32
    013736  006614                        .WORD   EM32
    013740  007604                        .WORD   DH44
153 013742  000137  014142                JMP     39$             ;EXIT
154
155 013746  032762  000040  000042  28$:  BIT     #DCU,42(R2)     ;DC LOW ?
156 013754  001406                        BEQ     29$             ;BRANCH IF NONE
157 013756  104456                        TRAP    C$ERHRD
    013760  000041                        .WORD   33
    013762  006637                        .WORD   EM33
    013764  007604                        .WORD   DH44
158 013766  000137  014142                JMP     39$             ;EXIT
159
160 013772  032762  000100  000042  29$:  BIT     #IXU,42(R2)     ;INDEX UNSAFE ?
161 014000  001406                        BEQ     30$             ;BRANCH IF NONE
162 014002  104456                        TRAP    C$ERHRD
    014004  000042                        .WORD   34
    014006  006657                        .WORD   EM34
    014010  007604                        .WORD   DH44
163 014012  000137  014142                JMP     39$             ;EXIT
164
165 014016  032762  000400  000042  30$:  BIT     #PHF,42(R2)     ;PROCESSOR HANDSHAKE FAILURE??
166 014024  001452                        BEQ     42$             ;BRANCH IF NOT
167 014026  104456                        TRAP    C$ERHRD
    014030  000043                        .WORD   35
    014032  006674                        .WORD   EM35
    014034  007604                        .WORD   DH44
163 014036  000137  014142                JMP     39$
169
170 014042  052737  000001  002254  31$:  BIS     #BIT0,SVSTAT    ;MCPE=1,RHXX A-SYNC CONTROL BUS PARITY
171 014050  000451                        BR      43$
172
173 014052  052737  000002  002254  32$:  BIS     #BIT1,SVSTAT    ;RHXX DATA BUS PARITY,ILLEGAL CONDITION
174 014060  000445                        BR      43$             ;DATA LATE, WRITE CHECK.
175
176 014062  052737  000004  002254  33$:  BIS     #BIT2,SVSTAT    ;PROGRAM ERROR: PROHIBITED COMMANDS
177 014070  000441                        BR      43$             ;WERE EXECUTED (WRITE/READ TRACK DES,
178                                                               ;FORMAT TRACK).
179
180 014072  052737  000010  002254  34$:  BIS     #BIT3,SVSTAT    ;DRIVE CLOCK, TIMING, DATA ERROR
181 014100  000435                        BR      43$             ;RETRY SHOULD BE ALLOWED.
182
183 014102  052737  000020  002254  35$:  BIS     #BIT4,SVSTAT    ;ILLEGAL CONDITION ,DECODER, INTERFACE
184 014110  000431                        BR      43$             ;PROBLEM
185
186 014112  052737  000040  002254  36$:  BIS     #BIT5,SVSTAT    ;POSITIONING ERROR
187 014120  000425                        BR      43$
188
189 014122  052737  000100  002254  37$:  BIS     #BIT6,SVSTAT    ;MECHANICAL FAILURE : AIR, TEMP ETC.
190 014130  000421                        BR      43$
191
192 014132  052737  000200  002254  38$:  BIS     #BIT7,SVSTAT    ;HEADER INFORMATION ( HEADER FAILURE,
193 014140  000415                        BR      43$             ;OR UNFORMAT TRACK )
194
195 014142  052737  000400  002254  39$:  BIS     #BIT8,SVSTAT    ;UNSAFE (READ/WRITE, INDEX, TACH)
196 014150  000411                        BR      43$
```

```
    197
    198 014152  032762  100000  000042  42$:    BIT     #BSE,42(R2)     ;BAD SECTOR DETECTED ?
    199 014160  001005                          BNE     43$             ;EXIT NOT REPORT ERROR
    200 014162  104456                          TRAP    C$ERHRD
        014164  000054                          .WORD   44
        014166  007067                          .WORD   EM44
        014170  007604                          .WORD   DH44
    201 014172  000763                          BR      39$             ;EXIT
    202 014174                          43$:
        014174  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
        014176  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
        014200  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
        014202  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
    203 014204  000205                          RTS     R5
```

```
                                        ;SUBROUTINE TO ADJUST THE SECTOR ADDRESS BECAUSE IT IS AUTOMATICALLY
                                        ;INCREMENTED AT THE END OF A TRANSFER
                                        ;CALL
                                        ;       JSR     PC,ADJUST       ;CALL ROUTINE

014206  005737  002272          ADJUST: TST     SEC.RD          ;SECTOR 0?
014212  001014                          BNE     1$              ;BR IF NOT
014214  013737  002264  002272          MOV     NS1,SEC.RD      ;MAKE IT LAST PHYSICAL SECTOR AND DECR TRACK
014222  005737  002270                  TST     TRK.RD          ;LAST TRACK?
014226  001011                          BNE     2$              ;BR IF NOT
014230  013737  002262  002270          MOV     NT1,TRK.RD      ;MAKE IT LAST PHYSICAL TRACK AND DECR CYL
014236  005337  002266                  DEC     CYL.RD          ;DECR CYL
014242  000405                          BR      3$              ;EXIT
014244  005337  002272          1$:     DEC     SEC.RD          ;
014250  000402                          BR      3$              ;EXIT
014252  005337  002270          2$:     DEC     TRK.RD          ;ADJUST TRACK
014256  000207                  3$:     RTS     PC

                                        ;THIS ROUTINE WILL CALL THE RP07 DRIVER AND THEN WAIT ON THE FUNCTION
                                        ;TO COMPLETE. IF AN ERROR OCCURS IT IS REPORTED.
                                        ;CALL
                                        ;       FILL "DPB" WITH COMMAND INFORMATION
                                        ;       JSR     R4,CALL.A
                                        ;       RETURN

014260  004437  020750          CALL.A: JSR     R4,RP07         ;CALL RP07 DRIVER
014264  002540                          DPB.A
014266  000774                          BR      CALL.A
014270  005737  002556          1$:     TST     DPB.A+16        ;DONE?
014274  001775                          BEQ     1$              ;NO--LOOP
014276  100036                          BPL     3$              ;BRANCH IF NO ERROR
014300  013737  002552  002274          MOV     DPB.A+12,CYL.DS ;CYLINDER
014306  113737  002551  002300          MOVB    DPB.A+11,TRK.DS ;TRACK
014314  113737  002550  002276          MOVB    DPB.A+10,SEC.DS ;SECTOR
014322  004537  015100                  JSR     R5,ERRABO       ;CHECK THE ABORT CONDITION
014326  002540                          DPB.A                   ;PARAMETER BLOCK ADDRESS
014330  004537  012664                  JSR     R5,ERRANY       ;DETECT ERROR
014334  002540                          DPB.A
014336  022737  000200  002254          CMP     #BIT7,SVSTAT    ;HEADER ERROR?
014344  001013                          BNE     3$              ;IF NOT MATCH, NO
014346  013746  002542                  MOV     DPB.A+2,-(SP)
014352  112737  000107  002542          MOVB    #RECAL,DPB.A+2  ;SET UP FOR A RECAL COMMAND
014360  004437  020750                  JSR     R4,RP07         ;ISSUE THE COMMAND
014364  002540                          DPB.A                   ;THIS BUFFER
014366  000240                          NOP                     ;FILLER FOR THE DRIVER
014370  012637  002542                  MOV     (SP)+,DPB.A+2
014374  000204                  3$:     RTS     R4              ;RETURN

                                        ;THIS ROUTINE IS THE SAME AS "CALL.A" EXCEPT FOR THE DPB USED AND IF
                                        ;THE COMMAND IS A READ HEADER AND DATA THE HEADER (CYLINDER, TRACK,
                                        ;AND SECTOR) READ IS CHECKED FOR VALIDITY.
                                        ;CALL
                                        ;       FILL DPB
                                        ;       JSR     R4,CALL.B
                                        ;       RETURN

014376  004437  020750          CALL.B: JSR     R4,RP07         ;CALL  DRIVER
```

```
 56 014402  002560                          DPB.B
 57 014404  000774                          BR      CALL.B
 58 014406  005737  002576          1$:     TST     DPB.B+16        ;DONE?
 59 014412  001775                          BEQ     1$              ;NO--BRANCH
 60 014414  100037                          BPL     3$              ;BRANCH IF NO ERROR
 61 014416  013737  002572  002274          MOV     DPB.B+12,CYL.DS ;CYLINDER
    014424  113737  002571  002300          MOVB    DPB.B+11,TRK.DS ;TRACK
    014432  113737  002570  002276          MOVB    DPB.B+10,SEC.DS ;SECTOR
 62 014440  004537  015100                  JSR     R5,ERRABO       ;CHECK THE ABORT CONDITION
 63 014444  002560                          DPB.B
 64 014446  004537  012664                  JSR     R5,ERRANY
 65 014452  002560                          DPB.B
 66 014454  022737  000200  002254          CMP     #BIT7,SVSTAT    ;HEADER ERRORS?
 67 014462  001013                          BNE     2$              ;TAKE BRANCH IF NOT MATCH
 68 014464  013746  002562                  MOV     DPB.B+2,-(SP)
 69 014470  112737  000107  002562          MOVB    #RECAL,DPB.B+2  ;SET UP A RECAL COMMAND
 70 014476  004437  020750                  JSR     R4,RP07         ;ISSUE THE COMMAND
 71 014502  002560                          DPB.B                   ;THIS BUFFER
 72 014504  000240                          NOP                     ;FILLER FOR THE DRIVER
 73 014506  012637  002562                  MOV     (SP)+,DPB.B+2           ;RESTORE THE COMMAND
 74 014512  000421                  2$:     BR      5$              ;EXIT
 75 014514  123727  002562  000173  3$:     CMPB    DPB.B+2,#RDHD   ;DOING IMPLIED SEEKS?
 76 014522  001007                          BNE     4$              ;NO--BRANCH
 77 014524  005737  002576                  TST     DPB.B+16        ;ERROR DETECTED ?
 78 014530  100404                          BMI     4$              ;BRANCH IF SO
 79 014532  004437  015354                  JSR     R4,VERIFY       ;GO CHECK THE DATA
 80 014536  002570                          DPB.B+10
 81 014540  000406                          BR      5$              ;ERROR DURING VERIFY
 82 014542                          4$:
 83 014542  105737  002231                  TSTB    STALLF          ;STALL ?
 84 014546  001403                          BEQ     5$              ;NO--BRANCH
 85 014550  004437  015274                  JSR     R4,STALL        ;YES--CALL STALL ROUTINE
 86 014554  002346                          .WORD   STALL1          ;STALL TIME POINTER
 87 014556  000204                  5$:     RTS     R4              ;RETURN
 88
 89                                         ;THIS ROUTINE IS THE SAME AS "CALL.B" EXCEPT FOR THE DPB USED.
 90                                         ;CALL
 91                                         ;       FILL DPB
 92                                         ;       JSR     R4,CALL.C
 93                                         ;       RETURN
 94
 95 014560  004437  020750          CALL.C: JSR     R4,RP07         ;CALL  DRIVER
 96 014564  002600                          DPB.C
 97 014566  000774                          BR      CALL.C
 98 014570  005737  002616          1$:     TST     DPB.C+16        ;DONE?
 99 014574  001775                          BEQ     1$              ;NO--LOOP
100 014576  100037                          BPL     3$              ;YES--BRANCH IF NO ERROR
101 014600  013737  002612  002274          MOV     DPB.C+12,CYL.DS ;CYLINDER
    014606  113737  002611  002300          MOVB    DPB.C+11,TRK.DS ;TRACK
    014614  113737  002610  002276          MOVB    DPB.C+10,SEC.DS ;SECTOR
102 014622  004537  015100                  JSR     R5,ERRABO
103 014626  002600                          DPB.C                   ;CHECK THE ABORT CONDITION
104 014630  004537  012664                  JSR     R5,ERRANY
105 014634  002600                          DPB.C
106 014636  022737  000200  002254          CMP     #BIT7,SVSTAT    ;HEADER ERRORS?
107 014644  001013                          BNE     2$              ;IF NO MATCH, NO!
108 014646  013746  002602                  MOV     DPB.C+2,-(SP)
```

```
 109 014652  112737  000107  002602          MOVB    #RECAL,DPB.C+2  ;SET UP A RECAL COMMAND
 110 014660  004437  020750                  JSR     R4,RP07         ;ISSUE THE COMMAND
 111 014664  002600                          DPB.C                   ;FROM THIS BUFFER
 112 014666  000240                          NOP                     ;FILLER FOR THE DRIVER
 113 014670  012637  002602                  MOV     (SP)+,DPB.C+2
 114 014674  000421                  2$:     BR      5$              ;EXIT
 115
 116 014676  123727  002602  000173  3$:     CMPB    DPB.C+2,#RDHD   ;DOING IMPLIED SEEK?
 117 014704  001007                          BNE     4$              ;NO--EXIT
 118 014706  005737  002616                  TST     DPB.C+16        ;ANY ERROR ?
 119 014712  100404                          BMI     4$              ;EXIT
 120 014714  004437  015354                  JSR     R4,VERIFY       ;YES--CHECK THE DATA
 121 014720  002610                          DPB.C+10
 122 014722  000406                          BR      5$              ;ERROR DURING VERIFY
 123 014724  105737  002231          4$:     TSTB    STALLF          ;STALL ?
 124 014730  001403                          BEQ     5$              ;NO--BRANCH
 125 014732  004437  015274                  JSR     R4,STALL        ;YES--CALL STALL ROUTINE
 126 014736  002346                          .WORD   STALL1          ;STALL TIME POINTER
 127 014740  000204                  5$:     RTS     R4
```

```
                                        ;TH S ROUTINE IS THE SAME AS "CALL.A" EXCEPT FOR THE DPB USED AND
                                        ;ON AN ERROR LOCATION "ERR.CT" IS EXAMINED. IF ERR.CT IS EQUAL TO
                                        ;$ER LG EXIT IS TO THE NEXT TEST.
                                        ;CA L
                                        ;       FILL DPB
                                        ;       JSR     R4,DRVCAL
                                        ;       RETURN

 014742  005037  002340        DRVCAL: CLR     WCEFLG          ;CLEAR WRITE CHECK ERROR FLAG
 014746  004437  020750                JSR     R4,RP07         ;CALL  DRIVER
 014752  002620                        DTADPB
 014754  000772                        BR      DRVCAL
 014756  005737  002636        3$:     TST     DTADPB+16       ;DONE
 014762  001775                        BEQ     3$              ;NO--LOOP
 014764  100401                        BMI     1$              ;BR IF ERRORS
 014766  000417                        BR      4$              ;NO ERRORS
 014770                          1$:
 014770  013737  002632  002274        MOV     DTADPB+12,CYL.DS        ;CYLINDER
 014776  113737  002631  002300        MOVB    DTADPB+11,TRK.DS        ;TRACK
 015004  113737  002630  002276        MOVB    DTADPB+10,SEC.DS        ;SECTOR
 015012  004537  015100                JSR     R5,ERRABO       ;CHECK THE ABORT CONDITION
 015016  002620                        DTADPB                  ;DATA BLOCK ADDRESS
 015020  004537  012664                JSR     R5,ERRANY
 015024  002620                        DTADPB
 015026                          4$:
 015026  105737  002231                TSTB    STALLF          ;STALL ?
 015032  001403                        BEQ     5$              ;NO--BRANCH
 015034  004437  015274                JSR     R4,STALL        ;YES--CALL STALL ROUTINE
 015040  002350                        .WORD   STALL2          ;STALL TIME POINTER
 015042  000204                5$:     RTS     R4


                                        ;SUBR TO EXECUTE A COMMAND STORED IN DTADPB.
                                        ;SIMILAR TO SUBR CALL.A EXCEPT THAT HARD AND SOFT ERRORS ARE NOT CHECKED
                                        ;I.E. NO CALL TO ERRANY.

 015044  004437  020750        EXECMD: JSR     R4,RP07                 ;EXEC CMD
 015050  002620                        DTADPB                          ;DPB PTR
 015052  000774                        BR      EXECMD                  ;WAIT FOR Q NOT FULL
 015054  005737  002636        2$:     TST     DTADPB+16               ;DONE?
 015060  001775                        BEQ     2$                      ;WAIT FOR DONE
 015062  100003                        BPL     3$                      ;SKIP ON ERROR FREE DONE
 015064  004537  015100                JSR     R5,ERRABO               ;ERROR: CHECK ABORT CONDITION
                                                                        ;EXIT TEST IF 'DPB'+16 SET WITH ERRORS:
                                                                        ;NED+PRT+STO+MCP+PAR+OFL+UNS.
 015070  002620                        DTADPB                          ;'DPB' PTR
 015072  013702  002634        3$:     MOV     DTADPB+14,R2            ;FETCH AD OF SAVED REG TBL
 015076  000207                        RTS     PC
```

```
 1
 2                                      ;THIS ROUTINE IS USED TO DETERMINE THE ABORT CONDITIONS OF
 3                                      ;THE I/O ROUTINES
 4                                      ;CALLING SEQ
 5                                      ;       JSR     R5,ERRABO
 6                                      ;       DPB                     DATA BLOCK PAR ADDRESS
 7                                      ;       NORMAL RET
 8
 9 015100  010146                       ERRABO: MOV     R1,-(SP)        ;SAVE R1
10 015102  010246                               MOV     R2,-(SP)        ;SAVE R2
11 015104  012501                               MOV     (R5)+,R1        ;LOAD THE DPB ADDRESS
12 015106  016102  000014                       MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
13 015112  016237  000036  002266               MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
14 015120  116237  000006  002272               MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
15 015126  116237  000007  002270               MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
16 015134  016102  000016                       MOV     16(R1),R2       ;R2 TEMP STORAGE
17 015140  032702  000002                       BIT     #BIT1,R2        ;DRIVE BECOME NON-EXIST ?
18 015144  001405                               BEQ     1$              ;BRANCH IF NOT
19 015146  104455                               TRAP    C$ERDF
   015150  000031                               .WORD   25
   015152  006330                               .WORD   EM25
   015154  010600                               .WORD   DH25
20 015156  000440                               BR      5$              ;EXIT
21 015160  032702  000004           1$:         BIT     #BIT2,R2        ;PORT REQUEST TIMEOUT ?
22 015164  001405                               BEQ     2$              ;BRANCH IF NOT
23 015166  104455                               TRAP    C$ERDF
   015170  000032                               .WORD   26
   015172  006366                               .WORD   EM26
   015174  007604                               .WORD   DH44
24 015176  000430                               BR      5$
25 015200  032702  001000           2$:         BIT     #BIT9,R2        ;TIME OUT ON THIS DRIVE
26 015204  001405                               BEQ     3$              ;BANCH IF NOT
27 015206  104455                               TRAP    C$ERDF
   015210  000033                               .WORD   27
   015212  006436                               .WORD   EM27
   015214  007604                               .WORD   DH44
28 015216  000420                               BR      5$              ;EXIT
29 015220  032702  006000           3$:         BIT     #BIT10!BIT11,R2 ;MASSBUS PARITY ERROR ?
30 015224  001405                               BEQ     4$              ;BRANCH IF NOT
31 015226  104455                               TRAP    C$ERDF
   015230  000036                               .WORD   30
   015232  006475                               .WORD   EM30
   015234  010600                               .WORD   DH25
32 015236  000410                               BR      5$
33 015240  032702  050000           4$:         BIT     #BIT12!BIT14,R2 ;DRIVE UNSAFE OR OFFLINE
34 015244  001407                               BEQ     6$              ;BRANCH IF NOT (OTHER ERROR CATLOG)
35 015246  104455                               TRAP    C$ERDF
   015250  000037                               .WORD   31
   015252  006552                               .WORD   EM31
   015254  010600                               .WORD   DH25
36 015256  000400                               BR      5$
37 015260  013705  002252           5$:         MOV     BYPASS,R5       ;THE ABORT ADDRESS
38 015264  012602                   6$:         MOV     (SP)+,R2        ;EXIT IF NO ABORT CONDITION
39 015266  012601                               MOV     (SP)+,R1
40 015270  000205                               RTS     R5              ;EXIT
41
42
```

```
                                ;ABORT RETURN ADDRESS FROM 'ERRABO' SUBR, VIA 'BYPASS',  ON DEV FATAL ERROR

015272                          ABOPAS:
015272  104444                          TRAP    C$DCLN


                                ;THIS ROUTINE WILL PROVIDE A STALL IN MILLISECONDS FOR A SPECIFIC
                                ;AMOUNT OF TIME IF STALRD = 0 OR A RANDOM AMOUNT OF TIME IF STALRD = 1.
                                ;STALL1 CONTAINS SPECIFIED TIME FOR TESTS 1-6, AND STALL2
                                ;CONTAINS THE TIME FOR TESTS 13-18.
                                ;CALL
                                ;       JSR     R4,STALL
                                ;       TIME POINTER            ;WHERE TO FIND THE STALL TIME

015274  013446                  STALL:  MOV     @(R4)+,-(SP)    ;PICKUP STALL TIME
015276  105737  002232                  TSTB    STALRD          ;USE A RANDOM TIME ?
015302  001406                          BEQ     1$              ;NO--BRANCH
015304  004737  011610                  JSR     PC,RAND         ;YES--FORM RANDOM NUMBER
015310  013716  011672                  MOV     $RP1,(SP)       ;AND USE IT FOR THE STALL TIME
015314  042716  177700                  BIC     #^C77,(SP)      ;BUT NEVER > 64 MILLISECONDS
015320  005046                  1$:     CLR     -(SP)           ;CLEAR TEMP. LOCATION
015322  162766  000001  000002  2$:     SUB     #1,2(SP)        ;MORE STALL REQUIRED?
015330  103407                          BLO     4$              ;NO--BRANCH
015332  012716  000144                  MOV     #100.,(SP)      ;STALL FOR ABOUT 1 MILLISECOND
015336  005704                  3$:     TST     R4              ;NOP TO KILL TIME
015340  005366  000000                  DEC     0(SP)           ;COUNT
015344  001374                          BNE     3$              ;LOOP IF MORE COUNTS NEEDED
015346  000765                          BR      2$
015350  022626                  4$:     CMP     (SP)+,(SP)+     ;CLEAN OFF THE STACK
015352  000204                          RTS     R4              ;EXIT
```

```
                                        ;ROUTINE TO SOFTWARE COMPARE HEADER ON IMPLIED SEEKS
                                        ;CALL
                                        ;       JSR     R4,VERIFY
                                        ;       ADR POINTER             ;ADDRESS OF DPB+10 (SECTOR NUMBER)
                                        ;       ERR RETURN
                                        ;       RETURN

 015354  010146                 VERIFY: MOV     R1,-(SP)        ;SAVE R1
 015356  012401                         MOV     (R4)+,R1        ;GET ADDRESS OF DPB+10
 015360  042737  150000  042610         BIC     #150000,DBUFF   ;STRIP FORMAT AND BAD SECTOR BITS FROM CYLINDER NUMBER
 015366  023761  042610  000002         CMP     DBUFF,2(R1)     ;CYLINDER NUMBER OK?
 015374  001003                         BNE     1$              ;NO--BRANCH
 015376  023711  042612                 CMP     DBUFF+2,(R1)    ;YES--HOW ABOUT TRACK/SECTOR?
 015402  001431                         BEQ     3$              ;BRANCH IF GOOD
 015404  013737  042610  002266 1$:     MOV     DBUFF,CYL.RD    ;SAVE THE EXPECTED AND THE
 015412  113737  042613  002270         MOVB    DBUFF+3,TRK.RD  ;RECIEVED CYLINDER, TRACK,
 015420  113737  042612  002272         MOVB    DBUFF+2,SEC.RD  ;AND SECTOR
 015426  112137  002276                 MOVB    (R1)+,SEC.DS
 015432  112137  002300                 MOVB    (R1)+,TRK.DS
 015436  011137  002274                 MOV     (R1),CYL.DS
 015442  005744                         TST     -(R4)           ;MAKE IT TEST PC+4
 015444  104456                         TRAP    C$ERHRD
 015446  000052                         .WORD   42
 015450  007020                         .WORD   EM42
 015452  010340                         .WORD   DH45
 015454  012737  000107  002542 2$:     MOV     #RECAL,DPB.A+2  ;LOAD RECALIBRATE ORDER CODE
 015462  004437  014260                 JSR     R4,CALL.A       ;GO EXECUTE THE COMMAND
 015466  062704  000002         3$:     ADD     #2,R4           ;INCREMENT RETURN ADDRESS
 015472  012601                 4$:     MOV     (SP)+,R1        ;RESTORE R1
 015474  000204                         RTS     R4              ;EXIT
```

```
                                        ;THIS ROUTINE WILL PERFORM A "MASSBUS" INIT. FOLLOWED BY
                                        ;A "RECALIBRATE" ON THE DRIVE UNDER TEST.
                                        ;NOTE: THIS ROUTINE DESTROYS R1 AND R4
                                        ;CALL
                                        ;       JSR     R4,SRCH00       ;DO A MASSBUS INIT. AND RECAL
                                        ;       RETURN1                 ;RETURN HERE IF NO ERROR
                                        ;       RETURN2                 ;RETURN HERE ON ERROR

015476  005001                  SRCH00: CLR     R1              ;INCASE OF ERROR (TYPTIM)
015500  012777  000040  165162          MOV     #CLR,@RPCS2     ;MASSBUS INIT.
015506  005037  002630                  CLR     DTADPB+10       ;TRACK=0; SECTOR=0
015512  005037  002632                  CLR     DTADPB+12       ;CYLINDER =0
015516  012737  000107  002622          MOV     #RECAL,DTADPB+2 ;COMMAND = RECALIBRATE
015524  004437  020750                  JSR     R4,RP07         ;CALL THE DRIVER
015530  002620                          DTADPB                  ;DPB POINTER
015532  000433                          BR      4$              ;BRANCH IF QUEUE FULL,NO SPACE
015534  005737  002636          1$:     TST     DTADPB+16       ;WAIT ON DONE
015540  001775                          BEQ     1$
015542  100021                          BPL     3$              ;TAKE NORMAL EXIT IF NO ERROR
015544  013737  002632  002274          MOV     DTADPB+12,CYL.DS        ;CYLINDER
015552  113737  002631  002300          MOVB    DTADPB+11,TRK.DS        ;TRACK
015560  113737  002630  002276          MOVB    DTADPB+10,SEC.DS        ;SECTOR
015566  004537  015100                  JSR     R5,ERRABO       ;CHECK ANY ABORT CONDITION
015572  002620                          DTADPB
015574  004537  012664                  JSR     R5,ERRANY
015600  002620                          DTADPB
015602  005724                  2$:     TST     (R4)+           ;ADJUST FOR ERROR EXIT
015604  000406                          BR      4$              ;GO TO THE EXIT
015606  012777  000000  165052  3$:     MOV     #0,@RPDA        ;TRACK AND SECTOR =0
015614  012777  000000  165072          MOV     #0,@RPDC        ;CYLINDER = 0
015622  000204                  4$:     RTS     R4              ;RETURN

                                        ;THIS IS AN RTI WHICH IS USED BY THE TIMING TESTS

015624                          DORTI:                          ;RETURN FROM INTERRUPT
015624                          L10011:
015624  000002                          RTI

                                        ;THIS ROUTINE WILL INITIALIZE THE TIMERS USED BY THE TIMING ROUTINE
                                        ;CALL
                                        ;       JSR     PC,STRTMR
                                        ;       RETURN

015626  004737  010646          STRTMR: JSR     PC,SAVREG       ;SAVE R0-R5
015632  012700  002302                  MOV     #TIM.UP,R0      ;START AT TIM.UP (MINIMUM)
015636  012701  002336                  MOV     #TIM.PT,R1      ;STOP AT TIM.PT
015642  005020                  1$:     CLR     (R0)+           ;CLEAR
015644  020001                          CMP     R0,R1           ;DONE?
015646  103775                          BLO     1$              ;NO--BRANCH
015650  012710  042610                  MOV     #DBUFF,(R0)     ;SETUP POINTER
015654  012737  077777  002302          MOV     #^CBIT15,TIM.UP ;SET MINIMUM TIME TO MAXIMUM
015662  012737  077777  002320          MOV     #^CBIT15,TIM.DN ;POSITIVE NUMBER
015670  004737  010700                  JSR     PC,RESPEG       ;RESTORE R0-R5
015674  000207                          RTS     PC              ;RETURN

                                        ;THIS ROUTINE IS USED FOR MEASURE THE AVERAGE SEEK TIME
```

```
                                        ;IN THE TEST 10
                                        ;THE TIME IS MEASURED AS:
                                        ;
                                        ;                (T1X629+T2X628+T3X627+T4X626.....)X2
                                        ;           T   =-----------------------------------
                                        ;                        629X629
                                        ;
                                        ; WHERE THE T1 IS THE SEEK TIME FROM CYL0 TO CYL1
                                        ;       THE T2 IS THE SEEK TIME FROM CYL0 TO CYL2 ,ETC.
                                        ;THE COUNT2: ROUTINE WILL CALCULATE THE FOLLOWING SUMMATION.
                                        ;
                                        ;                (T1X629+T2X628+T3X627+.....) X 2
                                        ;           T   =--------------------------------
                                        ;                        629
                                        ;
015676  012702  002302          COUNT2: MOV     #TIM.UP,R2      ;COUNT UP TABLE
015702  005705                          TST     R5              ;COUNT UP CALCULATING ?
015704  001402                          BEQ     1$              ;BRANCH IF SO
015706  012702  002320                  MOV     #TIM.DN,R2      ;LOAD THE COUNT DOWN TABLE
015712  010146                  1$:     MOV     R1,-(SP)        ;COEFFICIENT 629,628,627..... ETC.
015714  017746  174204                  MOV     @PKC,-(SP)      ;MEASURED TIME INTERVAL
015720  004737  011316                  JSR     PC,$MULT        ;TIME INTERVAL X COEFFICIENT
015724  016666  000002  177776          MOV     2(SP),-2(SP)    ;SWAP THE LSB , MSB OF THE PRODUCTION
015732  011666  000002                  MOV     (SP),2(SP)      ;
015736  016616  177776                  MOV     -2(SP),(SP)     ; FOR THE CALLING SEQ OF $DIV ROUTINE
015742  013746  002206                  MOV     LC,-(SP)        ;DIVIDED BY 629 (TOTOL # OF SEEKS)
015746  006216                          ASR     (SP)            ; DIVIDED BY 629/2
015750  005216                          INC     (SP)            ;ROUND UP THE FRACTION
015752  004737  011074                  JSR     PC,$DIV         ;TIME X COEFFICIENT/TOTAL # OF SEEKS
015756  006126                          ROL     (SP)+           ;REMAINDER OVER 0.5 ?
015760  100001                          BPL     2$              ;BRANCH IF NOT
015762  005216                          INC     (SP)            ;ROUND UP
015764  062662  000010          2$:     ADD     (SP)+,10(R2)    ;LSB OF THE TOTAL SUM
015770  005562  000012                  ADC     12(R2)          ;HSB OF THE TOTAL SUM
015774  005262  000014                  INC     14(R2)          ;TOTAL SEEK COUNT
016000  017777  174120  164330          MOV     @PKC,@TIM.PT    ;SAVE THE TIME INTERVAL
016006  062737  000002  002336          ADD     #2,TIM.PT               ;ADJUST THE POINTER
016014  027712  174104                  CMP     @PKC,(R2)               ;MINIMUM TIME
016020  002002                          BGE     3$              ;BRANCH IF NOT
016022  017712  174076                  MOV     @PKC,(R2)       ;LOAD THE NEW MINIMUM
016026  027763  174072  000004  3$:     CMP     @PKC,4(R3)      ;LOWER THEN THE LIMIT ?
016034  002002                          BGE     4$              ;BRANCH IF NOT
016036  005262  000002                  INC     2(R2)           ;UPDATE THE COUNTER IS SO
016042  027762  174056  000004  4$:     CMP     @PKC,4(R2)      ;GREATER THAN THE MAXIMUM VALUE ?
016050  003403                          BLE     5$              ;BRANCH IF NOT
016052  017762  174046  000004          MOV     @PKC,4(R2)      ;LOAD THE NEW MAXIMUM VALUE
016060  027763  174040  000006  5$:     CMP     @PKC,6(R3)      ;OVER THE LIMIT
016066  003402                          BLE     6$              ;BRANCH IF NOT
016070  005262  000006                  INC     6(R2)           ;UPDATE THE COUNT, IF SO
016074  000207                  6$:     RTS     PC              ;EXIT
                                        ;
                                        ;THIS ROUTINE WILL ADD THE ELAPSED TIME TO THE AVERAGE COUNTER AND
                                        ;MAINTAIN THE MINIMUM AND MAXIMUM TIMES.
                                        ;NOTE: THIS ROUTINE DESTROYS R2
                                        ;CALL
                                        ;       MOV     #TP,R3          ;PARAMETER POINTER
                                        ;       MOV     FLAG,R5         ;FLAG=0=COUNT UP
```

```
                                        ;                               ;FLAG=-1=COUNT DOWN
                                        ;       JSR     PC,COUNT
                                        ;       RETURN
                                        COUNT:  MOV     #TIM.UP,R2      ;PICKUP THE "UP" POINTER
016076  012702  002302                  TST     R5                      ;USE IT?
016102  005705                          BEQ     1$                      ;YES--BRANCH
016104  001402                          MOV     #TIM.DN,R2              ;NO--PICKUP "DOWN" POINTER
016106  012702  002320                  CMP     @PKC,(R2)+              ;LESS THAN PREVIOUS LOW?
016112  027722  174006          1$:     BGE     2$                      ;NO--BRANCH
016116  002003                          MOV     @PKC,-2(R2)             ;YES--SAVE IT
016120  017762  174000  177776          CMP     @PKC,4(R3)              ;LESS THAN THE LOW LIMIT?
016126  027763  173772  000004  2$:     BGE     3$                      ;NO--BRANCH
016134  002001                          INC     (R2)                    ;YES--COUNT IT
016136  005212                          TST     (R2)+                   ;ADVANCE THE POINTER
016140  005722                  3$:     CMP     @PKC,(R2)+              ;GREATER THAN PREVIOUS HIGH?
016142  027722  173756                  BLE     4$                      ;NO--BRANCH
016146  003403                          MOV     @PKC,-2(R2)             ;YES--SAVE IT
016150  017762  1737.0  177776          CMP     @PKC,6(R3)              ;GREATER THAN THE HIGH LIMIT?
016156  027763  17374.  000006  4$:     BLE     5$                      ;NO--BRANCH
016164  003401                          INC     (R2)                    ;YES--COUNT IT
016166  005212                          TST     (R2)+                   ;ADVANCE THE POINTER
016170  005722                  5$:     ADD     @PKC,(R2)+              ;ADD THIS COUNT TO THE TOTAL
016172  067722  173726                  ADC     (R2)+
016176  005522                          INC     (R2)                    ;COUNT THIS READING
016200  005212                          CMP     L$TEST,#18.             ;DO NOT SAVE COUNTS IN MEMO IN 8 TO ALLOW
016202  023727  002114  000022                                          ;A WRITE-CHECK OPERATION AFTER THE TIMED WRITE
                                                                        ;OTHERWISE WRITE DATA WILL BE DESTOYED AND A
                                                                        ;WRITE CHECK ERROR WCE WILL RESULT IN RPCS2!
016210  001412                          BEQ     6$
016212  022737  C.7534  002336          CMP     #DBUFF+<4*629.>,TIM.PT ;SAVE THIS COUNT?
                                                                        ;LAST CYLINDER X 4
016220  101406                          BLOS    6$                      ;NO--BRANCH
016222  017777  173676  164106          MOV     @PKC,@TIM.PT            ;YES--WELL SAVE IT THEN
016230  062737  000002  002336          ADD     #2,TIM.PT               ;ADVANCE THE POINTER
016236  000207                  6$:     RTS     PC                      ;RETURN


                                        ;THIS ROUTINE PRINTS THE SPEC OF ALL TIMING TESTS
                                        ;CALL
                                        ;       JSR     R4,SPTYP
                                        ;       TABLE ADDRESS
                                        ;
                                        ;TABLE: .WORD   MESSAGE
                                        ;       .WORD   MIN VALUE
                                        ;       .WORD   MAX VALUE


                                        SPTYP:  MOV     (R4)+,R2        ;THE TABLE ADDRESS
016240  012402                          TSTB    TIMTYP                  ;ALLOW PRINT
016242  105737  002227                  BEQ     3$                      ;EXIT IF NOT
016246  001447                                                          ;PRINT MESSAGE
                                        MOV     (R2)+,-(SP)
016250  012246                          MOV     #1,-(SP)
016252  012746  000001                  MOV     SP,R0
016256  010600                          TRAP    C$PNTF
016260  104417                          ADD     #4,SP
016262  062706  000004
```

GLOBAL SUBROUTINES SECTION

```
166 016266  005722                          TST     (R2)+           ;LOAD MIN VALUE
167 016270  001412                          BEQ     1$              ;SKIP IF MIN VALUE IS 0
168 016272  016246  177776                  MOV     -2(R2),-(SP)
    016276  012746  017110                  MOV     #MSGMIN,-(SP)
    016302  012746  000002                  MOV     #2,-(SP)
    016306  010600                          MOV     SP,R0
    016310  104417                          TRAP    C$PNTF
    016312  062706  000006                  ADD     #6,SP
169 016316  005722                  1$:     TST     (R2)+           ;THE MAXIMUM VALUE
170 016320  001412                          BEQ     2$              ;BRANCH IF NO LIMIT
171 016322  016246  177776                  MOV     -2(R2),-(SP)
    016326  012746  017133                  MOV     #MSGMAX,-(SP)
    016332  012746  000002                  MOV     #2,-(SP)
    016336  010600                          MOV     SP,R0
    016340  104417                          TRAP    C$PNTF
    016342  062706  000006                  ADD     #6,SP
172 016346                          2$:                             ;CR-LF
173 016346  012746  003054                  MOV     #CRLF,-(SP)
    016352  012746  000001                  MOV     #1,-(SP)
    016356  010600                          MOV     SP,R0
    016360  104417                          TRAP    C$PNTF
    016362  062706  000004                  ADD     #4,SP
174 016366  000204                  3$:     RTS     R4
```

GLOBAL SUBROUTINES SECTION

```
 1
 2                                  ;;THIS ROUTINE IS USED TO TYPE THE MINIMUM,
 3                                  ;MAXIMUM, AND AVERAGE TIMES FOR THE TIMING TESTS
 4                                  ;IT WILL ALSO CHECK THE TIMES TO ENSURE
 5                                  ;THEY ARE WITHIN TOLERANCE AND IF NOT FLAG THE BAD TIMES.
 6                                  ;NOTE: THIS ROUTINE DESTROYS R2-R5
 7                                  ;CALL
 8                                  ;       JSR     R4,TYPTIM       ;GO REPORT THE TIMES
 9                                  ;       TABLE                   ;POINT TO THE PROPER TABLE
10                                  ;       RETURN
11                                  ;
12                                  ;TABLE: MSGADR1                 ;ADDRESS OF ASCIZ MESSAGE NUMBER 1
13                                  ;       MSGADR2                 ;ADDRESS OF ASCIZ MESSAGE NUMBER 2
14                                  ;       MIN. ALLOWED            ;MINIMUM TIME ALLOWED
15                                  ;       MAX. ALLOWED            ;MAXIMUM TIME ALLOWED
16
17 016370  012402                   TYPTIM: MOV     (R4)+,R2        ;PICKUP THE TABLE POINTER
18 016372  105737  002227                   TSTB    TIMTYP          ;INHIBIT TIME REPORTS?
19 016376  001001                           BNE     1$              ;NO, PROCEED
20 016400  000204                           RTS     R4              ;EXIT
21
22 016402  010446                   1$:     MOV     R4,-(SP)        ;SAVE RET ADR
23 016404  012237  017104                   MOV     (R2)+,11$       ;ADDRESS OF MESSAGE NUMBER 1
24 016410  012205                           MOV     (R2)+,R5        ;ADDRESS OF MESSAGE NUMBER 2
25 016412  012203                           MOV     (R2)+,R3        ;PICKUP THE LOW LIMIT
26 016414  011202                           MOV     (R2),R2         ;AND THE HIGH LIMIT
27 016416  012704  002302                   MOV     #TIM.UP,R4      ;PARAMETER POINTER
28 016422  004737  017462                   JSR     PC,CHKTIM       ;SEE IF ALL THE DATA IS TO BE TYPED
29 016426                           2$:
   016426  013746  017104                   MOV     11$,-(SP)
   016432  012746  000001                   MOV     #1,-(SP)
   016436  010600                           MOV     SP,R0
   016440  104417                           TRAP    C$PNTF
   016442  062706  000004                   ADD     #4,SP
30 016446  005764  000014                   TST     14(R4)          ;DID ANY COUNTS OCCUR?
31 016452  001012                           BNE     3$              ;BR IF YES
32 016454  012746  017443                   MOV     #MSGNON,-(SP)
   016460  012746  000001                   MOV     #1,-(SP)
   016464  010600                           MOV     SP,R0
   016466  104417                           TRAP    C$PNTF
   016470  062706  000004                   ADD     #4,SP
33 016474  000137  017100                   JMP     10$
34 016500                           3$:
   016500  012446                           MOV     (R4)+,-(SP)
   016502  012746  017110                   MOV     #MSGMIN,-(SP)
   016506  012746  000002                   MOV     #2,-(SP)
   016512  010600                           MOV     SP,R0
   016514  104417                           TRAP    C$PNTF
   016516  062706  000006                   ADD     #6,SP
35 016522  005724                           TST     (R4)+           ;ANY SEEKS BELOW THE LOW LIMIT
36 016524  001416                           BEQ     4$              ;NO--BRANCH
37 016526  005737  017542                   TST     $$FLG           ;TYPE # OF SEEKS BELOW LIMIT?
38 016532  001413                           BEQ     4$              ;NO, SKIP IT
39 016534  010346                           MOV     R3,-(SP)
   016536  016446  177776                   MOV     -2(R4),-(SP)
   016542  012746  017202                   MOV     #MSGBEL,-(SP)
   016546  012746  000003                   MOV     #3,-(SP)
```

```
                016552  010600                          MOV     SP,R0
                016554  104417                          TRAP    C$PNTF
                016556  062706  000010                  ADD     #10,SP
             40 016562                          4$:
                016562  012446                          MOV     (R4)+,-(SP)
                016564  012746  017133                  MOV     #MSGMAX,-(SP)
                016570  012746  000002                  MOV     #2,-(SP)
                016574  010600                          MOV     SP,R0
                016576  104417                          TRAP    C$PNTF
                016600  062706  000006                  ADD     #6,SP
             41 016604  005724                          TST     (R4)+           ;ANY SEEKS ABOVE THE HIGH LIMIT
             42 016606  001416                          BEQ     5$              ;NO--BRANCH
             43 016610  005737  017542                  TST     $$FLG           ;TYPE # OF SEEKS BELOW LIMIT?
             44 016614  001413                          BEQ     5$              ;NO, SKIP IT
             45 016616  010246                          MOV     R2,-(SP)
                016620  016446  177776                  MOV     -2(R4),-(SP)
                016624  012746  017257                  MOV     #MSGABV,-(SP)
                016630  012746  000003                  MOV     #3,-(SP)
                016634  010600                          MOV     SP,R0
                016636  104417                          TRAP    C$PNTF
                016640  062706  000010                  ADD     #10,SP
             46 016644                          5$:
                016644  012746  017156                  MOV     #MSGAVG,-(SP)
                016650  012746  000001                  MOV     #1,-(SP)
                016654  010600                          MOV     SP,R0
                016656  104417                          TRAP    C$PNTF
                016660  062706  000004                  ADD     #4,SP
             47 016664  012446                          MOV     (R4)+,-(SP)     ;FORM THE AVERAGE
             48 016666  012446                          MOV     (R4)+,-(SP)
             49 016670  012446                          MOV     (R4)+,-(SP)
             50 016672  004737  011074                  JSR     PC,$DIV
             51 016676  006126                          ROL     (SP)+           ;IS THE REMAINDER OVER HALF?
             52 016700  100001                          BPL     6$              ;NO--BRANCH
             53 016702  005216                          INC     (SP)            ;YES--ROUND UP
             54 016704  012637  017106          6$:     MOV     (SP)+,AVERAG    ;POP AVERAGE VALUE FOR PRINT
             55 016710  013746  017106                  MOV     AVERAG,-(SP)
                016714  012746  017167                  MOV     #AVGVAL,-(SP)
                016720  012746  000002                  MOV     #2,-(SP)
                016724  010600                          MOV     SP,R0
                016726  104417                          TRAP    C$PNTF
                016730  062706  000006                  ADD     #6,SP
             56 016734  022737  000007  002114          CMP     #7,L$TEST       ;TEST 7 ?
             57 016742  001423                          BEQ     7$              ;BRANCH IF SO
             58 016744  022737  000016  002114          CMP     #14.,L$TEST     ;TEST 14 ?
             59 016752  001432                          BEQ     8$              ;BRANCH IF SO
             60 016754  022737  000022  002114          CMP     #18.,L$TEST     ;TEST 18 ?
             61 016762  001426                          BEQ     8$              ;BRANCH IF SO
             62 016764  016446  177776                  MOV     -2(R4),-(SP)
                016770  012746  017334                  MOV     #MSGNUM,-(SP)
                016774  012746  000002                  MOV     #2,-(SP)
                017000  010600                          MOV     SP,R0
                017002  104417                          TRAP    C$PNTF
                017004  062706  000006                  ADD     #6,SP
             63 017010  000425                          BR      9$              ;SKIP
             64 017012                          7$:
                017012  016446  177776                  MOV     -2(R4),-(SP)
                017016  012746  017361                  MOV     #MSGSEA,-(SP)
```

```
                017022  012746  000002                  MOV     #2,-(SP)
                017026  010600                          MOV     SP,R0
                017030  104417                          TRAP    C$PNTF
                017032  062706  000006                  ADD     #6,SP
     65         017036  000412                          BR      9$                      ;SKIP
     66         017040                          8$:
                017040  016446  177776                  MOV     -2(R4),-(SP)
                017044  012746  017411                  MOV     #MSGOPE,-(SP)
                017050  012746  000002                  MOV     #2,-(SP)
                017054  010600                          MOV     SP,R0
                017056  104417                          TRAP    C$PNTF
                017060  062706  000006                  ADD     #6,SP
     67         017064  010537  017104          9$:     MOV     R5,11$                  ;NEXT MESSAGE POINTER
     68         017070  001403                          BEQ     10$                     ;IF NONE EXIT
     69         017072  005005                          CLR     R5                      ;NO MORE THAN 2
     70         017074  000137  016426                  JMP     2$
     71         017100  012604                  10$:    MOV     (SP)+,R4                ;FETCH RET ADR
     72         017102  000204                          RTS     R4                      ;EXIT
     73
     74         017104  000000                  11$:    .WORD   0                       ;ADRRESS OF MSG 1
     75         017106  000000                  AVERAG: .WORD   0                       ;AVERAGE VALUE
     76
     80         017110      045     116     045  MSGMIN: .ASCIZ  /%N%AMIN=%D5%A0. US/
     81         017133      045     116     045  MSGMAX: .ASCIZ  /%N%AMAX=%D5%A0. US/
     82         017156      045     116     045  MSGAVG: .ASCIZ  /%N%AAVG=/
     83         017167      045     104     065  AVGVAL: .ASCIZ  /%D5%A0. US/
     84         017202      045     101     040  MSGBEL: .ASCIZ  /%A  %D4%A. BELOW THE MINIMUM OF %D5%A0. US%N/
     85         017257      045     101     040  MSGABV: .ASCIZ  /%A  %D4%A. ABOVE THE MAXIMUM OF %D5%A0. US%N/
     86         017334      045     104     065  MSGNUM: .ASCIZ  /%D5%A. SEEKS TIMED%N/
     87         017361      045     104     065  MSGSEA: .ASCIZ  /%D5%A. SEARCHES TIMED%N/
     88         017411      045     104     065  MSGOPE:: .ASCIZ /%D5%A. OPERATIONS TIMED%N/
     89         017443      045     101     040  MSGNON: .ASCIZ  /%A NOT TIMED%N/
     90
     91                                           .EVEN
     95
     96                                   ;SUBR TO CHECK IF COMPLETE SPECS ON SEEKS SHOULD BE TYPED
     97                                   ;IF THE AVERAGE SEEK TIME IS ABOVE SPEC, THEN TYPE ABOVE AND BELOW VALUES
     98                                   ;ELSE, DO NOT TYPE THEM
     99                                   ;$$FLG IS SET TO INDICATE TYPE THEM
    100
    101 017462  005037  017542           CHKTIM: CLR     $$FLG                   ;INIT FLAG
    102 017466  122737  000011  002114           CMPB    #9.,L$TEST              ;TEST 9, AVERAGE SEEK TIMING ?
    103 017474  001017                          BNE     2$                      ;EXIT IF NOT
    104 017476  016446  000010                  MOV     10(R4),-(SP)            ;PUSH LOW DIVIDEND OF TOTAL TIME OF ALL SEEKS
    105 017502  016446  000012                  MOV     12(R4),-(SP)            ;PUSH HIGH DIVIDEND
    106 017506  016446  000014                  MOV     14(R4),-(SP)            ;PUSH DIVISOR = NUMBER OF SEEKS TIMED
    107 017512  004737  011074                  JSR     PC,$DIV                 ;CALCULATE AVERAGE
    108 017516  006116                          ROL     (SP)                    ;REM/2
    109 017520  022664  000014                  CMP     (SP)+,14(R4)            ;IS REM OVER HALF?
    110 017524  002401                          BLT     1$                      ;NO, SKIP NEXT
    111 017526  005216                          INC     (SP)                    ;YES, ROUND UP AVG TIME
    112 017530  022602                  1$:     CMP     (SP)+,R2                ;OUT OF SPEC?
    113 017532  003402                          BLE     3$                      ;EXIT IF NOT
    114 017534  005237  017542          2$:     INC     $$FLG                   ;SET FLAG TO REPORT ALL DATA
    115 017540  000207                  3$:     RTS     PC
    116
    117 017542  000000                  $$FLG:  .WORD   0                       ;TYPE ALL SPECS FLAG
```

GLOBAL SUBROUTINES SECTION

```
                                ;THIS ROUTINE GENERATES RANDOM CYLINDER, TRACK, AND SECTOR
                                ;ADDRESSES AND SAVES THEN IN THE DPB (DTADPB+10, 11 & DTADPB+12).
                                ;NOTE: THIS ROUTINE DESTROYS R1-R3
                                ;CALL
                                ;       JSR     R4,RANADR
                                ;       RETURN

017544  004737  011610          RANADR: JSR     PC,RAND         ;GENERATE A RANDOM NUMBER
017550  113701  011672                  MOVB    $RP1,R1         ;FORM SECTOR IN R1
017554  042701  177700                  BIC     #177700,R1      ;REDUCE SIZE TO <= 63

                                        ;BINARY SEARCH FOR FS<=R1<=LS

017560  020137  002222          1$:     CMP     R1,LS           ;WHILE R1>LS DO R1=FS+(R1-FS)/2
017564  003407                          BLE     2$
017566  163701  002220                  SUB     FS,R1
017572  000241                          CLC
017574  006001                          ROR     R1
017576  063701  002220                  ADD     FS,R1
017602  000766                          BR      1$

017604  020137  002220          2$:     CMP     R1,FS           ;WHILE R1<FS DO R1=LS-(LS-R1)/2
017610  002011                          BGE     3$
017612  013702  002222                  MOV     LS,R2
017616  010203                          MOV     R2,R3
017620  160102                          SUB     R1,R2
017622  000241                          CLC
017624  006002                          ROR     R2
017626  160203                          SUB     R2,R3
017630  010301                          MOV     R3,R1
017632  000764                          BR      2$

017634  110137  002630          3$:     MOVB    R1,DTADPB+10    ;SET RANDOM SECTOR IN DPB
017640  113701  011673                  MOVB    $RP1+1,R1       ;FORM TRACK IN R1
017644  042701  177740                  BIC     #177740,R1      ;REDUCE SIZE TO <= 31

                                        ;BINARY SEARCH FOR FT<=R1<=LT

017650  020137  002214          4$:     CMP     R1,LT           ;WHILE R1>LT DO R1=FT+(R1-FT)/2
017654  003407                          BLE     5$
017656  163701  002212                  SUB     FT,R1
017662  000241                          CLC
017664  006001                          ROR     R1
017666  063701  002212                  ADD     FT,R1
017672  000766                          BR      4$
017674  020137  002212          5$:     CMP     R1,FT           ;WHILE R1<FT DO R1=LT-(LT-R1)/2
017700  002011                          BGE     6$
017702  013702  002214                  MOV     LT,R2
017706  010203                          MOV     R2,R3
017710  160102                          SUB     R1,R2
017712  000241                          CLC
017714  006002                          ROR     R2
017716  160203                          SUB     R2,R3
017720  010301                          MOV     R3,R1
017722  000764                          BR      5$

017724  110137  002631          6$:     MOVB    R1,DTADPB+11    ;SET RANDOM TRACK IN DPB
```

```
 58 017730  004737  011610                JSR     PC,RAND         ;GENERATE RANDOM NUMBERS
 59 017734  013701  011672                MOV     $RP1,R1         ;PICK ONE FOR CYLINDER
 60 017740  042701  176000                BIC     #176000,R1      ;REDUCE SIZE TO <=1777
 61
 62                                       ;BINARY SEARCH FOR FC<=R1<=LC
 63
 64 017744  020137  002206      7$:       CMP     R1,LC           ;WHILE R1>LC DO R1=FC+(R1-FC)/2
 65 017750  003407                        BLE     8$
 66 017752  163701  002204                SUB     FC,R1
 67 017756  000241                        CLC
 68 017760  006001                        ROR     R1
 69 017762  063701  002204                ADD     FC,R1
 70 017766  000766                        BR      7$
 71
 72 017770  020137  002204      8$:       CMP     R1,FC           ;WHILE R1<FC DO R1=LC-(LC-R1)/2
 73 017774  003011                        BGE     9$
 74 017776  013702  002206                MOV     LC,R2
 75 020002  010203                        MOV     R2,R3
 76 020004  160102                        SUB     R1,R2
 77 020006  000241                        CLC
 78 020010  006002                        ROR     R2
 79 020012  160203                        SUB     R2,R3
 80 020014  010301                        MOV     R3,R1
 81 020016  000764                        BR      8$
 82
 83 020020  010137  002632      9$:       MOV     R1,DTADPB+12    ;SAVE CYLINDER ADDRESS
 84 020024  000204                        RTS     R4              ;RETURN
```

```
                                .SBTTL  RP07 DRIVER
                                ;STORAGE FOR RPDS, RPER1, RPER2, AND RPER3
020026  000000  000000  000000  RPSTU0: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 0
020036  000000  000000  000000  RPSTU1: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 1
020046  000000  000000  000000  RPSTU2: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 2
020056  000000  000000  000000  RPSTU3: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 3
020066  000000  000000  000000  RPSTU4: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 4
020076  000000  000000  000000  RPSTU5: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 5
020106  000000  000000  000000  RPSTU6: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 6
020116  000000  000000  000000  RPSTU7: .WORD   0,0,0,0          ;DS, ER1, ER2 & ER3 STORAGE FOR DRIVE 7

                                ;TABLE OF DRIVE ACTIVE INDICATORS (DRVACT=8 BYTES)
                                        ;DRVACT=0 IF DRIVE IS IDLE
                                        ;DRVACT>0 IF DRIVE IS ACTIVE WITH A COMMAND
                                        ;DRVACT<0 IF DRIVE IS ACTIVE WITH AN ERROR RECOVERY OPERATION

020126      000                 DRVACT: .BYTE   0               ;DRIVE 0
020127      000                         .BYTE   0               ;DRIVE 1
020130      000                         .BYTE   0               ;DRIVE 2
020131      000                         .BYTE   0               ;DRIVE 3
020132      000                         .BYTE   0               ;DRIVE 4
020133      000                         .BYTE   0               ;DRIVE 5
020134      000                         .BYTE   0               ;DRIVE 6
020135      000                         .BYTE   0               ;DRIVE 7

                                ;TABLE OF DRIVE STATUS INDICATORS (DRVSTA=8 BYTES)
                                        ;DRVSTA=0 IF DRIVE IS OFFLINE OR NONEXSITENT
                                        ;DRVSTA>0 IF DRIVE IS ONLINE
                                        ;DRVSTA<0 IF DRIVE IS UNSAFE

020136      000                 DRVSTA: .BYTE   0               ;DRIVE 0
020137      000                         .BYTE   0               ;DRIVE 1
020140      000                         .BYTE   0               ;DRIVE 2
020141      000                         .BYTE   0               ;DRIVE 3
020142      000                         .BYTE   0               ;DRIVE 4
020143      000                         .BYTE   0               ;DRIVE 5
020144      000                         .BYTE   0               ;DRIVE 6
020145      000                         .BYTE   0               ;DRIVE 7

                                ;TABLE OF DRIVE TYPES (DRVTYP=8 BYTES)
                                        ;DRVTYP=0 IF DRIVE IS NONEXISTENT (DRVSTA=0, ALSO)
                                        ;DRVTYP=5 IF DRIVE IS RP07  MOVING HEAD OPTION
                                        ;DRVTYP=4 IF DRIVE IS RP07 FIX HEAD OPTION
                                        ;DRVTYP=-1 IF NOT RP07

020146      000                 DRVTYP: .BYTE   0               ;DRIVE 0
020147      000                         .BYTE   0               ;DRIVE 1
020150      000                         .BYTE   0               ;DRIVE 2
020151      000                         .BYTE   0               ;DRIVE 3
020152      000                         .BYTE   0               ;DRIVE 4
020153      000                         .BYTE   0               ;DRIVE 5
020154      000                         .BYTE   0               ;DRIVE 6
020155      000                         .BYTE   0               ;DRIVE 7

                                ;TABLE OF DUAL PORT INITIALIZATION INDICATORS
```

```
                                        ;DPINT=0 IF INITIALIZATION IS NOT ACTIVE ON THE DRIVE
                                        ;DPINT<0 IF INITIALIZATION IS IN PROGRESS

020156  000                     DPINT:  .BYTE   0               ;DRIVE 0
020157  000                             .BYTE   0               ;DRIVE 1
020160  000                             .BYTE   0               ;DRIVE 2
020161  000                             .BYTE   0               ;DRIVE 3
020162  000                             .BYTE   0               ;DRIVE 4
020163  000                             .BYTE   0               ;DRIVE 5
020164  000                             .BYTE   0               ;DRIVE 6
020165  000                             .BYTE   0               ;DRIVE 7

                                ;TABLE OF PENDING DUAL PORT REQUESTS
                                        ;DPRQS=0 IF THAT A DUAL PORT REQUEST IS NOT PENDING FOR THAT DRIVE
                                        ;DPRQS<0 IF THAT A DUAL PORT REQUEST IS PENDING FOR THAT DRIVE

020166  000                     DPRQS:  .BYTE   0               ;DRIVE 0
020167  000                             .BYTE   0               ;DRIVE 1
020170  000                             .BYTE   0               ;DRIVE 2
020171  000                             .BYTE   0               ;DRIVE 3
020172  000                             .BYTE   0               ;DRIVE 4
020173  000                             .BYTE   0               ;DRIVE 5
020174  000                             .BYTE   0               ;DRIVE 6
020175  000                             .BYTE   0               ;DRIVE 7

                                ;TRANSFER WAIT FLAG (TRNSWT=1 WORD)
                                        ;THIS IS A ONE WORD QUEUE. IT WILL CONTAIN THE ADDRESS OF
                                        ;"DPB" OF THE I/O OPERATION.

020176  000000                  TRNSWT: .WORD   0

                                ;SEARCH WAIT KEYS (SRCHWT=1 WORD)
                                        ;THIS IS A ONE WORD QUEUE THAT WILL CONTAIN A KEY FOR EACH OF
                                        ;THE DRIVES THAT ARE PERFORMING A SEARCH COMMAND FOR THE I/O
                                        ;REQUEST THAT IS AT THE TOP OF THEIR REQUEST QUEUE.
                                        ;EACH DRIVE IS ASSIGNED ONE BIT, STARTING AT BIT00 FOR DRIVE 0.

020200  000000                  SRCHWT: .WORD   0

                                ;RP07 DRIVER ACTIVE FLAG (ACTDRV=1 BYTE)
                                        ;ACTDRV=0 IF DRIVER IS INACTIVE
                                        ;ACTDRV>0 IF DRIVER IS ACTIVE

020202  000                     ACTDRV: .BYTE   0

                                ;SOFTWARE TIMER ROUTINE ACTIVE FLAG (ACTSTR=1 BYTE)
                                        ;ACTSTR=0 IF SOFTWARE TIMER ROUTINE IS INACTIVE
                                        ;ACTSTR>0 IF SOFTWARE TIMER ROUTINE IS ACTIVE

020203  000                     ACTSTR: .BYTE   0


                                ;TIMEOUT TABLE (TIMER=8 WORDS)
                                        ;THIS TABLE CONTAINS THE TIME ALLOWED FOR AN OPERATION

020204  177777                  TIMER:  .WORD   -1       ;DRIVE 0
020206  177777                          .WORD   -1       ;DRIVE 1
```

```
    118 020210  177777                        .WORD   -1      ;DRIVE 2
    119 020212  177777                        .WORD   -1      ;DRIVE 3
    120 020214  177777                        .WORD   -1      ;DRIVE 4
    121 020216  177777                        .WORD   -1      ;DRIVE 5
    122 020220  177777                        .WORD   -1      ;DRIVE 6
    123 020222  177777                        .WORD   -1      ;DRIVE 7
    124
    125                             ;DATA TRANSFER UNDERWAY INDICATOR (DTUW=1 WORD)
    126                                     ;DTUW<0 IF NO DATA TRANSFER UNDERWAY
    127                                     ;DTUW=+N (WHERE N=0 TO 7) IMPLIES DATA TRANSFER UNDERWAY ON DRIVE N
    128
    129 020224  177777                  DTUW:   .WORD   -1
```

```
                                ;RHXX/RP07 DRIVER INITIALIZATION CODE
                                        ;THIS ROUTINE WILL DETERMINE WHICH RP07 DRIVES ARE
                                        ;AVAILABLE FOR TESTING AND SET THE DRVSTA INDICATOR
                                        ;TO THE PROPER STATE FOR EACH DRIVE.
                                        ;NOTE: THIS ROUTINE CALLS DRVINT
                                ;
                                ;CALL
                                ;
                                ;       JSR     PC,RPINIT
                                ;       RETURN
                                ;
                                ;NOTE: THE 'P' OR 'L' CLOCK MUST BE STARTED
                                ;
020226  004737  010646          RPINIT: JSR     PC,SAVREG       ;SAVE R0 - R5
020232  004737  011676                  JSR     PC,ST.CLK       ;TURN ON THE CLOCK
                                                                ;SAVE THE PRESENT PROCESSOR STATUS
020236  104440                          TRAP    C$GPRI
020240  010046                          MOV     R0,-(SP)
                                                                ;CHANGE THE PRIORITY TO 5
020242  012700  000240                  MOV     #PRI05,R0
020246  104441                          TRAP    C$SPRI
020250  004737  025176                  JSR     PC,CLRQUE       ;CLEAR ALL REQUEST QUEUES
020254  012701  020026                  MOV     #RPSTU0,R1      ;FIRST ADDRESS TO BE CLEARED
020260  012702  020204                  MOV     #TIMER,R2       ;LAST ADDRESS TO BE CLEARED
020264  005021                  1$:     CLR     (R1)+           ;CLEAR
020266  020102                          CMP     R1,R2           ;ARE WE DONE?
020270  103775                          BLO     1$              ;BRANCH IF NO
020272  012702  020224                  MOV     #DTUW,R2        ;LAST ADDRESS
020276  012721  177777          2$:     MOV     #-1,(R1)+       ;INITIALIZE
020302  020102                          CMP     R1,R2           ;DONE?
020304  101774                          BLOS    2$              ;LOOP IF NO
020306  005037  020136                  CLR     DRVSTA          ;SET ALL DRIVES TO OFFLINE
020312  005037  020140                  CLR     DRVSTA+2
020316  005037  020142                  CLR     DRVSTA+4
020322  005037  020144                  CLR     DRVSTA+6
                                                                ;SETUP RHXX/RP07 VECTOR
020326  013746  002646                  MOV     RPVEC+2,-(SP)
020332  012746  022674                  MOV     #ISRV,-(SP)
020336  013746  002644                  MOV     RPVEC,-(SP)
020342  012746  000003                  MOV     #3,-(SP)
020346  104437                          TRAP    C$SVEC
020350  062706  000010                  ADD     #10,SP
020354  012777  000040  162306          MOV     #CLR,@RPCS2     ;MASSBUS INIT
020362  013701  002654                  MOV     DRVNO,R1        ;GET SELECTED DRIVE
020366  004437  020414          3$:     JSR     R4,DRVINT       ;INIT THE DRIVE
020372  000401                          BR      4$              ;'DVA' NOT SET OR PARITY ERROR
020374  000402                          BR      5$              ;NORMAL RETURN

020376  105061  020136          4$:     CLRB    DRVSTA(R1)      ;SET DRIVE STATUS TO OFFLINE
020402                          5$:                             ;RESTORE THE PROCESSOR STATUS
020402  012600                          MOV     (SP)+,R0
020404  104441                          TRAP    C$SPRI
020406  004737  010700                  JSR     PC,RESREG       ;RESTORE R0 - R5
020412  000207                          RTS     PC              ;BYE-BYE

                                ;DRIVE INITILIZATION ROUTINE
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                                        ;THIS ROUTINE DETERMINES IF A DRIVE EXIST AND IF IT IS
                                        ;AN RP07. IF IT IS, A "READ-IN PRESET" IS ISSUED AND FMT16
                                        ;IS SET TO A "1". THEN MOL, DPR, DRY, AND VV ARE CHECKED TO
                                        ;INSURE THEY ARE ALL ON A "1". AND DEPENDING ON THEIR STATE,
                                        ;DRVSTA IS SET TO THE PROPER CONDITION.
                                ;CALL
                                ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
                                ;       JSR     R4,DRVINT       ;CALLED BY A JSR
                                ;       RETURN1                 ;ERROR OCCURRED (PARITY)
                                ;       RETURN2                 ;NORPAL RETURN
                                ;
020414  010546                 DRVINT: MOV     R5,-(SP)        ;SAVE R5
020416  112761  177777  020156          MOVB    #-1,DPINT R1)   ;SET THE INITIAL FLAG
020424  006301                         ASL     R1
020426  012761  003720  020204          MOV     #2000.,T MER(R1)        ;SET A 2 SECOND TIMER
020434  006201                         ASR     R1              ;DRIVE ADDRESS
020436  105061  020136          10$:    CLRB    DRVSTA(R1)      ;START DRIVE STATUS AS OFFLINE
020442  105061  020146                 CLRB    DRVTYP(R1)      ;CLEAR THE DRIVE TYPE INDICATOR
020446  010177  162216                 MOV     R1,@RPCS2       ;SELECT A DRIVE
020452  112777  000111  162200         MOVB    #111,@RPCS1     ;DO A DRIVE CLEAR COMMAND (& SEIZE DRIVE)
020460  032777  010000  162202         BIT     #BIT12,@RPCS2 ;NONEXISTENT DRIVE?
020466  001403                         BEQ     1$              ;NO---BRANCH
020470  004737  024632                 JSR     PC,SET.IE       ;GO SET "IE" WITHOUT A "TRE"
020474  000513                         BR      6$              ;LEAVE THIS ROUTINE

020476  105061  020136          1$:     CLRB    DRVSTA(R1)      ;SET DRIVE STATUS TO OFFLINE
020502  032777  004000  162150         BIT     #BIT11,@RPCS1   ;SEE IF DRIVE AVAILABLE
020510  001004                         BNE     22$             ;BRANCH IF DVA SET
020512  105761  020156                 TSTB    DPINT(R1)       ;SOFTWARE TIME OUT
020516  001347                         BNE     10$             ;BRANCH IF NOT
020520  000501                         BR      6$              ;OTHERWISE EXIT

020522  004437  024254          22$:    JSR     R4,RD.RP        ;READ THE DRIVE TYPE REG.
020526                                 26
020530  020726                         8$                      ;ERROR RETURN ADDRESS
020532  012605                         MOV     (SP)+,R5        ;PUT DRIVE TYPE IN R5
020534  112761  000005  020146         MOVB    #5,DRVTYP(R1)   ;SET RP07 INDICATOR
020542  022705  020040                 CMP     #20040,R5       ;SINGLE PORT RP07
020546  001420                         BEQ     2$              ;BR IF YES
020550  022705  024040                 CMP     #24040,R5       ;DUAL PORT RP07
020554  001415                         BEQ     2$              ;BR IF YES
020556  112761  000004  020146         MOVB    #4,DRVTYP(R1)   ;SET RP07+ INDICATOR
020564  022705  020042                 CMP     #20042,R5       ;SINGLE PPRT RP07+
020570  001407                         BEQ     2$              ;BRANCH IF SO
020572  022705  024042                 CMP     #24042,R5       ;DUAL PORT RP07+
020576  001404                         BEQ     2$              ;BRANCH IF SO
020600  112761  177777  020146         MOVB    #-1,DRVTYP(R1)  ;SET INDICATOR TO 'OTHER'
020606  000446                         BR      6$              ;EXIT

020610  012746  000121          2$:     MOV     #121,-(SP)      ;DO A "READ-IN PRESET"
020614  004437  024346                 JSR     R4,WRT.RP
020620  000000                         0
020622  020726                         8$
020624  012746  010000                 MOV     #BIT12,-(SP)    ;SET FMT16=1
020630  004437  024346                 JSR     R4,WRT.RP
020634  000032                         32
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                                                8$
                                        JSR     R4,RD.RP        ;READ RPDS
                                        12
                                        8$
                                        MOV     (SP)+,R5        ;AND SAVE IT IN R5
                                        BPL     4$              ;BRANCH IF ATA=0
                                        MOVB    ATABIT(R1),@RPAS ;CLEAR ATTENTION BIT
                                        JSR     R4,RD.RP        ;FIND OUT WHY ATA=1
                                        14
                                        8$
                                        ROL     (SP)+           ;IS IT UNSAFE?
                                        BPL     4$              ;BR IF NOT
                                        MOVB    #-1,DRVSTA(R1)  ;SET UNSAFE INDICATOR
                                        BR      6$              ;EXIT
                                4$:     COM     R5              ;CHECK MOL, DPR, DRY, AND VV
                                        BIC     #^C<BIT12!BIT08!BIT07!BIT06>,R5
                                        BNE     6$              ;BRANCH IF MOL, DPR, DRY, OR VV IS CLEAR
                                        MOVB    #1,DRVSTA(R1)   ;SET DRIVE STATUS TO ONLINE
                                6$:     TST     (R4)+           ;STEP OVER THE ERROR RETURN
                                7$:
                                8$:     ASL     R1              ;WORD INDEX
                                        MOV     #-1,TIMER(R1)   ;STOP THE CLOCK
                                        ASR     R1              ;DRIVE ADDRESS
                                        CLRB    DPINT(R1)
                                        MOV     (SP)+,R5        ;RESTORE R5
                                        RTS     R4              ;EXIT

                                ;REQUEST PRE-PROCESSOR-HANDLES SUBSYSTEM REQUEST
                                ;
                                ;CALL
                                ;
                                ;       JSR     R4,RP07         ;CALL THE RP07 DRIVER
                                ;       PNTADR                  ;ADDRESS OF POINTER OF DRIVES PARAMETER BLOCK
                                ;       RETURN1                 ;RETURN HERE IF QUEUE IS FULL
                                ;       RETURN2                 ;RETURN HERE IF REQUEST IS IN QUEUE OR THERE
                                ;                               ;IS AN ERROR CONDITION

020750                          RP07:                           ;SAVE THE CALLING STATUS
020750  104440                          TRAP    C$GPRI
020752  010046                          MOV     R0,-(SP)
                                                                ;DON'T ALLOW ANY RP07 INTERRUPTS
020754  013700  002646                  MOV     RPVEC+2,R0
020760  104441                          TRAP    C$SPRI
020762  112737  000001  020202          MOVB    #1,ACTDRV       ;SET "ACTIVE DRIVER" FLAG
020770  004737  010646                  JSR     PC,SAVREG       ;SAVE R0 - R5
020774  011402                          MOV     (R4),R2         ;PICKUP THE DRIVE PARAMETER BLOCK POINTER
020776  005062  000016                  CLR     16(R2)          ;CLEAR THE STATUS/ERROR INDICATOR
021002  111201                          MOVB    (R2),R1         ;PICKUP THE DRIVE NUMBER
021004  105761  020136                  TSTB    DRVSTA(R1)      ;CHECK DRIVES STATUS
021010  003006                          BGT     1$              ;BRANCH IF ONLINE
021012  004437  020414                  JSR     R4,DRVINT       ;GO INIT. THE DRIVE
021016  000421                          BR      4$              ;ERROR RETURN
                                                                ;NO ERROR
021020  105761  020136                  TSTB    DRVSTA(R1)      ;IS DRIVE STATUS ONLINE?
021024  003436                          BLE     6$              ;BR IF NOT
021026  105761  020166          1$:     TSTB    DPRQS(R1)       ;OUTSTANDING PORT REQUEST FOR THE DRIVE ?
021032  001016                          BNE     5$              ;BR IF YES
```

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                                MOV     R1,@RPCS2       ;SELECT THE DRIVE
                                JSR     R4,DRVQUE       ;PUT THIS REQUEST IN QUEUE
                                BR      9$              ;QUEUE IS FULL

                        2$:     TSTB    DRVACT(R1)      ;IS THIS DRIVE ACTIVE?
                                BNE     8$              ;BR IF YES
                                JSR     PC,OPT          ;CALL THE OPTIMIZER
                                BR      8$
                        3$:
                        4$:     JSR     PC,C17          ;GO HANDLE THE PARITY ERROR
                                BR      8$

                        5$:     JSR     R4,DRVQUE       ;PUT REQUEST IN QUEUE
                                BR      9$              ;QUEUE IS FULL

                                MOV     #0,@RPCC        ;WRITE THE CURRENT CYL REG
                                BIT     #BIT06,@RPCS1   ;IE BIT SET ?
                                BNE     8$              ;YES
                                JSR     PC,SET.IE       ;SET THE INTERRUPT
                                BR      8$              ;RETURN

                        6$:     TSTB    DRVSTA(R1)      ;SEE IF DRIVE OFFLINE OR UNSAFE
                                BLT     7$              ;BR IF UNSAFE
                                MOV     #BIT15!BIT14,16(R2)  ;SET OFFLINE ERROR INDICATOR
                                TSTB    DRVTYP(R1)      ;SEE IF OFFLINE OR NONEXISTENT
                                BNE     8$              ;BR IF OFFLINE
                                MOV     #BIT15!BIT01,16(R2)  ;REPORT DRIVE NONEXISTENT
                                BR      8$              ;GO TO EXIT

                        7$:     MOV     #BIT15!BIT12,16(R2)  ;DRIVE IS UNSAFE
                        8$:     JSR     PC,RESREG       ;RESTORE R0 - R5
                                TST     (R4)+           ;SETUP FOR NORMAL RETURN
                                BR      10$             ;FINISH UP, THEN EXIT
                        9$:     JSR     PC,RESREG       ;RESTORE R0 - R5
                        10$:    TST     (R4)+           ;CORRECT THE RETURN ADDRESS
                                CLRB    ACTDRV          ;CLEAR "ACTIVE DRIVER" FLAG
                                                        ;RESTORE PRIORITY
                                MOV     (SP)+,R0
                                TRAP    C$SPRI
                                RTS     R4              ;RETURN TO CALLER

                        ;OPTIMIZER-CALLED FOR A PARTICULAR DRIVE
                        ;
                        ;CALL
                        ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
                        ;       JSR     PC,OPT          ;SETUP A COMMAND

                        OPT:    JSR     PC,SAVREG       ;SAVE R0 - R5
                                TRAP    C$GPRI
                                MOV     R0,-(SP)
                                BICB    ATABIT(R1),SRCHWT       ;CLEAR LA SEACH FLAG
                                CLRB    DPRQS(R1)       ;RESET THE PORT REQ FLAG ****
                                JSR     PC,GETREQ       ;GET "DPB" POINTER OF REQUEST
                                TST     R2              ;IS THERE A REQUEST IN QUEUE?
                                BEQ     7$              ;NO--BRANCH TO EXIT
                                MOV     R1,@RPCS2       ;LOAD THE DRIVE ADDRESS *******
                                MOV     #111,@RPCS1     ;CLEAR THE DRIVE
```

```
                                                BIT     #BIT8,@RPDS     ;DPR SET ?
                                                BEQ     5$              ;TO PROT REQUEST ,IF NOT
                                        10$:    TSTB    DRVSTA(R1)      ;IS DRIVE ONLINE?
                                                BGT     1$              ;YES--BRANCH
                                                JSR     PC,POPQUE       ;NO--REMOVE REQUEST FROM QUEUE
                                                MOV     #BIT15!BIT14,16(R2)     ;SET OFFLINE STATUS/ERROR INDICATOR
                                                TSTB    DRVSTA(R1)      ;IS DRIVE UNSAFE ?
                                                BPL     8$              ;BR TO EXIT IF NOT
                                                MOV     #BIT15!BIT12,16(R2)     ;SET UNSAFE STATUS/ERROR INDICATOR
                                                BR      8$              ;BRANCH TO EXIT

                                        1$:     CMPB    #150,2(R2)      ;IS THE REQUEST FOR I/O?
                                                BLT     2$              ;YES--BRANCH
                                                CMPB    #135,2(R2)      ;IS THE DIAGNOSTIC COMMAND ?
                                                BEQ     2$              ;BRANCH IF SO
                                                JSR     PC,CI4          ;CALL THE COMMAND INITIATOR
                                                BR      8$              ;BRANCH TO EXIT

                                        2$:     TST     DTUW            ;DATA TRANSFER UNDERWAY?
                                                BGE     4$              ;YES--GO START A SEARCH
                                        3$:     JSR     PC,CI1          ;START A DATA TRANSFER
                                                BR      8$

                                        4$:     JSR     PC,CI3          ;START A SEARCH
                                                BR      8$              ;GO TO THE EXIT

                                        5$:     MOVB    #-1,DPROS(R1)   ;SET PORT REQUEST INDICATOR
                                                MOV     R1,R3           ;SET UP TO ADDRESS WORDS
                                                ASL     R3              ;CONVERT TO WORD INDEX
                                                MOV     #20000.,TIMER(R3)       ;SET A 20. SECOND TIMER
                                                MOV     #0,@RPCC        ;SET PORT REQUEST
                                                BR      7$              ;EXIT
                                        6$:     JSR     PC,CI7          ;PROCESS THE PARITY ERROR
                                        7$:     BIT     #BIT06,@RPCS1   ;SEE IF 'IE' ALREADY SET
                                                BNE     8$              ;BR IF SET
                                                JSR     PC,SET.IE       ;SET "IE" WITHOUT A "TRE"
                                        8$:                             ;RESTORE PROC. STATUS
                                                MOV     (SP)+,R0
                                                TRAP    C$SPRI
                                                JSR     PC,RESREG       ;RESTORE R0 - R5
                                                RTS     PC
```

```
                                        ;COMMAND INITIATOR
                                        ;
                                        ;CALL
                                        ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER
                                        ;       MOV     #DPB,R2         ;ADDRESS OF DPB
                                        ;       JSR     PC,CI?          ;CI?= CI1,CI3, OR CI4
                                        ;                               ;WHERE:
                                        ;                               ;CI1=DATA TRANSFER
                                        ;                               ;CI3=SEARCH REQUESTED BY DATA XFER
                                        ;                               ;CI4=NOT DATA TRANSFER

021456  004737  025376          CI1:    JSR     PC,POPQUE       ;REMOVE REQUEST FROM "DRIVES WAIT" QUEUE
021462  010237  020176                  MOV     R2,TRNSWT       ;PUT REQ. IN TRANSFER WAIT QUEUE
021466  010203                          MOV     R2,R3           ;DPB ADDRESS TO R3
021470  013704  002660                  MOV     RPCS1,R4        ;RPCS1 ADDRESS
021474  010177  161170                  MOV     R1,@RPCS2       ;SELECT DRIVE
021500  122762  000135  000002          CMPB    #DIAG,2(R2)     ;DIAGNOSTIC COMMAND ?
021506  001011                          BNE     1$              ;BRANCH IF NOT
021510  016246  000004                  MOV     4(R2),-(SP)     ;GET THE RT NUMBER, PARAMETERS
021514  052716  100000                  BIS     #DMD,(SP)       ;SET THE GIAGNOSTIC MODE BIT
021520  004437  024346                  JSR     R4,WRT.RP       ;WRITE THE RPMR1 REG
021524  000024                          24
021526  022364                          CI7                     ;RETURN HERE ON ERROR
021530  000432                          BR      2$              ;LOAD THE COMMAND AND EXIT

021532  062703  000004          1$:     ADD     #4,R3           ;DESIRED WORD COUNT
021536  062704  000002                  ADD     #2,R4           ;RPWC ADDRESS
021542  012324                          MOV     (R3)+ (R4)+     ;LOAL WORD COUNT
021544  012324                          MOV     (R3)+,(R4)+     ;LOAD BUFFER ADDRESS
021546  012346                          MOV     (R3)+,-(SP)     ;LOAD SECTOR AND TRACK
021550  004437  024346                  JSR     R4,WRT.RP       ;CALL THE LOAD(WRITE) ROUTINE
021554  000006                          6                       ;INDEX OF REGISTER TO LOAD
021556  022364                          CI7                     ;RETURN HERE ON ERROR
021560  012346                          MOV     (R3)+,-(SP)     ;LOAD CYLINDER ADDRESS
021562  004437  024346                  JSR     R4,WRT.RP
021566  000034                          34
021570  022364                          CI7                     ;RETURN HERE ON ERROR
021572  032712  100000                  BIT     #BIT15,(R2)     ;MAINTENANCE MODE FLAG BIT SET ?
021576  001407                          BEQ     2$              ;BRANCH IF NOT
021600  005046                          CLR     -(SP)           ;SET DMD BIT IN RPMR
021602  052716  100000                  BIS     #BIT15,(SP)     ;SET DMD BIT ONLY THE REST BITS MUST BE 0
021606  004437  024346                  JSR     R4,WRT.RP       ;WRITE TO RPMR
021612  000024                          24
021614  022364                          CI7                     ;RETURN HERE ON ERROR
021616  016246  000002          2$:     MOV     2(R2),-(SP)     ;LOAD "COMMAND+GO", "A17&A16", AND "PSEL"
021622  004437  024346                  JSR     R4,WRT.RP
021626  000000                          0
021630  022364                          CI7                     ;RETURN HERE ON ERROR
021632  010137  020224                  MOV     R1,DTUW         ;SET "DATA TRANSFER UNDERWAY"
021636  000137  022300                  JMP     CI5

021642  013704  002660          CI3:    MOV     RPCS1,R4        ;RPCS1 ADDRESS
021646  010177  161016                  MOV     R1,@RPCS2       ;SELECT DRIVE
021652  016246  000012                  MOV     12(R2),-(SP)    ;DESIRED CYLINDER ADDRESS
021656  004437  024346                  JSR     R4,WRT.RP
021662  000034                          34
021664  022364                          CI7                     ;RETURN HERE ON ERROR
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021666  016246  000010                  MOV     10(R2),-(SP)    ;THE SECTOR AND TRACK ADDRESS
021672  004437  024346                  JSR     R4,WRT.RP       ;LOAD DESIRED TRACK & SECTOR
021676  000006                          6
021700  022364                          CI7                     ;RETURN HERE ON ERROR
021702  032762  100000  000000          BIT     #BIT15,0(R2)    ;MAINTENANCE MODE ?
021710  001407                          BEQ     1$              ;BRANCH IF NOT
021712  005046                          CLR     -(SP)
021714  052716  100000                  BIS     #BIT15,(SP)     ;SET DMD BIT ONLY,THE REST BITS MUST BE 0
021720  004437  024346                  JSR     R4,WRT.RP
021724  000024                          24
021726  022364                          CI7                     ;RETURN HERE ON ERROR
021730                          1$:
021730  012746  000131                  MOV     #SEARCH,-(SP)   ;START A SEARCH
021734  004437  024346                  JSR     R4,WRT.RP
021740  000000                          0
021742  022364                          CI7                     ;RETURN HERE ON ERROR
021744  156137  002734  020200          BISB    ATABIT(R1),SRCHWT       ;SET ''SEARCH WAIT'' KEY
021752  000552                          BR      CI5

021754  013704  002660          CI4:    MOV     RPCS1,R4        ;RPCS1 ADDRESS
021760  010177  160704                  MOV     R1,@RPCS2       ;SELECT DRIVE
021764  116203  000002                  MOVB    2(R2),R3        ;PICKUP THE REQUESTED COMMAND
021770  122703  000131                  CMPB    #SEARCH,R3      ;IS IT A SEARCH COMMAND?
021774  001007                          BNE     1$              ;BRANCH IF NO
021776  016246  000010                  MOV     10(R2),-(SP)    ;LOAD DESIRED TRACK & SECTOR
022002  004437  024346                  JSR     R4,WRT.RP
022006  000006                          6
022010  022364                          CI7                     ;RETURN HERE ON ERROR
022012  000403                          BR      2$              ;GO LOAD CYLINDER

022014  122703  000105          1$:     CMPB    #SEEK,R3        ;IS IT A SEEK COMMAND
022020  001007                          BNE     3$              ;BRANCH IF NO
022022  016246  000012          2$:     MOV     12(R2),-(SP)    ;LOAD DESIRED CYLINDER
022026  004437  024346                  JSR     R4,WRT.RP
022032  000034                          34
022034  022364                          CI7                     ;RETURN HERE ON ERROR
022036  000531                          BR      CI6

022040  122703  000115          3$:     CMPB    #OFFSET,R3      ;IS IT AN ''OFFSET'' REGISTER CHANGE COMMAND ?
022044  001013                          BNE     4$              ;BR IF NO
022046  004437  024254                  JSR     R4,RD.RP        ;MERGE THE OFFSET VALUE INTO RPOF
022052  000032                          32                      ;BUT DON'T CHANGE THE UPPER
022054  022364                          CI7                     ;RETURN HERE ON ERROR
022056  116216  000001                  MOVB    1(R2),(SP)      ;BYTE WHEN LOADING THE
022062  004437  024346                  JSR     R4,WRT.RP       ;REGISTER (RPOF)
022066  000032                          32
022070  022364                          CI7                     ;RETURN HERE ON ERROR
022072  000513                          BR      CI6             ;GO START THE COMMAND

022074  122703  000107          4$:     CMPB    #RECAL,R3       ;IS IT A ''RECALIBRATE'' COMMAND?
022100  001510                          BEQ     CI6             ;BRANCH IF YES
022102  122703  000117                  CMPB    #RTC,R3         ;IS IT A RETURN TO CENTER?
022106  001505                          BEQ     CI6             ;BRANCH IF YES
022110  122703  000147          5$:     CMPB    #SETFORM,R3     ;IS IT A ''SET FORMAT'' COMMAND?
022114  001014                          BNE     6$              ;BRANCH IF NO
022116  004437  024254                  JSR     R4,RD.RP        ;READ THE OFFSET REGISTER
022122  000032                          32
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115 022124  022364                        CI7                     ;RETURN HERE ON ERROR
116 022126  116266  000001  000001        MOVB    1(R2),1(SP)     ;COMBINE "FMT16", "ECI", AND "HCI"
117 022134  004437  024346                JSR     R4,WRT.RP       ;LOAD "FMT16", "ECI", AND/OR "HCI".
118 022140  000032                        32
119 022142  022364                        CI7                     ;RETURN HERE ON ERROR
120 022144  000445                        BR      12$
121
122 022146  122703  000141          6$:   CMPB    #GETREG,R3      ;IS IT A "GET REGISTER" COMMAND?
123 022152  001023                        BNE     10$             ;BRANCH IF NO
124 022154  016203  000006          7$:   MOV     6(R2),R3        ;POINTS TO 1ST ADDRESS OF WHERE
125                                                               ;TO PUT THE REGISTER(S)
126 022160  116237  000010  022176        MOVB    10(R2),9$       ;INIT. THE INDEX FOR THE FIRST REG.
127 022166  116205  000011                MOVB    11(R2),R5       ;INDEX OF LAST REG. TO MOVE
128 022172  004437  024254          8$:   JSR     R4,RD.RP        ;READ RHXX/RP07 REGISTER
129 022176  000000          9$:   0                               ;INDEX OF REG. TO READ
130 022200  022364                        CI7                     ;RETURN HERE ON ERROR
131 022202  012623                        MOV     (SP)+,(R3)+     ;GET THE CONTENTS OF RHXX//RP07 REG.
132 022204  023705  022176                CMP     9$,R5           ;LAST REG. BEEN READ?
133 022210  001423                        BEQ     12$             ;GET OUT IF YES
134 022212  062737  000002  022176        ADD     #2,9$           ;INCREASE THE INDEX BY 2
135 022220  000764                        BR      8$              ;LOOP--MORE TO READ
136
137 022222  122703  000145         10$:   CMPB    #MAINT,R3       ;IS IT A "SELECT MAINTENANCE" COMMAND?
138 022226  001007                        BNE     11$             ;BRANCH IF NOT
139 022230  012746  100000                MOV     #DMD,-(SP)      ;SET DIAGNOSTIC MODE COMMAND
140 022234  004437  024346                JSR     R4,WRT.RP       ;WRITE THE MAINTENANCE REGISTER
141 022240  000024                        24
142 022242  022364                        CI7                     ;RETURN HERE ON ERROR
143 022244  000405                        BR      12$             ;EXIT
144
145 022246  010346         11$:   MOV     R3,-(SP)        ;LOAD THE COMMAND
146 022250  004437  024346                JSR     R4,WRT.RP
147 022254  000000                        0                       ;INDEX OF REG. TO WRITE
148 022256  022364                        CI7                     ;RETURN HERE ON ERROR
149 022260  004737  025376         12$:   JSR     PC,POPQUE       ;REMOVE REQ. FROM QUEUE
150 022264  052762  000200  000016        BIS     #BIT07,16(R2)   ;SET THE "DONE" BIT
151 022272  004737  024472                JSR     PC,SVRHXX       ;YES--GO SAVE THE REGISTERS
152 022276  000207         13$:   RTS     PC                      ;RETURN TO USER
153
154 022300  006301          CI5:  ASL     R1
155 022302  012761  001750  020204        MOV     #1000.,TIMER(R1)        ;SET A ONE SECOND TIMER
156 022310  006201                        ASR     R1
157 022312  112761  000001  020126        MOVB    #1,DRVACT(R1)   ;SET THE DRIVE ACTIVE
158 022320  000207                        RTS     PC              ;RETURN TO THE USER
159
160 022322  032762  100000  000000  CI6:  BIT     #BIT15,0(R2)    ;MAINTENANCE MODE ?
161 022330  001407                        BEQ     1$              ;BRANCH IF NOT
162 022332  005046                        CLR     -(SP)           ;
163 022334  052716  100000                BIS     #BIT15,(SP)     ;SET DMD BIT ONLY
164 022340  004437  024346                JSR     R4,WRT.RP       ;THE REST BITS MUST BE 0
165 022344  000024                        24
166 022346  022364                        CI7                     ;RETURN HERE ON ERROR
167 022350  010346          1$:   MOV     R3,-(SP)        ;LOAD THE COMMAND
168 022352  004437  024346                JSR     R4,WRT.RP
169 022356  000000                        0                       ;INDEX OF REG. TO WRITE
170 022360  022364                        CI7                     ;RETURN HERE ON ERROR
171 022362  000746                        BR      CI5
```

```
                                        CI7:
022364                                  1$:     TST     R2              ;ANYTHING IN QUEUE ?
022364  005702                                  BNE     2$              ;BRANCH IF QUEUE IS THERE
022366  001001                                  RTS     PC              ;OTHERWISE EXIT
022370  000207
022372  012762  104000  000016        2$:     MOV     #BIT15!BIT11,16(R2)     ;SET "PARITY" ERROR INDICATOR
022400
022400  012746  000111                CI7B:   MOV     #111,-(SP)      ;DO A "DRIVE CLEAR"
022404  004437  024346                        JSR     R4,WRT.RP
022410  000000                                0
022412  022452                                CI8                     ;RETURN HERE ON ERROR
022414  004737  025260                2$:     JSR     PC,EMPTYQ       ;EMPTY THE QUEUE
022420  105061  020166                        CLRB    DPRQS(R1)       ;CLEAR THE PORT REQUEST FLAG
022424  105061  020126                        CLRB    DRVACT(R1)      ;DRIVE IS IDLE
022430  020237  020176                        CMP     R2,TRNSWT       ;IF THIS DRIVE HAD AN I/O REQUEST
022434  001005                                BNE     1$              ;IN PROGRESS CLEAR ALL OF THE FLAGS
022436  005037  020176                        CLR     TRNSWT
022442  012737  177777  020224              MOV     #-1,DTUW
022450  000207                          1$:     RTS     PC

022452  004737  010646                CI8:    JSR     PC,SAVREG       ;SAVE R0 - R5
022456  005001                                CLR     R1
022460  005003                                CLR     R3
022462  105761  020126                1$:     TSTB    DRVACT(R1)      ;DRIVE ACTIVE?
022466  001003                                BNE     22$             ;BRANCH IF IN ACTIVE
022470  105761  020166                        TSTB    DPRQS(R1)       ;PORT REQUEST
022474  001443                                BEQ     5$              ;BRANCH IF NOT
022476  013702  020176                22$:    MOV     TRNSWT,R2       ;GET THE "TRANSFER WAIT" QUEUE
022502  020137  020224                        CMP     R1,DTUW         ;DID THIS DRIVE HAVE AN I/O IN PROGRESS?
022506  001402                                BEQ     2$              ;BRANCH IF YES
022510  004737  025354                        JSR     PC,GETREQ       ;GET THE DPB POINTER
022514  005702                          2$:     TST     R2              ;QUEUE ENTRY FOR DRIVE ?
022516  001413                                BEQ     4$              ;BR IF NOT
022520  032777  010000  160142                BIT     #BIT12,@RPCS2   ;'NED' SET ?
022526  001404                                BEQ     3$              ;BR IF NOT
022530  012762  100002  000016                MOV     #BIT15!BIT01,16(R2)  ;SET 'DRIVE NON-EXISTENT' INDICATOR
022536  000403                                BR      4$              ;CONTINUE

022540  012762  102000  000016        3$:     MOV     #BIT15!BIT10,16(R2) ;SET "NON-CLEARABLE PARITY" ERROR INDICATOR
022546  012763  177777  020204        4$:     MOV     #-1,TIMER(R3)   ;STOP THE TIMER
022554  105061  020126                        CLRB    DRVACT(R1)      ;SET "DRIVE ACTIVE" TO IDLE
022560  105061  020166                        CLRB    DPRQS(R1)       ;CLEAR PORT REQUEST FLAG
022564  020137  020224                        CMP     R1,DTUW         ;IS THIS DRIVE SETUP FOR A TRANSFER
022570  001005                                BNE     5$              ;BR IF NOT
022572  012737  177777  020224              MOV     #-1,DTUW        ;RESET THE INDICATOR
022600  005037  020176                        CLR     TRNSWT          ;CLEAR THE TRANSFER QUEUE
022604  005201                          5$:     INC     R1              ;MOVE TO THE NEXT DRIVE
022606  062703  000002                        ADD     #2,R3
022612  042701  177770                        BIC     #^C7,R1
022616  001321                                BNE     1$              ;BRANCH IF MORE DRIVES
022620  012737  177777  020224              MOV     #-1,DTUW        ;NO DATA TRANSFERS UNDERWAY
022626  005037  020176                        CLR     TRNSWT          ;CLEAR THE 'TRANSFER WAIT' QUEUE
022632  004737  025176                        JSR     PC,CLRQUE       ;CLEAR ALL OF THE REQUEST QUEUES
022636  012777  000040  160024              MOV     #CLR,@RPCS2     ;DO A MASSBUS INIT.
022644  000406                                BR      7$              ;CONTINUE

022646  004737  025260                6$:     JSR     PC,EMPTYQ       ;CLEAR THE DRIVE'S QUEUE
022652  105061  020136                        CLRB    DRVSTA(R1)      ;SET DRIVE TO OFFLINE
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    229 022656  105061  020146
    230 022662  004737  024632          7$:     CLRB    DRVTYP(R1)      ;CLEAR THE DRIVE TYPE INDICATOR
    231 022666  004737  010700                  JSR     PC,SET.IE       ;SET "IE" WITHOUT "TRE"
    232 022672  000207                          RTS     PC              ;RESTORE R0 - R5
                                                                        ;RETURN
```

```
                                        ;INTERRUPT SERVICE ROUTINE
                                        ;
022674  112737  000001  020202  ISRV:   MOVB    #1,ACTDRV       ;SET "ACTIVE DRIVER" FLAG
022702  005237  002242                  INC     ISRCNT          ;COUNT INTERRUPTS
022706  004737  010646                  JSR     PC,SAVREG       ;SAVE R0 - R5
022712  013701  020224                  MOV     DTUW,R1         ;GET "DATA TRANSFER UNDERWAY" INDICATOR
022716  002403                          BLT     1$              ;BRANCH IF NO DATA TRANSFER UNDERWAY
022720  004737  022744                  JSR     PC,TD           ;CALL TRANSFER DONE
022724  000402                          BR      2$              ;EXIT
022726  004737  023132          1$:     JSR     PC,SC           ;CALL SPECIAL CONDITIONS
022732  004737  010700          2$:     JSR     PC,RESREG       ;RESTORE R0 - R5
022736  105037  020202                  CLRB    ACTDRV          ;CLEAR "ACTIVE DRIVER" FLAG
022742                          L10012:
022742  000002                          RTI
                                        ;
                                        ;TRANSFER DONE ROUTINE
                                        ;
022744  105061  020126          TD:     CLRB    DRVACT(R1)      ;SET DRIVE ACTIVE INDICATOR TO IDLE
022750  012737  177777  020224          MOV     #-1,DTUW        ;NO DATA TRANSFERS UNDERWAY
022756  006301                          ASL     R1
022760  012761  177777  020204          MOV     #-1,TIMER(R1)   ;CANCEL TIMEOUT
022766  006201                          ASR     R1
022770  013702  020176                  MOV     TRNSWT,R2       ;GET "DPB" ADDRESS FROM THE
022774  005037  020176                  CLR     TRNSWT          ;TRANSFER WAIT QUEUE--CLEAR QUEUE
023000  052762  000200  000016          BIS     #BIT07,16(R2)   ;SET DONE
023006  010177  157656                  MOV     R1,@RPCS2       ;SELECT THE DRIVE
023012  004437  024254                  JSR     R4,RD.RP        ;TRANSFER ERROR(TRE=1)?
023016  000000                          0
023020  022364                          CI7                     ;RETURN HERE ON ERROR
023022  006126                          ROL     (SP)+
023024  100424                          BMI     3$              ;BR IF YES
023026  004737  024472                  JSR     PC,SVRHXX       ;YES--SAVE THE REGISTERS
023032  122762  000135  000002          CMPB    #135,2(R2)      ;IE FROM DIAGNOSTIC COMMAND ?
023040  001003                          BNE     1$              ;BRANCH IF NOT
023042  116177  002734  157626          MOVB    ATABIT(R1),@RPAS        ;RESET THE ATA BIT
023050  004737  025354          1$:     JSR     PC,GETREQ       ;GET DPB POINTER
023054  005702                          TST     R2              ;ENTRY FOR DRIVE ?
023056  001403                          BEQ     2$              ;BR IF NOT
023060  004737  021212                  JSR     PC,OPT          ;CALL OPTIMIZER
023064  000422                          BR      SC              ;CHECK OTHER DRIVES
                                        ;
023066  012777  000113  157564  2$:     MOV     #113,@RPCS1     ;RELEASE THE DRIVE
023074  000416                          BR      SC              ;CHECK FOR OTHER DRIVES
023076  052762  100100  000016  3$:     BIS     #BIT15!BIT06,16(R2) ;SET DATA ERROR FLAG
023104  004737  025260                  JSR     PC,EMPTYQ       ;EMPTY THE "DRIVE'S WAIT" QUEUE
023110  004737  024472                  JSR     PC,SVRHXX       ;SAVE THE RHXX/RP07 REGISTERS
023114  012777  040111  157536          MOV     #40111,@RPCS1   ;ISSUE A "DRIVE CLEAR"
023122  012777  000113  157530          MOV     #113,@RPCS1     ;ISSUE A RELEASE TO THE DRIVE
023130  000400                          BR      SC              ;CHECK FOR OTHER DRIVES
                                        ;
                                        ;SPECIAL CONDITION ROUTINE
                                        ;
023132  117703  157540          SC:     MOVB    @RPAS,R3        ;READ "RPAS"
023136  001014                          BNE     2$              ;BRANCH IF ANY 'ATA' BITS SET
023140  004437  024254                  JSR     R4,RD.RP        ;READ CONTROL AND STATUS REGISTER
023144  000000                          0
```

```
                                        C18                     ;RETURN HERE ON ERROR
                                        ROLB    (SP)+           ;IS "IE"=1?
                                        BMI     1$              ;YES, NO DRIVES TO CHECK
                                        NOP
                                        NOP
                                        NOP
                                        JSR     PC,SET.IE       ;SET INTERRUPT ENABLE
                                1$:     RTS     PC              ;RETURN
                                2$:     CLR     -(SP)           ;PROCESS ALL DRIVES THAT HAVE
                                        MOVB    R3,(SP)         ;AN "ATA"=1
                                        MOV     #1,R3
                                        CLR     R1
                                SC3:    BIT     R3,(SP)         ;ATA=1?
                                        BNE     SC5             ;YES--BRANCH
                                SC4:    INC     R1              ;MOVE TO THE NEXT DRIVE
                                        ASLB    R3
                                        BNE     SC3             ;BRANCH IF MORE TO CHECK?
                                        TST     (SP)+           ;CLEAN OFF THE STACK
                                        RTS     PC              ;RETURN TO USER
                                SC5:
                                1$:     TSTB    DPRQS(R1)       ;PORT REQUEST OUTSTANDING ?
                                        BEQ     2$              ;BR IF NOT
                                        JMP     SC13            ;START THE OUTSTANDING COMMAND
                                2$:     TSTB    DRVSTA(R1)      ;CHECK THE DRIVE STATUS
                                        BGT     5$              ;BRANCH IF ONLINE
                                        JSR     PC,GETREQ       ;GET DPB POINTER
                                        JSR     PC,SVRHXX       ;SAVE THE RHXX/RP07 REGISTERS
                                        JSR     PC,SC12         ;SAVE RPDS, RPER1, RPER3, AND RPER2
                                                                ;ALSO DO A DRIVE INIT (DRVINI)
                                        TSTB    DRVSTA(R1)      ;DID DRIVE COME ONLINE?
                                        BLE     6$              ;NO---BRANCH
                                5$:     TSTB    DRVACT(R1)      ;DRIVE ACTIVE WITH COMMAND OR ERROR RECOVERY ?
                                        BNE     SC6             ;BR IF EITHER
                                        JSR     PC,SC12         ;SAVE RPDS, RPER1, RPER3, AND RPER2
                                                                ;ALSO DO A DRVINT
                                6$:     TSTB    DRVSTA(R1)      ;CHECK ON DRIVE'S STATUS
                                        BMI     7$              ;BR IF UNSAFE
                                        ASL     R1
                                        ASL     R1
                                        ASL     R1
                                        MOV     RPSTU0+4(R1),R5
                                        ASR     R1
                                        ASR     R1
                                        ASR     R1
                                        BIT     #BIT13,R5       ;ADDRESS PLUG CHANGED
                                        BNE     8$              ;BRANCH IF SO
                                        MOV     #111,-(SP)      ;DRIVE CLEAR
                                        JSR     R4,WRT.RP       ;WRITE THE COMMAND INTO RPCS1
                                        0                       ;REGISTER INDEX
                                        SC8                     ;PARITY EXIT ADDRESS
                                7$:     MOV     (SP),R5         ;PICKUP (RPAS) BEFORE THE ERROR CALL
                                        NOP
                                        NOP
                                        BR      SC4             ;GO CHECK FOR MORE ATA'S

                                8$:     NOP
                                        NOP
```

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023360  000712                          BR      SC4             ;CHECK FOR MORE DRIVES

023362  006301                  SC6:    ASL     R1              ;SETUP TO ADDRESS WORDS
023364  012761  177777  020204          MOV     #-1,TIMER(R1)   ;STOP THE TIMER
023372  006201                          ASR     R1              ;RESTORE THE DRIVE ADDRESS
023374  004737  025354                  JSR     PC,GETREQ       ;GET THE DPB POINTER FROM THE QUEUE
023400  010177  157264                  MOV     R1,@RPCS2       ;SELECT DRIVE
023404  000137  023440                  JMP     SC11            ;PROCESS THE SEARCH
023410  105761  020126          SC8:    TSTB    DRVACT(R1)      ;IS DRIVE IDLE?
023414  001405                          BEQ     1$              ;YES--BRANCH
023416  004737  025354                  JSR     PC,GETREQ       ;GET DPB POINTER
023422  004737  022364                  JSR     PC,CI7          ;PROCESS THE PARITY ERROR
023426  000402                          BR      2$              ;CONTINUE

023430  004737  022400          1$:     JSR     PC,CI7B         ;PROCESS THE UNCORRECTABLE PARITY ERROR
023434  000137  023206          2$:     JMP     SC4             ;CHECK MORE DRIVES

023440                          SC11:
023440  105061  020126          1$:     CLRB    DRVACT(R1)      ;SET DRIVE IDLE
023444  136137  002734  020200          BITB    ATABIT(R1),SRCHWT  ;DOING A SEARCH OPERATION FOR
                                                                ;AN I/O COMMAND?
023452  001007                          BNE     2$              ;BRANCH IF YES
023454  004737  025376                  JSR     PC,POPQUE       ;REMOVE REQUEST FROM QUEUE
023460  052762  000200  000016          BIS     #BIT07,16(R2)   ;SET "DONE" BIT
023466  004737  024472                  JSR     PC,SVRHXX       ;YES--SAVE ALL OF THE RHXX/RP07 REG'S
023472  116177  002734  157176  2$:     MOVB    ATABIT(R1),@RPAS  ;CLEAR ATTENTION BIT
023500  146137  002734  020200          BICB    ATABIT(R1),SRCHWT       ;CLEAR IMPLIED SEEK SET
023506  006301                          ASL     R1              ;WORD INDEX
023510  012761  177777  020204          MOV     #-1,TIMER(R1)   ;STOP CLOCK
023516  006201                          ASR     R1              ;RESTORE R1
023520  004737  021212                  JSR     PC,OPT          ;START A REQUEST
023524  000137  023206                  JMP     SC4             ;CHECK FOR MORE DRIVES

023530  010177  157134          SC12:   MOV     R1,@RPCS2       ;SELECT DRIVE
023534  006301                          ASL     R1
023536  006301                          ASL     R1
023540  006301                          ASL     R1
023542  017761  157124  020026          MOV     @RPDS,RPSTU0(R1)
023550  017761  157120  020030          MOV     @RPER1,RPSTU0+2(R1)
023556  017761  157136  020032          MOV     @RPER2,RPSTU0+4(R1)
023564  017761  157132  020034          MOV     @RPER3,RPSTU0+6(R1)
023572  006201                          ASR     R1
023574  006201                          ASR     R1
023576  006201                          ASR     R1
023600  004437  020414                  JSR     R4,DRVINT       ;INIT. THE STATE OF THE DRIVE
023604  000401                          BR      1$              ;TAKE ERROR EXIT
023606  000207                          RTS     PC              ;RETURN

023610  005726                  1$:     TST     (SP)+           ;CLEAR THE STACK
023612  000676                          BR      SC8             ;PROCESS THE PARITY ERROR

023614                          SC13:;  ASL     R1              ;SETUP TO ADDRESS WORDS
                                :       MOV     #-1,TIMER(R1)   ;STOP THE TIMER
                                ;       ASR     R1              ;
023614  010177  157050                  MOV     R1,@RPCS2       ;SELECT THE DRIVE
023620  116177  002734  157050          MOVB    ATABIT(R1),@RPAS  ;CLEAR THE ATTENTION BIT
023626  105761  020156          1$:     TSTB    DPINT(R1)       ;INITIALIZING THE DRIVE ?
```

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                                                BEQ     2$              ;BR IF NOT
                                                CLRB    DFINT(R1)       ;CLEAR THE INIT INDICATOR
                                                JSR     R4,DRVINT       ;GO INIT THE DRIVE
                                                NOP                     ;DUMMY PARITY ERROR RETURN
                                                TSTB    DRVSTA(R1)      ;DRIVE ONLINE ?
                                                BGT     2$              ;BR IF YES -- START ORDER
                                                TST     R2              ;QUEUE ENTRY FOR THE DRIVE
                                                BEQ     3$              ;BR IF NOT
                                                JSR     PC,GETREQ       ;GET DPB ADDRESS
                                                BIS     #BIT15!BIT14,16(R2)  ;INFORP USER THAT DRIVE OFFLINE
                                                JSR     PC,SVRHXX       ;SAVE THE REGISTERS
                                                JSR     PC,POPQUE       ;REMOVE THE QUEUE
                                                BR      3$

                        156760  2$:             BIT     #BIT8,@RPDS     ;DVA SET ?
                                                BNE     4$              ;SET THEN CALL OPT
                                        ;       ASL     R1
                                        ;       MOV     #60000.,TIMER(R1);SET A 60. SECOND TIMER
                                        ;       ASR     R1
                                                JSR     PC,SET.IE
                                                BR      3$

                                        4$:     JSR     PC,OPT          ;START THE PENDING REQUEST
                                        3$:     JMP     SC4             ;PROCESS OTHER DRIVES

                                        ;/RP07 TIMER ROUTINE
                                        ;CALL
                                        ;       MOV     #TIME,-(SP)     ;ELASPED TIME IN MILLISECONDS ON THE STACK
                                        ;       JSR     PC,RPTMR        ;CALL RP07 TIME ROUTINE

                                        RPTMR:  TST     ACTDRV          ;CHECK "ACTDRV & ACTSTR"
                                                BNE     4$              ;IF NON ZERO EXIT
                        020203                  MOVB    #1,ACTSTR       ;SET "ACTSTR"
                                                JSR     PC,SAVREG       ;SAVE R0 - R5
                                                CLR     R1              ;START WITH DRIVE 0
                                                CLR     R3
                                        1$:     TST     TIMER(R3)       ;IS THE TIMER RUNNING?
                                                BLT     2$              ;BRANCH IF NO
                        020204                  SUB     2(SP),TIMER(R3) ;COUNT THE INTERVAL
                                                BGT     2$              ;BR IF NO SOFTWARE TIMEOUT
                                                JSR     PC,STO          ;CALL SOFTWARE TIMEOUT ROUTINE
                                        2$:     INC     R1              ;MOVE TO NEXT DRIVE
                                                TST     (R3)+
                                                CMP     #8.,R1          ;OUT OF DRIVES?
                                                BGT     1$              ;BRANCH IF NO
                                        3$:     JSR     PC,RESREG       ;RESTORE R0 - R5
                                                CLRB    ACTSTR          ;ZERO ACTIVE SOFTWARE TIMEOUT ROUTINE FLAG
                                        4$:     MOV     (SP)+,(SP)      ;ADJUST THE STACK
                                                RTS     PC              ;RETURN

                                        ;SOFTWARE TIMEOUT ROUTINE
                                        ;
                                        ;NOTE: THIS ROUTINE MUST BE ENTERED AT PRIORITY 6
                                        ;       OR GREATER
                                        ;
                                        ;CALL:  STO
                                        ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER
```

```
                                ;       JSR     PC,STO          ;CALL
                                ;       RETURN
                                ;
024026  010146                  STO:    MOV     R1,-(SP)        ;SAVE R1-R4
024030  010246                          MOV     R2,-(SP,        ;
024032  010346                          MOV     R3,-(SP)        ;
024034  010446                          MOV     R4,-(SP)        ;
024036  013702  020176                  MOV     TRNSWT,R2       ;PICKUP THE TRANSFER QUEUE
024042  020137  020224                  CMP     R1,DTUW         ;TRANSFER UNDER WAY ON THIS DRIVE
024046  001421                          BEQ     1$              ;BRANCH IF SC
024050  105761  020156                  TSTB    DPINT(R1)       ;DRIVE INITIALIZE ?
024054  001033                          BNE     2$              ;BRANCH IF SO
024056  105761  020166                  TSTB    DPRQS(R1)       ;PROT REQUEST ?
024062  001047                          BNE     3$              ;BRANCH IF SO
024064  012763  177777  020204          MOV     #-1,TIMER(R3)   ;STOP THE TIMER
024072  004737  025354                  JSR     PC,GETREQ       ;GET THE QUEUE
024076  005702                          TST     R2              ;EXIT IF NONE
024100  001460                          BEQ     5$              ;
024102  052762  101000  000016          BIS     #BIT15!BIT9,16(R2)      ;TIME OUT OR LOST INTERRUPT
                                                                ;ON HOUSE KEEPING COMMANDS
024110  000454                          BR      5$              ;EXIT
024112  052762  101000  000016  1$:     BIS     #BIT15!BIT9,16(R2)      ;TIME OUT ON DATA TRANSFER
024120  004737  024472                  JSR     PC,SVRHXX       ;READ ALL REGISTERS
024124  105061  020126                  CLRB    DRVACT(R1)      ;DRRIVE SET TO IDLE
024130  005037  020176                  CLR     TRNSWT          ;CLEAR DATA TRANSFER QUEUE
024134  012737  177777  020224          MOV     #-1,DTUW        ;CLEAR THE TRANSFER DRIVE #
024142  000437                          BR      5$              ;EXIT
024144  105061  020156          2$:     CLRB    DPINT(R1)       ;CLEAR THE INITIALIZE INDICATOR
024150  105061  020136                  CLRB    DRVSTA(R1)      ;SET UNIT TO OFFLINE
024154  012763  177777  020204          MOV     #-1,TIMER(R3)   ;STOP THE TIMER
024162  004737  025354                  JSR     PC,GETREQ       ;GET THE DPB ADDRESS
024166  005702                          TST     R2              ;ANYTHING IN QUEUE
024170  001424                          BEQ     5$              ;BRANCH IF NOT
024172  052762  140000  000016          BIS     #BIT15!BIT14,16(R2) ;INFORM THE USER DRIVE NOT AVAILABLE
024200  000420                          BR      5$              ;FINISH
024202  012763  177777  020204  3$:     MOV     #-1,TIMER(R3)   ;STOP THE TIMER
024210  105061  020166                  CLRB    DPRQS(R1)       ;CLEAR THE PORT REQUEST INDICATOR
024214  004737  025354                  JSR     PC,GETREQ       ;GET DPB ADDRESS
024220  005702                          TST     R2              ;ANYTHING IN QUEUE ?
024222  001407                          BEQ     5$              ;BRANCH IF NONE
024224  012762  100004  000016          MOV     #BIT15!BIT2,16(R2) ;INFORM USER OF PROT REQUEST TIMEOUT
024232  004737  024472          4$:     JSR     PC,SVRHXX       ;READ ALL REGISTERS
024236  004737  025260                  JSR     PC,EMPTYQ       ;CANCEL ALL QUEUE REQ
024242  012604                  5$:     MOV     (SP)+,R4        ;RESTORE R4-R1
024244  012603                          MOV     (SP)+,R3
024246  012602                          MOV     (SP)+,R2
024250  012601                          MOV     (SP)+,R1
024252  000207                          RTS     PC              ;EXIT

                                ;ROUTINE TO READ A RHXX/RP07 REGISTER
                                ;
                                ;CALL
                                ;       JSR     R4,RD.RP        ;GO READ A REGISTER
                                ;       INDEX                   ;REG. INDEX FROM BASE
                                ;       ERRADR                  ;ERROR ADDRESS--PROCESS ERROR STARTING
                                ;                               ;AT THIS ADDRESS
                                ;       RETURN                  ;CONTENTS OF REG. IS ON THE STACK
```

```
                                        ;
024254                          RD.RP:
024254  011646                          MOV     (SP),-(SP)      ;SAVE R4
024256  013746  002660                  MOV     RPCS1,-(SP)     ;ADDRESS OF THE
024262  062416                          ADD     (R4)+,(SP)      ;REG
024264  017666  000000  000004          MOV     @(SP),4(SP)     ;READ THE CONTENTS OF THE REG
024272  013716  002660                  MOV     RPCS1,(SP)      ;CHECK IF NON-EXIST DRIVE
024276  062716  000010                  ADD     #10,(SP)        ;
024302  032776  010000  000000          BIT     #BIT12,@(SP)    ;NED BIT SET ?
024310  001004                          BNE     1$              ;ERROR EXIT
024312  032777  020000  156340          BIT     #BIT13,@RPCS1   ;MCPE SET ?
024320  001406                          BEQ     2$              ;EXIT
024322  016666  000002  000004  1$:     MOV     2(SP),4(SP)     ;MOVE THE R4 TO TOP OF STACK
024330  022626                          CMP     (SP)+,(SP)+     ;CLEAR OFF THE STACK
024332  011404                          MOV     (R4),R4 ;ERROR EXIT ADDRESS
024334  000403                          BR      3$              ;EXIT
024336  062704  000002          2$:     ADD     #2,R4           ;NORMAL EXIT
024342  005726                          TST     (SP)+           ;CLEAR OFF STACK
024344  000204                  3$:     RTS     R4              ;EXIT

                                ;ROUTINE TO WRITE A REGISTER
                                ;
                                ;CALL
                                ;       MOV     DATA,-(SP)      ;DATA TO BE LOADED ON THE STACK
                                ;       JSR     R4,WRT.RP       ;CALL THE ROUTINE TO LOAD(WRITE) THE REG.
                                ;       INDEX                   ;INDEX OF THE REGISTER TO BE LOADED
                                ;       ERRADR                  ;ADDRESS TO RETURN TO ON AN ERROR
                                ;       RETURN                  ;ERROR FREE RETURN

024346                          WRT.RP:
024346  012446                          MOV     (R4)+,-(SP)     ;FORMING THE REG ADDRESS
024350  001014                          BNE     1$              ;BRANCH IF NOT RPCS1
024352  122766  000150  000004          CMPB    #150,4(SP)      ;DATA XTRNS COMMAND ?
024360  002410                          BLT     1$              ;BRANCH IF NOT
024362  017746  156272                  MOV     @RPCS1,-(SP)    ;READ RPCS1
024366  000316                          SWAB    (SP)            ;MERG THE A17,A18,PSEL B'TS
024370  042716  177770                  BIC     #^C7,(SP)       ;CHOP OFF THE REST BITS FROM RPCS1
024374  111666  000007                  MOVB    (SP),7(SP)      ;ATTACH A17,A18,PSEL TO COMMAND
024400  005726                          TST     (SP)+           ;RESTORE STACK LEVEL
024402  063716  002660          1$:     ADD     RPCS1,(SP)      ;THE DEST REG ADDRESS
024406  016676  000004  000000          MOV     4(SP),@(SP)     ;WRITE THE REGISTER
024414  013716  002660                  MOV     RPCS1,(SP)      ;CHECK NED,PAR BITS
024420  062716  000010                  ADD     #10,(SP)        ;
024424  032776  010000  000000          BIT     #BIT12,@(SP)    ;NONE EXIST DRIVE ?
024432  001013                          BNE     2$              ;BRANCH IF IT IS
024434  013716  002660                  MOV     RPCS1,(SP)      ;ADDRESS RPER1
024440  062716  000014                  ADD     #14,(SP)        ;
024444  032776  000010  000000          BIT     #BIT3,@(SP)     ;PAR SET ?
024452  001003                          BNE     2$              ;BRANCH IF SO
024454  062704  000002                  ADD     #2,R4           ;NORMAL RETURN
024460  000401                          BR      3$              ;EXIT
024462  011404                  2$:     MOV     (R4),R4         ;ERROR EXIT
024464  005726                  3$:     TST     (SP)+           ;CLEAR OFF THE STACK
024466  012616                          MOV     (SP)+,(SP)      ;MOVE R4 TO TOP OF STACK
024470  000204                          RTS     R4              ;EXIT

                                ;ROUTINE TO SAVE THE RHXX/RP07 REGISTERS AS PER DPB+14
```

```
                                        ;
                                        ;CALL
                                        ;       MOV     #DPBNUM,R2      ;DPB POINTER TO R2
                                        ;       JSR     PC,SVRHXX       ;SAVE THE DRIVES REG'S (RHXX= RH11 OR RH70)

024472                                  SVRHXX:
024472  004737  010646                          JSR     PC,SAVREG       ;;SAVE R0-R5
024476  005702                                  TST     R2              ;QUEUE ENTRY FOR THE DRIVE ?
024500  001451                                  BEQ     7$              ;BR IF NONE
024502  111277  156162                          MOVB    (R2),@RPCS2     ;SELECT DRIVE
024506  016203  000014                          MOV     14(R2),R3       ;GET THE ERROR TABLE POINTER
024512  001444                                  BEQ     7$              ;EXIT IF NO ADDRESS
024514  005037  024550                          CLR     3$              ;COUNTER & POINTER
024520  023727  024550  000022    1$:           CMP     3$,#22          ;REACHED THE BUFFER REGISTER ?
024526  001006                                  BNE     2$              ;BR IF NOT
024530  032777  000200  156132                  BIT     #BIT07,@RPCS2   ;'OR' SET ?
024536  001002                                  BNE     2$              ;BR IF SET
024540  005023                                  CLR     (R3)+           ;STORE RPDB AS ZEROES
024542  000405                                  BR      4$              ;CONTINUE

024544  004437  024254            2$:           JSR     R4,RD.RP        ;READ THE SELECTED REGISTER
024550  000000                    3$:           .WORD   0               ;REGISTER INDEX
024552  024576                                  5$                      ;ERROR RETURN ADDRESS
024554  012623                                  MOV     (SP)+,(R3)+     ;STORE THE REGISTER CONTENTS
024556  023727  024550  000046    4$:           CMP     3$,#46          ;REACHED THE END ?
024564  001406                                  BEQ     6$              ;BR IF YES
024566  062737  000002  024550                  ADD     #2,3$           ;INCREMENT THE REGISTER INDEX
024574  000751                                  BR      1$              ;CONTINUE READING THE REGISTERS

024576  004737  022364            5$:           JSR     PC,CI7          ;PROCESS THE UNCORRECTABLE PARITY ERROR
024602  005737  002652            6$:           TST     RHTYPE          ;IS IT RH70 ?
024606  001406                                  BEQ     7$              ;IF EQ, NO
024610  013704  002642                          MOV     RPADR,R4        ;GET RPCS1 BASE ADDRESS
024614  063704  002650                          ADD     RHEXT,R4        ;POINT TO RPBAE
024620  012423                                  MOV     (R4)+,(R3)+     ;STORE THE CONTENTS
024622  011413                                  MOV     (R4),(R3)       ;GET RPCS3
024624                                  7$:
024624  004737  010700                          JSR     PC,RESREG       ;;RESTORE R0-R5
024630  000207                                  RTS     PC              ;RETURN

                                        ;ROUTINE TO SET THE INTERRUPT WITHOUT GETTING A "TRE"
                                        ;CALL
                                        ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
                                        ;       JSR     PC,SET.IE       ;SET "IE"
                                        ;       RETURN

024632  010446                  SET.IE: MOV     R4,-(SP)        ;SAVE R4
024634  013704  002660                  MOV     RPCS1,R4        ;PICKUP ADR OF RPCS1
024640  010177  156024                  MOV     R1,@RPCS2       ;SELECT DRIVE
024644  011446                          MOV     (R4),-(SP)      ;READ RPCS1
024646  052716  040000                  BIS     #BIT14,(SP)     ;SET THE "TRE" BIT OF THE WORD READ
024652  000316                          SWAB    (SP)            ;ADJUST FOR DATO
024654  112714  000100                  MOVB    #BIT06,(R4)     ;SET "IE"
024660  032777  010000  156002          BIT     #BIT12,@RPCS2 ;IS "NED"=1?
024666  001002                          BNE     1$              ;YES--CLEAR "TRE"
024670  005726                          TST     (SP)+           ;CLEAN OFF THE STACK
024672  000402                          BR      2$
```

```
    398 024674  112664  000001          1$:     MOVB    (SP)+,1(R4)     ;CLEAR "TRE"
    399 024700  012604                  2$:     MOV     (SP)+,R4        ;RESTORE R4
    400 024702  000207                          RTS     PC              ;RETURN TO CALLER
```

```
                                        ;QUEUE COUNT
024704    000                           QCNT:   .BYTE   0               ;DRIVE 0
024705    000                                   .BYTE   0               ;DRIVE 1
024706    000                                   .BYTE   0               ;DRIVE 2
024707    000                                   .BYTE   0               ;DRIVE 3
024710    000                                   .BYTE   0               ;DRIVE 4
024711    000                                   .BYTE   0               ;DRIVE 5
024712    000                                   .BYTE   0               ;DRIVE 6
024713    000                                   .BYTE   0               ;DRIVE 7

                                        ;QUEUE INPUT POINTERS

024714  024776                          QINPT:  .WORD   QDRV0           ;DRIVE 0
024716  025016                                  .WORD   QDRV1           ;DRIVE 1
024720  025036                                  .WORD   QDRV2           ;DRIVE 2
024722  025056                                  .WORD   QDRV3           ;DRIVE 3
024724  025076                                  .WORD   QDRV4           ;DRIVE 4
024726  025116                                  .WORD   QDRV5           ;DRIVE 5
024730  025136                                  .WORD   QDRV6           ;DRIVE 6
024732  025156                                  .WORD   QDRV7           ;DRIVE 7

                                        ;QUEUE OUTPUT POINTERS

024734  024776                          QOUTPT: .WORD   QDRV0           ;DRIVE 0
024736  025016                                  .WORD   QDRV1           ;DRIVE 1
024740  025036                                  .WORD   QDRV2           ;DRIVE 2
024742  025056                                  .WORD   QDRV3           ;DRIVE 3
024744  025076                                  .WORD   QDRV4           ;DRIVE 4
024746  025116                                  .WORD   QDRV5           ;DRIVE 5
024750  025136                                  .WORD   QDRV6           ;DRIVE 6
024752  025156                                  .WORD   QDRV7           ;DRIVE 7

024754  024776                          QSTART: .WORD   QDRV0           ;DRIVE 0 START ADDRESS
024756  025016                          QSTOP:  .WORD   QDRV1           ;DRIVE 0 STOP ADDRESS & DRIVE 1 START ADDRESS
024760  025036                                  .WORD   QDRV2           ;STOP DRIVE 1--START DRIVE 2
024762  025056                                  .WORD   QDRV3           ;STOP DRIVE 2--START DRIVE 3
024764  025076                                  .WORD   QDRV4           ;STOP DRIVE 3--START DRIVE 4
024766  025116                                  .WORD   QDRV5           ;STOP DRIVE 4--START DRIVE 5
024770  025136                                  .WORD   QDRV6           ;STOP DRIVE 5--START DRIVE 6
024772  025156                                  .WORD   QDRV7           ;STOP DRIVE 6--START DRIVE 7
024774  025176                                  .WORD   QTERP           ;STOP DRIVE 7

                                        ;DRIVE REQUEST QUEUES

024776                                  QDRV0:  .BLKW   10
025016                                  QDRV1:  .BLKW   10
025036                                  QDRV2:  .BLKW   10
025056                                  QDRV3:  .BLKW   10
025076                                  QDRV4:  .BLKW   10
025116                                  QDRV5:  .BLKW   10
025136                                  QDRV6:  .BLKW   10
025156                                  QDRV7:  .BLKW   10
        025176                          QTERP=.
```

```
                                        ;ROUTINE TO CLEAR ALL OF THE REQUEST QUEUES
                                        ;
                                        ;CALL
                                        ;       JSR     PC,CLRQUE
                                        ;
025176  004737  010646          CLRQUE: JSR     PC,SAVREG       ;SAVE R0 - R5
025202  012702  024704                  MOV     #QCNT,R2        ;ZERO THE QUEUE COUNTS
025206  005022                          CLR     (R2)+           ;DRIVES 0 & 1
025210  005022                          CLR     (R2)+           ;DRIVES 2 & 3
025212  005022                          CLR     (R2)+           ;DRIVES 4 & 5
025214  005022                          CLR     (R2)+           ;DRIVES 6 & 7
025216  012703  000010                  MOV     #8.,R3          ;MOVE THE STARTING
025222  012701  024754                  MOV     #QSTART,R1      ;ADDRESS OF THE QUEUE INTO
025226  012122                  1$:     MOV     (R1)+,(R2)+     ;THE QUEUE INPUT POINTER
025230  005303                          DEC     R3
025232  001375                          BNE     1$
025234  012703  000010                  MOV     #8.,R3          ;MOVE THE STARTING ADDRESS
025240  012701  024754                  MOV     #QSTART,R1      ;OF THE QUEUE INTO THE
025244  012122                  2$:     MOV     (R1)+,(R2)+     ;QUEUE OUTPUT POINTER
025246  005303                          DEC     R3
025250  001375                          BNE     2$
025252  004737  010700                  JSR     PC,RESREG       ;RESTORE R0 - R5
025256  000207                          RTS     PC
                                        ;EMPTY THE QUEUE SPECIFIED BY R1
                                        ;
                                        ;CALL
                                        ;       MOV     DRVNUM,R1       ;DRIVE NUMBER TO R1
                                        ;       JSR     PC,EMPTYQ
                                        ;
025260  105061  024704          EMPTYQ: CLRB    QCNT(R1)        ;CLEAR NUMBER OF ITEMS IN QUEUE
025264  006301                          ASL     R1
025266  016161  024714  024734          MOV     QINPT(R1),QOUTPT(R1) ;SET OUTPUT QUEUE POINTER-INPUT POINTER
025274  006201                          ASR     R1
025276  000207                          RTS     PC
                                        ;ROUTINE TO PUT A REQUEST IN QUEUE
                                        ;
                                        ;CALL
                                        ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER
                                        ;       MOV     #DPB,R2         ;ADDRESS OF PARAMETER BLOCK
                                        ;       JSR     R4,DRVQUE       ;GO PUT REQUEST IN QUEUE
                                        ;       RETURN1                 ;RETURN HERE IF QUEUE IS FULL
                                        ;       RETURN2                 ;RETURN HERE IF REQUEST IS IN QUEUE
                                        ;
025300  122761  000010  024704  DRVQUE: CMPB    #10,QCNT(R1)    ;IS QUEUE FULL?
025306  001421                          BEQ     2$              ;BR IF YES-TAKE RETURN1
025310  105261  024704                  INCB    QCNT(R1)        ;INCREMENT QUEUE COUNT
025314  006301                          ASL     R1
025316  010271  024714                  MOV     R2,@QINPT(R1)   ;PUT THIS REQUEST IN QUEUE
025322  062761  000002  024714          ADD     #2,QINPT(R1)    ;UPDATE THE QUEUE POINTER
025330  026161  024714  024756          CMP     QINPT(R1),QSTOP(R1) ;TIME TO RESET THE POINTER
025336  001003                          BNE     1$              ;BRANCH IF NO
025340  016161  024754  024714          MOV     QSTART(R1),QINPT(R1) ;YES--RESET POINTER
025346  006201                  1$:     ASR     R1
025350  005724                          TST     (R4)+           ;TAKE RETURN 2
```

```
     58 025352  000204                    2$:     RTS     R4              ;RETURN TO USER
     59
     60                                   ;ROUTINE TO GET THE "DPB" ADDRESS OF NEXT REQUEST IN QUEUE
     61                                   ;
     62                                   ;CALL
     63                                   ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
     64                                   ;       JSR     PC,GETREQ       ;GO GET THE REQUEST
     65                                   ;       RETURN                  ;R2="DPB" ADDRESS OF THE REQUEST
     66                                   ;                               ;R2=0 IF NO REQUEST IN QUEUE
     67
     68 025354  005002                    GETREQ: CLR     R2
     69 025356  105761  024704                    TSTB    QCNT(R1)        ;IS THERE ANY REQUEST IN QUEUE?
     70 025362  001404                            BEQ     2$              ;NO---BRANCH
     71 025364  006301                    1$:     ASL     R1
     72 025366  017102  024734                    MOV     @QOUTPT(R1),R2  ;PICKUP "DPB" POINTER FOR THIS DRIVE
     73 025372  006201                            ASR     R1
     74 025374  000207                    2$:     RTS     PC              ;RETURN TO USER
     75
     76                                   ;ROUTINE TO "POP" THE REQUEST FROM QUEUE
     77                                   ;
     78                                   ;CALL
     79                                   ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
     80                                   ;       JSR     PC,POPQUE       ;CALL TO REMOVE REQUEST
     81                                   ;       RETURN                  ;R2=ADDRESS OF DPB REMOVED
     82
     83 025376  105361  024704            POPQUE: DECB    QCNT(R1)        ;DECREMENT QUEUE COUNT
     84 025402  006301                            ASL     R1
     85 025404  017102  024734                    MOV     @QOUTPT(R1),R2  ;GET THE "DPB" POINTER
     86 025410  005071  024734                    CLR     @QOUTPT(R1)     ;REMOVE DPB ADDRESS FROM THE QUEUE
     87 025414  062761  000002  024734            ADD     #2,QOUTPT(R1)   ;UPDATE THE QUEUE POINTER
     88 025422  026161  024734  024756            CMP     QOUTPT(R1),QSTOP(R1) ;TIME TO RESET THE POINTER?
     89 025430  001003                            BNE     1$              ;NO--BRANCH TO EXIT
     90 025432  016161  024754  024734            MOV     QSTART(R1),QOUTPT(R1) ;YES--RESET THE POINTER
     91 025440  006201                    1$:     ASR     R1
     92 025442  000207                            RTS     PC              ;RETURN TO USER
     93
    102
    109
```

```
                                .SBTTL  REPORT CODING SECTION

                                ;++
                                ; THE REPORT CODING SECTION CONTAINS THE
                                ; "PRINTS" CALLS THAT GENERATE STATISTICAL REPORTS.
                                ;--

025444                          I$RPT::

025444  000167                          .WORD   J$JMP
025446  000000                          .WORD   L10013-2-.

                                        .EVEN

025450                          L10013:
025450  104425                          TRAP    C$RPT
```

```
                                .SBTTL  PROTECTION TABLE

                                ;++
                                ; THIS TABLE IS USED BY THE RUNTIME SERVICES
                                ; TO PROTECT THE LOAD MEDIA.
                                ;--

025452                          L$PROT::
025452  000000                            0               ;P-TABLE OFFSET OF CSR
025454  177777                            -1              ;NOT A MASSBUS DEVICE
025456  000006                            6               ;P-TABLE OFFSET DRIVE #
```

```
                                .SBTTL  INITIALIZE SECTION
                                ;++
                                ; THE INITIALIZE SECTION CONTAINS THE CODING THAT IS PERFORMED
                                ; AT THE BEGINNING OF EACH PASS.
                                ;--

025460                          L$INIT::
                                                                ;RESET THE WORLD
025460  104433                          TRAP    C$RESET
025462  012737  015272  002252          MOV     #ABOPAS,BYPASS  ;ABORT PASS ON DEV FATAL ERROR DETECTED IN 'ERRABO',
                                                                ;CALLED BY SFTW DRVRS
025470  012737  000001  002240          MOV     #1,ITCNT        ;RESET ITERATION COUNT
025476  005037  002242                  CLR     ISRCNT          ;CLEAR INTERRUPT COUNTER
                                                                ;POWER UP SEQUENCE ?
025502  012700  000034                  MOV     #EF.PWR,R0
025506  104447                          TRAP    C$REFG
                                                                ;GO TO 4$ IF YES
025510  103432                          BCS     4$
                                                                ;CONTINUE COMMAND ?
025512  012700  000036                  MOV     #EF.CON,R0
025516  104447                          TRAP    C$REFG
                                                                ;GO TO 1$ IF NO
025520  103002                          BCC     1$
025522  000137  026124                  JMP     CONTIN          ;GO TO 'CONTIN' IF YES
025526                          1$:                             ;'STA', 'RES' OR 'NEW PASS' ?
025526  012700  000035                  MOV     #EF.NEW,R0
025532  104447                          TRAP    C$REFG
                                                                ;GO TO 3$ IF NO, MUST BE NEW 'SUB-PASS'
025534  103016                          BCC     3$
                                                                ;CR-LF
025536  012746  003054                  MOV     #CRLF,-(SP)
025542  012746  000001                  MOV     #1,-(SP)
025546  010600                          MOV     SP,R0
025550  104417                          TRAP    C$PNTF
025552  062706  000004                  ADD     #4,SP
025556  012737  177777  002640          MOV     #-1,UNIT        ;RESET UNIT COUNT
025564  012727  177777                  MOV     #-1,(PC)+       ;RESET CLOCK MESSAGE FLAG
025570  000000                  2$:     .WORD   0               ;CLOCK MESSAGE FLAG GOES HERE
025572  005237  002640          3$:     INC     UNIT            ;GET NEXT UNIT NUMBER FOR TESTING
025576  023737  002640  002012  4$:     CMP     UNIT,L$UNIT     ;OUT OF UNITS TO TEST ?
025604  002166                          BGE     ABORT           ;BR IF YES
025606  012702  000024                  MOV     #20.,R2         ;RHXX/RP07 REGISTER COUNT
025612  012703  002660                  MOV     #RPCS1,R3       ;DATA SINK
                                                                ;GET UNIT FROM HARDWARE P-TABLE
025616  013700  002640                  MOV     UNIT,R0
025622  104442                          TRAP    C$GPHRD
025624  010005                          MOV     R0,R5
025626  103361                          BCC     3$
025630  011346                          MOV     (R3),-(SP)      ;SAVE R3
025632  011546                          MOV     (R5),-(SP)      ;AND THE BASE ADDRESS
025634  166616  000002                  SUB     2(SP),(SP)      ;DERIVE NEW ADDRESS
025640  061623                  5$:     ADD     (SP),(R3)+      ;LOG IT IN NEW TABLE
025642  005302                          DEC     R2              ;COUNT LOGGING
025644  001375                          BNE     5$              ;R2 NOT ZERO, CONTINUE LOGGING
025646  004737  010732                  JSR     PC,SIZE70       ;SEE IF RH70 IS PRESENT
025652  005737  002652                  TST     RHTYPE          ;IS IT AN RH70 ?
```

```
 49 025656  001406                      BEQ     6$                ;BR IF NO
 50 025660  017702  002650               MOV     RHEXT,R2          ;GET RPBAE OFFSET
 51 025664  061502                      ADD     (R5),R2           ;ADD BASE ADDRESS TO OFFSET
 52 025666  010223                      MOV     R2,(R3)+          ;SAVE NEW RPBAE
 53 025670  005722                      TST     (R2)+             ;ADD 2
 54 025672  010213                      MOV     R2,(R3)           ;SAVE NEW RPCS3
 55
 56 025674  022626              6$:     CMP     (SP)+,(SP)+       ;RESTORE STACK
 57 025676  012537  002642               MOV     (R5)+,RPADR       ;SAVE RPCS1 BASE ADDRESS
 58 025702  012537  002644               MOV     (R5)+,RPVEC       ;SAVE INTERUPT VECTOR ADDRESS
 59 025706  012537  002646               MOV     (R5)+,RPVEC+2     ;SAVE INTERUPT PRIORITY
 60 025712  011537  002654               MOV     (R5),DRVNO        ;SETUP DRIVE NUMBER FOR UNIT N
 61
 62 025716  004737  020226               JSR     PC,RPINIT         ;INITIALIZE THE SUB-SYSTEM
 63 025722  013705  002654               MOV     DRVNO,R5          ;PICKUP DRIVE # AS AN INDEX
 64 025726  105765  020136               TSTB    DRVSTA(R5)        ;CHECK DRIVE STATUS: IF NOT AVAILABLE, TRY ANOTHER DRIVE
 65 025732  100443                      BMI     9$                ;UNSAFE BRANCH
 66 025734  001054                      BNE     10$               ;DRIVE OK
 67 025736  105765  020146               TSTB    DRVTYP(R5)        ;NED + OFL ?
 68 025742  001425                      BEQ     8$                ;NED BRANCH: NON-EXISTENT DRV
 69 025744  100012                      BPL     7$                ;OFL BRANCH: OFF-LINE
 70
 71 025746  010546                      MOV     R5,-(SP)
    025750  012746  005273               MOV     #NOTMSG,-(SP)
    025754  012746  000002               MOV     #2,-(SP)
    025760  010600                      MOV     SP,R0
    025762  104417                      TRAP    C$PNTF
    025764  062706  000006               ADD     #6,SP
 72 025770  000700                      BR      3$                ;EXIT BLOCK
 73 025772                      7$:
    025772  010546                      MOV     R5,-(SP)
    025774  012746  005240               MOV     #OFLMSG,-(SP)
    026000  012746  000002               MOV     #2,-(SP)
    026004  010600                      MOV     SP,R0
    026006  104417                      TRAP    C$PNTF
    026010  062706  000006               ADD     #6,SP
 74 026014  000666                      BR      3$                ;EXIT BLOCK
 75 026016                      8$:
    026016  010546                      MOV     R5,-(SP)
    026020  012746  005201               MOV     #NEDMSG,-(SP)
    026024  012746  000002               MOV     #2,-(SP)
    026030  010600                      MOV     SP,R0
    026032  104417                      TRAP    C$PNTF
    026034  062706  000006               ADD     #6,SP
 76 026040  000654                      BR      3$                ;EXIT BLOCK
 77 026042                      9$:
    026042  010546                      MOV     R5,-(SP)
    026044  012746  005150               MOV     #UNSMSG,-(SP)
    026050  012746  000002               MOV     #2,-(SP)
    026054  010600                      MOV     SP,R0
    026056  104417                      TRAP    C$PNTF
    026060  062706  000006               ADD     #6,SP
 78 026064  000642                      BR      3$                ;DRV NOT AVAILABLE: TRY ANOTHER
 79
 80 026066  005737  002250       10$:    TST     CLKSTA            ;DRV IS OK! WHAT CLOCK TYPE?
 81 026072  100061                      BPL     EXINIT            ;P TYPE, OK!
 82 026074  005237  025570               INC     2$                ;UPDATE, CAN CLOCK MESSAGE BE TYPED ?
```

```
 83 026100  001056                          BNE     EXINIT          ;BR IF NO
 84                                                                  ;PRINT 'NO P-CLOCK, TIMING TESTS WILL NOT BE EXECUTED'
 85 026102  012746  004232                   MOV     #NOCLK,-(SP)
    026106  012746  000001                   MOV     #1,-(SP)
    026112  010600                           MOV     SP,R0
    026114  104417                           TRAP    C$PNTF
    026116  062706  000004                   ADD     #4,SP
 86 026122  000445                          BR      EXINIT          ;SKIP NEXT INTERMEDIATE BRANCHING
 87
 88 026124                          CONTIN:                         ;SETUP RHXX/RP07 VECTOR
 89 026124  013746  002646                   MOV     RPVEC+2,-(SP)
    026130  012746  022674                   MOV     #ISRV,-(SP)
    026134  013746  002644                   MOV     RPVEC,-(SP)
    026140  012746  000003                   MOV     #3,-(SP)
    026144  104437                           TRAP    C$SVEC
    026146  062706  000010                   ADD     #10,SP
 90 026152  004737  011676                   JSR     PC,ST.CLK       ;START CLOCK
 91 026156  104432                           TRAP    C$EXIT
    026160  000320                           .WORD   L10015-.
 92
 93 026162  004737  012262          ABORT:   JSR     PC,STOPCK       ;STOP THE CLOCK
 94 026166  012777  000040  154474           MOV     #CLR,@RPCS2     ;MASSBUS INIT TO CLEAR IMPENDING INTERRUPTS
 95 026174  005737  002250                   TST     CLKSTA          ;RELEASE APPROPRIATE CLOCK VECTOR
 96 026200  001410                           BEQ     2$              ;NO CLOCK, SKIP
 97 026202  100404                           BMI     1$              ;L-CLK
 98 026204  013700  012126                   MOV     PKV,R0
    026210  104436                           TRAP    C$CVEC
 99 026212  000403                           BR      2$              ;SKIP
100 026214                          1$:
    026214  013700  012136                   MOV     LKV,R0
    026220  104436                           TRAP    C$CVEC
101 026222                          2$:
    026222  013700  002644                   MOV     RPVEC,R0
    026226  104436                           TRAP    C$CVEC
102 026230  104444                           TRAP    C$DCLN
103 026232  104432                           TRAP    C$EXIT
    026234  000244                           .WORD   L10015-.
104
105 026236  013737  002654  002540  EXINIT:  MOV     DRVNC,DPB.A     ;STUFF DRIVE NUMBER IN DPB TABLES
106 026244  013737  002654  002560           MOV     DRVNO,DPB.B
107 026252  013737  002654  002600           MOV     DRVNO,DPB.C
108 026260  013737  002654  002620           MOV     DRVNO,DTADPB
109
110                                         ;PRINT DRIVE SERIAL NUMBER
111
112 026266  012701  000004                   MOV     #4,R1           ;4 DIGITS
113 026272  013777  002654  154370           MOV     DRVNO,@RPCS2    ;SELECT DRIVE
114 026300  013746  002654                   MOV     DRVNO,-(SP)
    026304  012746  004316                   MOV     #DSNMSG,-(SP)
    026310  012746  000002                   MOV     #2,-(SP)
    026314  010600                           MOV     SP,R0
    026316  104417                           TRAP    C$PNTF
    026320  062706  000006                   ADD     #6,SP
115 026324  017746  154360                   MOV     @RPSN,-(SP)     ;FETCH S N
116 026330  005002                  3$:      CLR     R2              ;ZERO OUTPUT
117 026332  006116                           ROL     (SP)            ;PUT NEXT DIGIT INTO R2
118 026334  006102                           ROL     R2
```

```
119 026336  006116                        ROL     (SP)
120 026340  006102                        ROL     R2
121 026342  006116                        ROL     (SP)
122 026344  006102                        ROL     R2
123 026346  006116                        ROL     (SP)
124 026350  006102                        ROL     R2
125 026352  062702  000060                ADD     #'0,R2          ;MAKE RESULT ASCII
126 026356  010237  002656                MOV     R2,DRVSN        ;SAVE R2 FOR PRINT
127 026362  012746  002656                MOV     #DRVSN,-(SP)
    026366  012746  004342                MOV     #SNDIGT,-(SP)
    026372  012746  000002                MOV     #2,-(SP)
    026376  010600                        MOV     SP,R0
    026400  104417                        TRAP    C$PNTF
    026402  062706  000006                ADD     #6,SP
128 026406  005301                        DEC     R1              ;COUNT DOWN DIGIT
129 026410  003347                        BGT     3$              ;NEXT DIGIT
130 026412  005726                        TST     (SP)+           ;RESTORE STACK
131                                                               ;CR LF
132 026414  012746  003054                MOV     #CRLF,-(SP)
    026420  012746  000001                MOV     #1,-(SP)
    026424  010600                        MOV     SP,R0
    026426  104417                        TRAP    C$PNTF
    026430  062706  000004                ADD     #4,SP
133
134 026434  004737  012622                JSR     PC,LDCMD        ;LOAD COMMAND IN DPB.B, DPB.C FOR SEEK TESTS
135 026440  012737  026162  002252        MOV     #ABORT,BYPASS   ;BYPASS ROUTE ON RP DRIVER FATAL ERROR
136 026446  112737  000020  002541        MOVB    #20,DPB.A+1     ;SET 16 BIT FORMAT
137 026454  112737  000147  002542        MOVB    #SETFORM,DPB.A+2        ;SET FORMAT MODE (16 BIT)
138 026462  004437  014260                JSR     R4,CALL.A       ;GO EXECUTE THE COMMAND
139 026466  012737  015272  002252        MOV     #ABOPAS,BYPASS  ;RESTORE ABORT ADDRESS FOR 'ERRABO' DEV FATAL ERROR
140
164
165 026474  104432                        TRAP    C$EXIT
    026476  000002                        .WORD   L10015-.
166
178                                       .EVEN
179
180 026500                          L10015:
    026500  104411                        TRAP    C$INIT
```

```
                                .SBTTL  AUTODROP SECTION
                                ;
                                ;++
                                ; THIS CODE IS EXECUTED IMMEDIATELY AFTER THE INITIALIZE CODE IF
                                ; THE "ADR" FLAG WAS SET.  THE UNIT(S) UNDER TEST ARE CHECKED TO
                                ; SEE IF THEY WILL RESPOND.  THOSE THAT DON'T ARE IMMEDIATELY
                                ; DROPPED FROM TESTING.
                                ;--
                                ;
026502                          L$AUTO::
026502                          L10016:
026502  104461                          TRAP    C$AUTO
```

```
                                .SBTTL  CLEANUP CODING SECTION

                                ;++
                                ; THE CLEANUP CODING SECTION CONTAINS THE CODING THAT IS PERFORMED
                                ; AFTER THE HARDWARE TESTS HAVE BEEN PERFORMED.
                                ;--

026504                          L$CLEAN::
                                                        ;SET PRIORITY TO 7
026504  012700  000340                  MOV     #PRI07,R0
026510  104441                          TRAP    C$SPRI
026512  012777  000040  154150          MOV     #CLR,@RPCS2     ;MASSBUS INIT TO CLEAR IMPENDING INTERRUPTS
026520  013777  002654  154142          MOV     DRVNO,@RPCS2    ;GET DRIVE NUMBER
026526  004737  012262                  JSR     PC,STOPCK       ;STOP THE CLOCK
026532  005737  002250                  TST     CLKSTA          ;RELEASE APPROPRIATE CLOCK VECTOR
026536  001410                          BEQ     2$              ;NO CLOCK, SKIP
026540  100404                          BMI     1$              ;L-CLK
                                                                ;P-CLK VECTOR RELEASE
026542  013700  012126                  MOV     PKV,R0
026546  104436                          TRAP    C$CVEC
026550  000403                          BR      2$
                                                        ;L-CLK VECTOR RELEASE
026552                          1$:
026552  013700  012136                  MOV     LKV,R0
026556  104436                          TRAP    C$CVEC
026560                          2$:                     ;RP07 VECTOR RELEASE
026560  013700  002644                  MOV     RPVEC,R0
026564  104436                          TRAP    C$CVEC
026566  104432                          TRAP    C$EXIT
026570  000002                          .WORD   L10017-.

026572                          L10017:
026572  104412                          TRAP    C$CLEAN
```

```
                                .SBTTL  DROP UNIT SECTION
                                ;++
                                ; THE DROP-UNIT SECTION CONTAINS THE CODING THAT CAUSES A DEVICE
                                ; TO NO LONGER BE TESTED.
                                ;--

026574                          L$DU::

026574  000167                          .WORD   J$JMP
026576  000000                          .WORD   L10020-2-.

                                        .EVEN

                                L10020:
026660  104453                          TRAP    C$DU
```

```
                                .SBTTL  ADD UNIT SECTION
                                ;++
                                ; THE ADD-UNIT SECTION CONTAINS ANY CODE THE PROGRAMMER WISHES
                                ;  TO BE EXECUTED IN CONJUNCTION WITH THE ADDING OF A UNIT BACK
                                ;  TO THE TEST CYCLE.
                                ;--

026602                          L$AU::

                                        .WORD   J$JMP
                                        .WORD   L10021-2-.

                                        .EVEN

026606                          L10021:
026606  104452                          TRAP    C$AU
```

```
                        .SBTTL  HARDWARE TESTS

                        ;*IN THE DESCRIPTIONS OF THE BELOW TESTS THE VARIABLES USED
                        ;*AND THEIR DEFAULT VALUES (UNLESS SPECIFIED OTHERWISE) ARE:
                        ;*
                        ;*MNEMONIC      VALUE           VARIABLE
                        ;*--------      -----           --------
                        ;*
                        ;*ITCNT         1               ITERATIONS
                        ;*FC            0               FIRST CYLINDER ADDRESS
                        ;*LC            629             LAST CYLINDER ADDRESS
                        ;*IC            1               INCREMENT VALUE
                        ;*NC OF NC1     FC+IC           NEW OR MODIFIED CYLINDER
                        ;*                              ADDRRESS
                        ;*NC2           LC-IC           NEW OR MODIFIED CYLINDER
                        ;*                              ADDRESS
                        ;*
                        ;*FT            0               FIRST TRACK ADDRESS
                        ;*LT            31.             LAST TRACK ADDRESS
                        ;*IT            1               INCREMENT VALUE
                        ;*NT            FT+IT           NEW OR MODIFIED TRACK ADDRESS
                        ;*
                        ;*FS            0               FIRST SECTOR ADDRESS
                        ;*LS            49.             LAST SECTOR ADDRESS

                        .SBTTL  SEEK TESTS

                        ;*THE SEEK TESTS WILL BE EXCUTED USING IMPLIED SEEKS. THESE
                        ;*IMPLIED SEEKS WILL BE PERFORMED BY "READ HEADER AND
                        ;*DATA" COMMANDS TO TRACK "FT" SECTOR "FS" OF THE DESIRED CYLINDER.
                        ;*THE WORD COUNT WILL BE SET SUCH THAT ONLY THE CYLINDER AND
                        ;*TRACK/SECTOR WORDS OF THE HEADER ARE READ.
                        ;*HOWEVER, THESE IMPLIED SEEKS CAN BE SUPERSEDED BY EXPLICIT SEEKS
                        ;*VIA OPERATOR DIALOGUE, IN WHICH CASE HEADER INFORMATION IS NOT VERIFIED.
```

```
                                .SBTTL  TEST 1: RECALIBRATE TEST
                                ;;*****************************************************************************
                                ;*      THIS TEST WILL CAUSE THE DRIVE TO EXECUTE A RECALIBRATE
                                ;*      COMMAND CYCLE AND THEN DO A READ HEADER AND DATA COMMAND
                                ;*      TO VERIFY POSITION.
                                ;;*****************************************************************************

026610                          T1::
026610  012737  000012  002240          MOV     #10.,ITCNT      ;SET ITERATION COUNT
026616                          TEST1:
026616  112737  000107  002542          MOVB    #RECAL,DPB.A+2  ;RECAL=COMMAND
026624  005037  002570                  CLR     DPB.B+10        ;SEC/TRK 0
026630  005037  002572                  CLR     DPB.B+12        ;CYL 0
026634                          T1.1:
026634  104402                          TRAP    C$BSUB
026636  004437  014260                  JSR     R4,CALL.A       ;GO EXECUTE THE COMMAND
026642  004437  014376                  JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
026646  005337  002240                  DEC     ITCNT           ;DONE ITERATIONS ?
026652  001361                          BNE     TEST1           ;BR IF NO
026654                          EXIT1:
026654                          L10023:
026654  104403                          TRAP    C$ESUB
026656                          L10022:
026656  104401                          TRAP    C$ETST
```

```
                                .SBTTL  TEST 2: INCREMENT SEEK TEST
                                ;;
                                ;;*************************************************************************
                                ;*      THIS TEST WILL COMMAND FORWARD SEEK CYCLES TO ADVANCE THE
                                ;*      CYLINDER ADDRESS FROM "FC" TO "LC" BY THE INCREMENT "IC".
                                ;*      WHEN THE RESULTANT CYLINDER ADDRESS (NC) EXCEEDS
                                ;*      "LC" REVERSE SEEK CYCLES ARE INITIATED; STARTING
                                ;*      AT THE LAST LEGAL "NC" AND DECREMENTING BY "IC"
                                ;*      UNTIL "NC" IS LESS THAN "FC". AT THE COMPLETION OF EACH
                                ;*      SEEK COMMAND THE PROPER INDICATORS ARE EXAMINED TO
                                ;*      ENSURE PROPER OPERATION.
                                ;;*************************************************************************
                                T2::
026660  113737  002220  002570  1$:     MOVB    FS,DPB.B+10     ;FS
026666  113737  002212  002571          MOVB    FT,DPB.B+11     ;FT
026674  013737  002204  002572          MOV     FC,DPB.B+12     ;FC
026702                          T2.11:
026702                          T2.1:
026702  104402                          TRAP    C$BSUB
026704  004437  014376                  JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
026710                          L10025:
026710  104403                          TRAP    C$ESUB
026712  063737  002210  002572          ADD     IC,DPB.B+12     ;MOVE TO NEXT CYLINDER
026720  023737  002206  002572          CMP     LC,DPB.B+12     ;OUT OF CYLINDERS?
026726  002365                          BGE     T2.11           ;NO--BRANCH
026730  013737  002206  002572          MOV     LC,DPB.B+12
026736                          T2.21:
026736                          T2.2:
026736  104402                          TRAP    C$BSUB
026740  004437  014376                  JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
026744                          L10026:
026744  104403                          TRAP    C$ESUB
026746  163737  002210  002572          SUB     IC,DPB.B+12
026754  023737  002204  002572          CMP     FC,DPB.B+12
026762  003765                          BLE     T2.21
026764                          EXIT2:
026764                          L10024:
026764  104401                          TRAP    C$ETST
```

```
                                        .SBTTL  TEST 3: RANDOM SEEK TEST
                                        ;
                                        ;*************************************************************************
                                        ;*      THIS TEST PERFORMS RANDOM SEEK OPERATIONS BETWEEN CYLINDERS 'FC'
                                        ;*      'LC'.  AFTER EACH SEEK, THE POSITION OF THE DRIVE IS VERIFIED BY
                                        ;*      READING A SECTOR FROM THE CURRENTLY ADDRESSED CYLINDER AND TRACK.
                                        ;*      THE TRACK ADDRESS IS INCREMENTED FOR EACH SEEK SO THAT VERIFICATION
                                        ;*      OF POSITIONING OCCURS USING EACH HEAD.  TRACK ADDRESSES ARE INCREMEN
                                        ;*      BETWEEN PARAMTERS 'FT' AND 'LT'.
                                        ;*      THE RANDOM CYLINDER IS GENERATED BY USING THE 'MOD' FUNCTION:
                                        ;*              X MOD Y = X - (X DIV Y) * Y
                                        ;*      IF X,Y ARE INTEGERS WITH Y <> 0 THEN:
                                        ;*              X MOD Y = REMAINDER OF X DIV Y
                                        ;*      THE ACTUAL OPERATION PERFORMED IS:
                                        ;*              FC + $RP1 MOD (LC+1)-FC
                                        ;*      BY DOING:
                                        ;*              CYL = FC + R
                                        ;*      WHERE R IS OBTAINED BY:
                                        ;*              $RP1 DIV (LC+1)-FC = Q + R
                                        ;*      WHERE Q = QUOTIENT,  R = REMAINDER,  $RP1 = A RANDOM NUMBER FROM RAND CALL.
                                        ;*************************************************************************
                                        ;
026766                                  T3::
026766  012737  000012  002240                  MOV     #10.,ITCNT      ;SET ITERATION COUNT
026774  113737  002212  002571                  MOVB    FT,DPB.B+11     ;LOAD STARTING TRACK ADDRESS
027002  112737  000105  002542                  MOVB    #SEEK,DPB.A+2   ;SEEK=COMMAND
027010  013737  002204  002572  TEST3:  MOV     FC,DPB.B+12     ;INITIAL CYLINDER ADDRESS
027016  023737  002204  002206                  CMP     FC,LC           ;CYLINDER LIMITS THE SAME ?
027024  001423                                  BEQ     T3.11           ;BR IF THEY ARE
                                        ;
                                        ;GENERATE A RANDOM CYLINDER
                                        ;
027026  004737  011610                  JSR     PC,RAND         ;CYCLE THE RANDOM NUMBER GENERATOR
027032  013746  011672                  MOV     $RP1,-(SP)      ;USE THE HIGH RANDOM NUMBER
027036  005046                          CLR     -(SP)           ;UPPER DIVIDEND
027040  013746  002206                  MOV     LC,-(SP)        ;FORM THE DIVISOR
027044  005216                          INC     (SP)            ;INCREMENT
027046  163716  002204                  SUB     FC,(SP)         ;SUBTRACT THE LOWER LIMIT
027052  004737  011074                  JSR     PC,$DIV         ;DIVIDE
027056  062637  002572                  ADD     (SP)+,DPB.B+12  ;ADD THE REMAINDER TO THE INITIAL CYLINDER
027062  005726                          TST     (SP)+           ;DISCARD THE QUOTENT
                                        ;
                                        ;END OF RANDOM CYL GEN.
                                        ;
027064  013737  002572  002552                  MOV     DPB.B+12,DPB.A+12       ;COPY NEW CYLINDER ADDRESS
027072                                  T3.1:
027072  104402                          TRAP    C$BSUB
027074                                  T3.11:
027074  004437  014260                  JSR     R4,CALL.A       ;GO EXECUTE THE COMMAND
027100                                  L10030:
027100  104403                          TRAP    C$ESUB
027102                                  T3.2:
027102  104402                          TRAP    C$BSUB
027104  113777  002540  153556                  MOVB    DPB.A,@RPCS2    ;SELECT THE DRIVE
027112  017746  153562                  MOV     @RPLA,-(SP)     ;GET THE LOOK AHEAD REGISTER
027116  006316                          ASL     (SP)            ;ALIGN THE SECTOR ADDRESS
027120  006316                          ASL     (SP)            ;ALIGN THE SECTOR ADDRESS
```

TEST 3: RANDOM SEEK TEST

```
     54 027122  000316                          SWAB    (SP)              ;PUT ADDRESS IN LOWER BYTE
     55 027124  112637  002570                  MOVB    (SP)+,DPB.B+10    ;LOAD THE DPB
     56 027130  013746  002264                  MOV     NS1,-(SP)         ;PUT LAST SECTOR ADDRESS ON THE STACK
     57 027134  122637  002570                  CMPB    (SP)+,DPB.B+10    ;NEW SECTOR ADDRESS TOO LARGE ?
     58 027140  103007                          BHIS    2$                ;BR IF NOT
     59 027142  103403                          BLO     1$                ;BR IF ADDRESS IS 2 GREATER
     60 027144  105037  002570                  CLRB    DPB.B+10          ;RESET TO SECTOR ADDRESS 0
     61 027150  000403                          BR      2$                ;CONTINUE
     62 027152  112737  000001  002570  1$:     MOVB    #1,DPB.B+10       ;RESET ADDRESS TO SECTOR 1
     63 027160                          2$:
        027160  004437  014376                  JSR     R4,CALL.B         ;GO EXECUTE THE COMMAND
     64 027164                          L10031:
        027164  104403                          TRAP    C$ESUB
     65 027166  105237  002571                  INCB    DPB.B+11          ;INCREMENT THE TRACK ADDRESS
     66 027172  123737  002571  002214          CMPB    DPB.B+11,LT       ;MAXIMUM ?
     67 027200  101703                          BLOS    TEST3             ;BR IF NOT
     68 027202  113737  002212  002571          MOVB    FT,DPB.B+11       ;RELOAD STARTING TRACK ADDRESS
     69 027210  005337  002240          EXIT3:  DEC     ITCNT             ;DONE ITERATIONS ?
     70 027214  001275                          BNE     TEST3             ;BR IF NO
     71 027216                          L10027:
        027216  104401                          TRAP    C$ETST
```

TEST 4: RECAL, RANDOM SEEK TEST

```
                                        .SBTTL  TEST 4: RECAL, RANDOM SEEK TEST
                                        ;
                                        ;;*************************************************************************
                                        ;*      THIS TEST EXECUTES A RECAL COMMAND, THEN A SEEK IMPLIED IN A READ HEADER
                                        ;*      AND DATA COMMAND, TO A RANDOMLY SELECTED CYLINDER.
                                        ;*      THIS SEQUENCE IS REPEATED 10 TIMES.
                                        ;*      THE TRACK AD OF THE RANDOMLY SELECTED CYLINDER IS INCREMENTED BY ONE,
                                        ;*      STARING FROM FC, AT EACH TEST ITERATION.
                                        ;*      THE RANDOM CYLINDER IS GENERATED BY USING THE 'MOD' FUNCTION:
                                        ;*              X MOD Y = X - (X DIV Y) * Y
                                        ;*      IF X,Y ARE INTEGERS WITH Y <> 0 THEN:
                                        ;*              X MOD Y = REMAINDER OF X DIV Y
                                        ;*      THE ACTUAL OPERATION PERFORMED IS:
                                        ;*              FC + $RP1 MOD (LC+1)-FC
                                        ;*      BY DOING:
                                        ;*              CYL = FC + R
                                        ;*      WHERE R IS OBTAINED BY:
                                        ;*              $RP1 DIV (LC+1)-FC = Q + R
                                        ;*      WHERE Q = QUOTIENT,  R = REMAINDER,  $RP1 = A RANDOM NUMBER FROM RAND CALL.
                                        ;;*************************************************************************
                                        ;
027220                                  T4::
027220  012737  000012  002240                  MOV     #10.,ITCNT      ;SET ITERATION COUNT
027226  113737  002212  002571                  MOVB    FT,DPB.B+11     ;LOAD STARTING TRACK ADDRESS
027234  112737  000107  002542                  MOVB    #RECAL,DPB.A+2  ;RECAL=COMMAND
027242  013737  002204  002572  TEST4:         MOV     FC,DPB.B+12     ;INITIAL CYLINDER ADDRESS
                                        ;
                                        ;GENERATE A RANDOM CYLINDER
                                        ;
027250  004737  011610                          JSR     PC,RAND         ;CYCLE THE RANDOM NUMBER GENERATOR
027254  013746  011672                          MOV     $RP1,-(SP)      ;USE THE HIGH RANDOM NUMBER
027260  005046                                  CLR     -(SP)           ;UPPER DIVIDEND
027262  013746  002206                          MOV     LC,-(SP)        ;FORM THE DIVISOR
027266  005216                                  INC     (SP)            ;INCREMENT
027270  163716  002204                          SUB     FC,(SP)         ;SUBTRACT THE LOWER LIMIT
027274  004737  011074                          JSR     PC,$DIV         ;DIVIDE
027300  062637  002572                          A^^     (SP)+,DPB.B+12  ;ADD THE REMAINDER TO THE INITIAL CYLINDER
027304  005726                                  TST     (SP)+           ;DISCARD THE QUOTENT
                                        ;
                                        ;END OF RANDOM CYL GEN.
027306                                  T4.1:
027306  104402                                  TRAP    C$BSUB
027310  004437  014260                          JSR     R4,CALL.A       ;GO EXECUTE THE COMMAND
027314                                  L10033:
027314  104403                                  TRAP    C$ESUB
027316                                  T4.2:
027316  104402                                  TRAP    C$BSUB
027320  113777  002540  153342                  MOVB    DPB.A,@RPCS2    ;SELECT THE DRIVE
027326  017746  153346                          MOV     @RPLA,-(SP)     ;GET THE LOOK AHEAD REGISTER
027332  006316                                  ASL     (SP)            ;ALIGN THE SECTOR ADDRESS
027334  006316                                  ASL     (SP)            ;ALIGN THE SECTOR ADDRESS
027336  000316                                  SWAB    (SP)            ;PUT ADDRESS IN LOWER BYTE
027340  112637  002570          1$:             MOVB    (SP)+,DPB.B+10  ;LOAD THE DPB
027344  013746  002264                          MOV     NS1,-(SP)       ;PUT LAST SECTOR ADDRESS ON THE STACK
027350  122637  002570                          CMPB    (SP)+,DPB.B+10  ;NEW SECTOR ADDRESS TOO LARGE ?
027354  103007                                  BHIS    3$              ;BR IF NOT
027356  103403                                  BLO     2$              ;BR IF ADDRESS IS 2 GREATER
```

```
     55 027360  105037  002570                 CLRB    DPB.B+10        ;RESET TO SECTOR ADDRESS 0
     56 027364  000403                         BR      3$              ;CONTINUE
     57
     58 027366  112737  000001  002570  2$:    MOVB    #1,DPB.B+10     ;RESET ADDRESS TO SECTOR 1
     59 027374                         3$:
        027374  004437  014376                 JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
     60 027400                         L10034:
        027400  104403                         TRAP    C$ESUB
     61 027402  105237  002571                 INCB    DPB.B+11        ;INCREMENT THE TRACK ADDRESS
     62 027406  123737  002571  002214         CMPB    DPB.B+11,LT     ;MAXIMUM ?
     63 027414  101712                         BLOS    TEST4           ;BR IF NOT
     64 027416  113737  002212  002571         MOVB    FT,DPB.B+11     ;RELOAD STARTING TRACK ADDRESS
     65 027424  005337  002240         EXIT4:  DEC     ITCNT           ;DONE ITERATIONS ?
     66 027430  001304                         BNE     TEST4           ;BR IF NO
     67 027432                         L10032:
        027432  104401                         TRAP    C$ETST
```

```
                                .SBTTL  TEST 5: DIFFERENTIAL SEEK TEST

                                ;;*****************************************************************************
                                ;*      THIS TEST CONSISTS OF 3 SUBTESTS TO TEST THE HEAD POSITIONER AND SERVO
                                ;*      SYSTEM RESPONSE TO 3 UNIQUE DIFFERENTIAL SEEK PROFILES:
                                ;*      1. 6 CYL DIF SEEK:  FORCES A SLEW RATE CHANGE BY SEEKING FROM CYL 0 TO 5,
                                ;*      2 TO 7, ... 624 TO 629, TO TEST THE POSITIONAL LOGIC.
                                ;*
                                ;*      2. 33 CYL DIF SEEK:  WORST CASE SEEK OVERSHOOT TEST, FORCED BY SEEKING
                                ;*      FROM CYL 0 TO 32, 1 TO 33, 2 TO 34, ... 597 TO 629.
                                ;*
                                ;*      3. 400 CYL DIF SEEK:  FORCES MAX ACCELERATION AND DECELERATION OF CARRIAGE
                                ;*      ASSEMBLY, FORCED BY SEEKING FROM CYL 0 TO 399, 1 TO 400, 2 TO 401, ...
                                ;*      230 TO 629.
                                ;;*****************************************************************************

027434                          T5::
027434  113737  002220  002570          MOVB    FS,DPB.B+10     ;FIRST SEEK OF THE PAIR OF SEEKS READS FS, FT
027442  113737  002212  002571          MOVB    FT,DPB.B+11
027450  113737  002222  002610          MOVB    LS,DPB.C+10     ;SECOND SEEK OF THE PAIR OF SEEKS READS LS, LT
027456  113737  002214  002611          MOVB    LT,DPB.C+11

                                        ;6 CYL DIFF SEEK

027464  005037  002572          TEST5:  CLR     DPB.B+12        ;FIRST SEEK STARTS AT 0
027470  012737  000005  002612          MOV     #5,DPB.C+12     ;SECOND SEEK IS TO FIRST CYL + 5
027476                          T5.1:
027476  104402                          TRAP    C$BSUB
027500                          T5.11:
027500  004437  014376                  JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
027504                          L10036:
027504  104403                          TRAP    C$ESUB
027506                          T5.2:
027506  104402                          TRAP    C$BSUB
027510  004437  014560                  JSR     R4,CALL.C       ;GO EXECUTE THE COMMAND
027514                          L10037:
027514  104403                          TRAP    C$ESUB
027516  005237  002572                  INC     DPB.B+12        ;NEXT CYL OF FIRST SEEK
027522  005237  002612                  INC     DPB.C+12        ;NEXT CYL OF SECOND SEEK
027526  023737  002256  002612          CMP     NC1,DPB.C+12    ;REACHED LAST USER CYL ON SECOND(LAST?) SEEK?
027534  002361                          BGE     T5.11           ;NOT YET, REPEAT ABOVE SEQ UNTIL OUT OF CYL

                                        ;33 CYL DIFF SEEK

027536  005037  002572                  CLR     DPB.B+12        ;FIRST SEEK STARTS AT 0
027542  012737  000040  002612          MOV     #32.,DPB.C+12   ;SECOND SEEK IS TO FIRST CYL + 32.
027550                          T5.3:
027550  104402                          TRAP    C$BSUB
027552                          T5.31:
027552  004437  014376                  JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
027556                          L10040:
027556  104403                          TRAP    C$ESUB
027560                          T5.4:
027560  104402                          TRAP    C$BSUB
027562  004437  014560                  JSR     R4,CALL.C       ;GO EXECUTE THE COMMAND
027566                          L10041:
027566  104403                          TRAP    C$ESUB
```

```
     48 027570  005237  002572                    INC     DPB.B+12        ;NEXT CYL OF FIRST SEEK
     49 027574  005237  002612                    INC     DPB.C+12        ;NEXT CYL OF SECOND SEEK
     50 027600  023737  002256  002612            CMP     NC1,DPB.C+12    ;REACHED LAST USER CYL ON SECOND(LAST?) SEEK?
     51 027606  002361                            BGE     T5.31           ;NOT YET, REPEAT ABOVE SEQ UNTIL OUT OF CYL
     52
     53                                           ;400 CYL DIFF SEEK
     54
     55 027610  005037  002572                    CLR     DPB.B+12        ;FIRST SEEK STARTS AT 0
     56 027614  012737  000617  002612            MOV     #399.,DPB.C+12  ;SECOND SEEK IS TO FIRST CYL + 399.
     57 027622                          T5.5:
        027622  104402                            TRAP    C$BSUB
     58 027624                          T5.51:
        027624  004437  014376                    JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
     59 027630                          L10042:
        027630  104403                            TRAP    C$ESUB
     60 027632                          T5.6:
        027632  104402                            TRAP    C$BSUB
     61 027634  004437  014560                    JSR     R4,CALL.C       ;GO EXECUTE THE COMMAND
     62 027640                          L10043:
        027640  104403                            TRAP    C$ESUB
     63 027642  005237  002572                    INC     DPB.B+12        ;NEXT CYL OF FIRST SEEK
     64 027646  005237  002612                    INC     DPB.C+12        ;NEXT CYL OF SECOND SEEK
     65 027652  023737  002256  002612            CMP     NC1,DPB.C+12    ;REACHED LAST USER CYL ON SECOND(LAST?) SEEK?
     66 027660  002361                            BGE     T5.51           ;NOT YET, REPEAT ABOVE SEQ UNTIL OUT OF CYL
     67 027662                          EXIT5:
        027662                          L10035:
        027662  104401                            TRAP    C$ETST
```

```
                                .SBTTL  TEST 6: OSCILLATING SEEK TEST
                                ;
                                ;;*************************************************************************
                                ;*      THIS TEST PERFORMS A SERIES OF SEEK OPERATIONS TO CAUSE AN OSCILLATING
                                ;*      MOVEMENT OF THE HEAD POSITIONER.
                                ;;*************************************************************************
                                ;
027664                          T6::
027664  113737  002220  002570          MOVB    FS,DPB.B+10     ;FS
027672  113737  002212  002571          MOVB    FT,DPB.B+11     ;FT
027700  113737  002222  002610          MOVB    LS,DPB.C+10     ;LS
027706  113737  002214  002611          MOVB    LT,DPB.C+11     ;LT
027714  013737  002204  002572  TEST6:  MOV     FC,DPB.B+12     ;FC
027722  013737  002206  002612          MOV     LC,DPB.C+12     ;LC
027730                          T6.1:
027730  104402                        TRAP    C$BSUB
027732                          T6.11:
027732  004437  014376                JSR     R4,CALL.B       ;GO EXECUTE THE COMMAND
027736                          L10045:
027736  104403                        TRAP    C$ESUB
027740                          T6.2:
027740  104402                        TRAP    C$BSUB
027742  004437  014560                JSR     R4,CALL.C       ;GO EXECUTE THE COMMAND
027746                          L10046:
027746  104403                        TRAP    C$ESUB
027750  005237  002572                INC     DPB.B+12
027754  005337  002612                DEC     DPB.C+12
027760  023737  002612  002204        CMP     DPB.C+12,FC     ;UNTIL
027766  002361                        BGE     T6.11
027770                          EXIT6:
027770                          L10044:
027770  104401                        TRAP    C$ETST
```

```
                                                .SBTTL  TIMING TESTS

                                                ;;*****************************************************************
                                                ;*THE TIMING TESTS WILL ENSURE THAT THOSE FUNCTIONS BEING
                                                ;*TIMED ARE WITHIN THE TOLERANCES SPECIFIED IN THE "RP07
                                                ;*ENGINEERING SPECIFICATIONS".
                                                ;*THE SEEK TIMING WILL BE PERFORMED USING EXPLICIT SEEK
                                                ;*OPERATIONS. AT THE COMPLETION OF EACH OF THE TIMING
                                                ;*TESTS THE MINIMUM, MAXIMUM AND AVERAGE TIMES WILL BE
                                                ;*TYPED, IF TIMTYP=1.

                                                .SBTTL  TEST 7: ROTATIONAL SPEED TIMING TEST

                                                ;;*****************************************************************
                                                ;*       THIS TEST WILL START A SEARCH TO CYLINDER FC, TRACK FT, SECTOR
                                                ;*       FS.  AS SOON AS THE INTERRUPT OCCURS, THE GO BIT IS SET AGAIN
                                                ;*       AND THE OPERATION IS TIMED.  THIS PROCEDURE IS REPEATED 10
                                                ;*       TIMES THEN THE AVERAGE TIME IS CALCULATED AND CHECKED TO
                                                ;*       ENSURE IT IS WITHIN TOLERANCE:
                                                ;*               16.515 MS/REV + OR - 3%
                                                ;;*****************************************************************

027772                                          T7::
027772  005737  002250                                  TST     CLKSTA          ;KW11-P CLOCK?
027776  003002                                          BGT     1$              ;YES--START TEST
030000  104432                                          TRAP    C$EXIT
030002  001044                                          .WORD   L10047-.
030004  004437  015476                          1$:     JSR     R4,SRCH00       ;DO A MASSBUS INIT & RECAL
030010  000402                                          BR      2$              ;RETURN HERE IF NO ERROR
030012  000137  031020                                  JMP     EXIT7           ;RETURN HERE IF ERROR

030016  005005                                  2$:     CLR     R5              ;COUNT UP
030020  012703  002432                                  MOV     #T7A,R3         ;TIMING LIMITS
030024  012701  000012                          TEST7:  MOV     #10.,R1         ;TIME 10 SEARCHES
030030  004737  015626                                  JSR     PC,STRTMR       ;INITIALIZE THE TIMERS
030034  004737  012262                                  JSR     PC,STOPCK       ;STOP THE CLOCK
                                                                                ;SETUP VECTOR IN CASE OF CLOCK OVERFLOW
030040  012746  000300                                  MOV     #PRI06,-(SP)
030044  012746  030660                                  MOV     #T7.7$,-(SP)
030050  013746  012126                                  MOV     PKV,-(SP)
030054  012746  000003                                  MOV     #3,-(SP)
030060  104437                                          TRAP    C$SVEC
030062  062706  000010                                  ADD     #10,SP
                                                                                ;SETUP RHXX/RP07 VECTOR
030066  012746  000000                                  MOV     #PRI00,-(SP)
030072  012746  015624                                  MOV     #DORTI,-(SP)
030076  013746  002644                                  MOV     RPVEC,-(SP)
030102  012746  000003                                  MOV     #3,-(SP)
030106  104437                                          TRAP    C$SVEC
030110  062706  000010                                  ADD     #10,SP
030114  013777  002204  152572                          MOV     FC,@RPDC        ;FC
030122  013746  002220                                  MOV     FS,-(SP)        ;FS
030126  113766  002212  000001                          MOVB    FT,1(SP)        ;FT
030134  012677  152526                                  MOV     (SP)+,@RPDA     ;LOAD FT/FS
030140                                          T7.1:
030140  104402                                          TRAP    C$BSUB
030142  005077  161754                          T7.1$:  CLR     @PKB            ;START COUNTING AT ZERO
```

```
                                                MOV     #131,@PKCS      ;INT.EN., COUNT UP AT 100KHZ
                                                MOV     #SEARCH,@RPCS1  ;START A SEARCH
                                                WAIT                    ;WAIT ON INTERRUPT
                                                MOV     @PKC,-(SP)      ;SAVE THE CLOCK
                                                BIC     #101,@PKCS      ;STOP THE CLOCK
                                                MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
                                                BIT     #BIT14,@RPDS    ;ERROR?
                                                BEQ     T7.2$           ;NO--BRANCH
                                                JSR     PC,SAVREG       ;;SAVE R0-R5
                                                MOV     #DTADPB,R2      ;DPB POINTER
                                                JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                                                MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                                                MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                                                JSR     PC,RESREG       ;;RESTORE R0-R5
                                                JSR     R5,ERRANY
                                                DTADPB                  ;FIND OUT WHAT ERROR
                                        L10050:
                                                TRAP    C$ESUB
                                                BIT     #BIT3!BIT7,SVSTAT       ;RETRY ALLOWED ?
                                                BNE     T7.44$          ;BRANCH IS SO
                                        T7.10$:
                                                MOV     #SEAERR,-(SP)
                                                MOV     #1,-(SP)
                                                MOV     SP,R0
                                                TRAP    C$PNTF
                                                ADD     #4,SP
                                                MOV     #ABOTST,-(SP)
                                                MOV     #1,-(SP)
                                                MOV     SP,R0
                                                TRAP    C$PNTF
                                                ADD     #4,SP
                                                JMP     T7.8$

                                        T7.44$: MOV     #16.,WCEFLG     ;RETRY 16 TIMES
                                        1$:     MOV     #SEARCH,@RPCS1
                                                WAIT                    ;WAIT FOR INTERRUPT
                                                BIT     #BIT14,@RPDS    ;ANY ERROR ?
                                                BEQ     T7.2$           ;EXIT IF NONE
                                                MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                                                MOV     DTADPB,@RPCS2   ;DRIVE ADDRESS
                                                DEC     WCEFLG          ;OVER RETRY LIMIT ?
                                                BNE     1$              ;BRANCH IF NOT
                                        T7.20$:
                                                MOV     #SEABAD,-(SP)
                                                MOV     #1,-(SP)
                                                MOV     SP,R0
                                                TRAP    C$PNTF
                                                ADD     #4,SP
                                                MOV     #ABOTST,-(SP)
                                                MOV     #1,-(SP)
                                                MOV     SP,R0
                                                TRAP    C$PNTF
                                                ADD     #4,SP
                                                BR      T7.8$           ;EXIT
                                        T7.2:
                                                TRAP    C$BSUB
                                        T7.2$:  CLR     @PKB            ;START THE COUNT AT ZERO
```

```
     78 030452  012777  000131  152200          MOV     #SEARCH,@RPCS1  ;START A SEARCH
     79 030460  012777  000131  161432          MOV     #131,@PKCS      ;START THE CLOCK
     80 030466  000001                          WAIT                    ;WAIT ON INTERRUPT
     81 030470  017746  161430                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
     82 030474  042777  000101  161416          BIC     #101,@PKCS      ;STOP THE CLOCK
     83 030502  012677  161414                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
     84 030506  032777  040000  152156          BIT     #BIT14,@RPDS    ;IS "ERR=1"?
     85 030514  001453                          BEQ     T7.3$           ;NO--BRANCH
     86 030516  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
        030522  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
        030526  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
        030532  012777  000040  152130          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
        030540  013777  002620  152122          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
        030546  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
     87 030552  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
     88 030556  002620                          DTADPB
     89 030560                          L10051:
        030560  104403                          TRAP    C$ESUB
     90 030562  032737  000210  002254          BIT     #BIT3!BIT7,SVSTAT       ;RETRY ALLOWED ?
     91 030570  001636                          BEQ     T7.10$          ;BRANCH IF NOT, ABORT TEST
     92 030572  012737  000020  002340          MOV     #16.,WCEFLG     ;RETRY 16 TIMES
     93 030600  012777  000131  152052  1$:     MOV     #SEARCH,@RPCS1  ;START TO SEARCH
     94 030606  000001                          WAIT
     95 030610  032777  040000  152054          BIT     #BIT14,@RPDS    ;ANY ERROR
     96 030616  001412                          BEQ     T7.3$           ;BRANCH IF NONE
     97 030620  012777  000040  152042          MOV     #CLR,@RPCS2     ;MASS BUS CLEAR
     98 030626  013777  002620  152034          MOV     DTADPB,@RPCS2   ;LOAD THE DRIVE ADDRESS
     99 030634  005337  002340                  DEC     WCEFLG          ;DECREMENT THE RETRY COUNT
    100 030640  001357                          BNE     1$              ;BRANCH IF NOT OVER THE LIMIT
    101 030642  000657                          BR      T7.20$          ;EXIT
    102
    103 030644  004737  016076          T7.3$:  JSR     PC,COUNT        ;UPDATE THE COUNT
    104 030650  005301                          DEC     R1              ;DONE?
    105 030652  003444                          BLE     T7.8$           ;YES--GO TO THE EXIT
    106 030654  000137  030142                  JMP     T7.1$           ;NO, LOOP
    107
    108 030660  004737  012324          T7.7$:  JSR     PC,FORSEC       ;RESET TIMER TO 4 SEC, CHANGE CLK SERVICE AD
    109                                                                 ;DROP THE PRIORITY
    110 030664  012700  000000                  MOV     #PR100,R0
        030670  104441                          TRAP    C$SPRI
    111 030672  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
        030676  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
        030702  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
        030706  012777  000040  151754          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
        030714  013777  002620  151746          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
        030722  016102  000014                  MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
        030726  016237  000036  002266          MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
        030734  116237  000006  002272          MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
        030742  116237  000007  002270          MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
        030750  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    112 030754  104456                          TRAP    C$ERHRD
        030756  000024                          .WORD   20
        030760  006112                          .WORD   EM20
        030762  007604                          .WORD   DH44
    113 030764                          T7.8$:
        030764  012777  000040  151676          MOV     #CLR,@RPCS2     ;CLEAR THE MASSBUS
        030772  013777  002620  151670          MOV     DTADPB,@RPCS2   ;& SELECT DRIVE
```

```
    114 031000  004737  011676                  JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
    115 031004  004437  016370                  JSR     R4,TYPTIM       ;GO TYPE THE TIMES
        031010  002432                          T7A                     ;POINTER
    116 031012  004437  016240                  JSR     R4,SPTYP        ;TYPE THE SPECIFICATION VALUE
    117 031016  002502                          SP7
    118 031020                          EXIT7:                          ;SETUP RHXX/RP07 VECTOR
    119 031020  013746  002646                  MOV     RPVEC+2,-(SP)
        031024  012746  022674                  MOV     #ISRV,-(SP)
        031030  013746  002644                  MOV     RPVEC,-(SP)
        031034  012746  000003                  MOV     #3,-(SP)
        031040  104437                          TRAP    C$SVEC
        031042  062706  000010                  ADD     #10,SP
    120 031046                          L10047:
        031046  104401                          TRAP    C$ETST
```

```
                                .SBTTL  TEST 8: ONE CYLINDER SEEK TIMING TEST

                                ;;*************************************************************************
                                ;*      THIS TEST WILL COMMAND FORWARD SEEK CYCLES TO ADVANCE THE
                                ;*      CYLINDER BY ONE FROM FC  UNTIL THE INCREMENT IS GREATER THAN THE
                                ;*      CYLINDER 'LC', THEN REVERSE SEEK TO CYLINDER 'FC'. DO IT TWICE.
                                ;*      THE TIME TO PERFORM EACH SEEK IS CHECKED TO ENSURE IT DOES NOT
                                ;*      EXCEED THE MAXIMUM TIME PERMITTED FOR A ONE CYLINDER SEEK.
                                ;*      THE TIME MUST BE LESS THAN 4MS.
                                ;;*************************************************************************

031050                          T8::
031050  005737  002250                TST     CLKSTA          ;KW11-P CLOCK?
031054  003002                        BGT     1$              ;YES--START TEST
031056  104432                        TRAP    C$EXIT
031060  000756                        .WORD   L10052-.
031062  004437  015476        1$:     JSR     R4,SRLH00       ;DO A MASSBUS INIT. AND RECAL
031066  000402                        BR      2$              ;NO ERROR RETURN
031070  104432                        TRAP    C$EXIT
031072  000744                        .WORD   L10052-.
031074  012703  002442        2$:     MOV     #TIMT10,R3      ;PARAMETER POINTER
031100  005037  002246        TEST8:  CLR     DOTWO           ;SET-UP FOR TWO ITERATIONS
031104  013737  002204  002632        MOV     FC,DTADPB+12    ;START WITH BEGINNING CYLINDER
031112  005737  002204                TST     FC              ;IF FC <> 0
031116  001407                        BEQ     T8.5$           ;ELSE SKIP
031120  012737  000105  002622        MOV     #SEEK,DTADPB+2  ;THEN SEEK TO FC BEFORE TIMING PORTION OF TEST
031126                          T8.1:
031126  104402                        TRAP    C$BSUB
031130  004437  014742                JSR     R4,DRVCAL       ;SEEK TO FC
031134                          L10053:
031134  104403                        TRAP    C$ESUB
031136  005005                T8.5$:  CLR     R5              ;SET THE UP/DOWN SWITCH TO UP
031140  004737  015626                JSR     PC,STRTMR       ;INITIALIZE THE TIMERS
031144  004737  012262                JSR     PC,STOPCK       ;STOP THE CLOCK
                                                            ;SETUP VECTOR IN CASE OF CLOCK OVERFLOW
031150  012746  000300                MOV     #PRI06,-(SP)
031154  012746  031650                MOV     #T8.7$,-(SP)
031160  013746  012126                MOV     PKV,-(SP)
031164  012746  000003                MOV     #3,-(SP)
031170  104437                        TRAP    C$SVEC
031172  062706  000010                ADD     #10,SP
                                                            ;SETUP RHXX/RP07 VECTOR
031176  012746  000000                MOV     #PRI00,-(SP)
031202  012746  015624                MOV     #DORTI,-(SP)
031206  013746  002644                MOV     RPVEC,-(SP)
031212  012746  000003                MOV     #3,-(SP)
031216  104437                        TRAP    C$SVEC
031220  062706  000010                ADD     #10,SP

                                        ;SEEK FORWARD:  FC --> LC

031224  005237  002632        T8.1$:  INC     DTADPB+12       ;MOVE TO NEXT CYLINDER UP
031230  023737  002632  002206        CMP     DTADPB+12,LC    ;OUT OF CYLINDERS?
031236  003063                        BGT     T8.3$           ;YES, GO SEEK REVERSE
031240                          T8.2:
031240  104402                        TRAP    C$BSUB
031242  005077  160654                CLR     @PKB            ;START THE COUNTER AT ZERO
```

```
     031246  013777  002632  151440          MOV     DTADPB+12,@RPDC ;LOAD DESIRED CYLINDER
     031254  012777  000105  151376          MOV     #SEEK,@RPCS1    ;START A SEEK
     031262  012777  000131  160630          MOV     #131,@PKCS      ;START THE CLOCK
     031270  000001                          WAIT                    ;WAIT ON INTERRUPT
     031272  017746  160626                  MOV     @PKC,-(SP)      ;GET THE CURRENT COUNT
     031276  042777  000101  160614          BIC     #101,@PKCS      ;STOP THE CLOCK
     031304  012677  160612                  MOV     (SP)+,@PKB      ;AND RESTORE THE VALUE
     031310  032777  040000  151354          BIT     #BIT14,@RPDS    ;ANY DISK ERRORS?
     031316  001426                          BEQ     T8.2$           ;NO--BRANCH
     031320  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
     031324  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
     031330  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
     031334  012777  000040  151326          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
     031342  013777  002620  151320          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
     031350  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
     031354  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
     031360  002620                          DTADPB
     031362                          L10054:
     031362  104403                          TRAP    C$ESUB
     031364  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
     031372  001075                          BNE     T8.9$           ;YES, ABORT TEST
     031374  004737  016076          T8.2$:  JSR     PC,COUNT        ;COUNT THIS SEEKS TIME
     031400  004737  012450                  JSR     PC,TWOMS        ;STALL TWO MILLISECONDS
     031404  000707                          BR      T8.1$           ;LOOP, SEEK FORWARD
     031406  005337  002632          T8.3$:  DEC     DTADPB+12       ;MOVE TO NEXT CYLINDER DOWN
     031412  012705  177777                  MOV     #-1,R5          ;SET UP/DOWN SWITCH TO DOWN

                                             ;SEEK REVERSE:  FC <-- LC

     031416  005337  002632          T8.4$:  DEC     DTADPB+12       ;MOVE TO NEXT CYLINDER DOWN
     031422  023737  002632  002204          CMP     DTADPB+12,FC    ;OUT OF CYLINDERS?
     031430  002474                          BLT     T8.6$           ;YES, EXIT LOOP
     031432                          T8.3:
     031432  104402                          TRAP    C$BSUB
     031434  005077  160462                  CLR     @PKB            ;START THE COUNTER AT ZERO
     031440  013777  002632  151246          MOV     DTADPB+12,@RPDC ;LOAD DESIRED CYLINDER
     031446  012777  000105  151204          MOV     #SEEK,@RPCS1    ;START A SEEK
     031454  012777  000131  160436          MOV     #131,@PKCS      ;START THE CLOCK
     031462  000001                          WAIT                    ;WAIT ON INTERRUPT
     031464  017746  160434                  MOV     @PKC,-(SP)      ;GET THE CURRENT COUNT
     031470  042777  000101  160422          BIC     #101,@PKCS      ;STOP THE CLOCK
     031476  012677  160420                  MOV     (SP)+,@PKB      ;AND RESTORE THE VALUE
     031502  032777  040000  151162          BIT     #BIT14,@RPDS    ;ANY DISK ERRORS?
     031510  001437                          BEQ     T8.10$          ;NO--BRANCH
     031512  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
     031516  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
     031522  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
     031526  012777  000040  151134          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
     031534  013777  002620  151126          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
     031542  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
     031546  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
     031552  002620                          DTADPB
     031554                          L10055:
     031554  104403                          TRAP    C$ESUB
     031556  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
     031564  001411                          BEQ     T8.10$          ;NO, CONTINUE
     031566                          T8.9$:
```

TEST 8: ONE CYLINDER SEEK TIMING TEST

```
        031566  012746  004544                  MOV     #POSERR,-(SP)
        031572  012746  000001                  MOV     #1,-(SP)
        031576  010600                          MOV     SP,R0
        031600  104417                          TRAP    C$PNTF
        031602  062706  000004                  ADD     #4,SP
     87 031606  000462                          BR      T8.8$
     88 031610  004737  016076          T8.10$: JSR     PC,COUNT        ;COUNT THIS SEEKS TIME
     89 031614  004737  012450                  JSR     PC,TWOMS        ;STALL TWO MILLISECONDS
     90 031620  000676                          BR      T8.4$           ;LOOP, SEEK REVERS_
     91 031622  005237  002632          T8.6$:  INC     DTADPB+12       ;MOVE TO NEXT CYLINDER
     92 031626  005737  002246                  TST     DOTWO           ;DONE TWICE?
     93 031632  100450                          BMI     T8.8$           ;IF MINUS, YES...
     94 031634  012737  177777  002246          MOV     #-1,DOTWO       ;MARK THE FIRST ITERATION
     95 031642  005005                          CLR     R5              ;SEEK FORWARD AGAIN
     96 031644  000137  031224                  JMP     T8.1$           ;NOW!!!
     97
     98 031650  004737  012324          T8.7$:  JSR     PC,FORSEC       ;RESET TIMER TO 4 SEC, CHANGE CLK SERVICE AD
     99                                                                  ;DROP THE PRIORITY
    100 031654  012700  000000                  MOV     #PRI00,R0
        031660  104441                          TRAP    C$SPRI
    101 031662  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
        031666  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
        031672  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
        031676  012777  000040  150764          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
        031704  013777  002620  150756          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
        031712  016102  000014                  MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
        031716  016237  000036  002266          MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
        031 ' 4 116237  000006  002272          MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
        0317?2  116237  000007  002270          MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
        031740  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    102 031744  104456                          TRAP    C$ERHRD
        031746  000024                          .WORD   20
        031750  006112                          .WORD   EM20
        031752  007604                          .WORD   DH44
    103 031754                          T8.8$:
        031754  012777  000040  150706          MOV     #CLR,@RPCS2     ;CLEAR THE MASSBUS
        031762  013777  002620  150700          MOV     DTADPB,@RPCS2   ;& SELECT DRIVE
    104 031770  004737  011676                  JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
    105 031774  004437  016370                  JSR     R4,TYPTIM       ;GO TYPE THE TIMES
        032000  002442                          TIMT10                  ;POINTER
    106 032002  004437  016240                  JSR     R4,SPTYP
    107 032006  002510                          SP10
    108                                                                 ;SETUP RHXX/RP07 VECTOR
    109 032010  013746  002646                  MOV     RPVEC+2,-(SP)
        032014  012746  022674                  MOV     #ISRV,-(SP)
        032020  013746  002644                  MOV     RPVEC,-(SP)
        032024  012746  000003                  MOV     #3,-(SP)
        032030  104437                          TRAP    C$SVEC
        032032  062706  000010                  ADD     #10,SP
    110 032036                          L10052:
        032036  104401                          TRAP    C$ETST
```

```
                                .SBTTL  TEST 9: AVERAGE SEEK TIME MEASUREMENT TEST
                                ;
                                ;
                                ;;*****************************************************************************
                                ;       THIS TEST WILL MEASURE THE AVERAGE SEEK TIME AS FOLLOWS:
                                ;
                                ;                2 X [ (T1 X 629) + (T2 X 628) + (T3 X 627) +....+ (T629 X 1)]
                                ;       T (AVG)=-------------------------------------------------------------
                                ;                                       629 X 629
                                ;
                                ;       WHERE:  THE TN IS THE MEASURED TIME INTERVAL FOR SEEKING FROM
                                ;                 CYLINDER 0 TO CYLINDER N OR FROM CYL N TO CYL 0.
                                ;               2X629 IS THE TOTAL NUMBER OF SEEKS.
                                ;;*****************************************************************************
                                ;
032040                          T9::
032040  005737  002250                  TST     CLKSTA          ;KW11-P CLOCK?
032044  003002                          BGT     1$              ;YES--START TEST
032046  104432                          TRAP    C$EXIT
032050  000702                          .WORD   L10056-.
032052  004437  015476          1$:     JSR     R4,SRCH00       ;DO A MASSBUS INIT & RECAL
032056  000402                          BR      2$              ;RETURN HERE IF NO ERROR
032060  104432                          TRAP    C$EXIT
032062  000670                          .WORD   L10056-.
032064  012703  002452          2$:     MOV     #TIMT11,R3      ;PARAMETER POINTER
032070  013701  002256          TEST9:  MOV     NC1,R1          ;COUNT AND COEFFICIENT
032074  004737  015626                  JSR     PC,STRTMR       ;INIT. THE COUNTERS
032100  004737  012262                  JSR     PC,STOPCK       ;STOP THE CLOCK
                                                                ;SETUP VECTOR IN CASE OF CLOCK OVERFLOW
032104  012746  000300                  MOV     #PRI06,-(SP)
032110  012746  032536                  MOV     #T9.7$,-(SP)
032114  013746  012126                  MOV     PKV,-(SP)
032120  012746  000003                  MOV     #3,-(SP)
032124  104437                          TRAP    C$SVEC
032126  062706  000010                  ADD     #10,SP
                                                                ;SETUP RH%X/RP07 VECTOR
032132  012746  000000                  MOV     #PRI00,-(SP)
032136  012746  015624                  MOV     #DORTI,-(SP)
032142  013746  002644                  MOV     RPVEC,-(SP)
032146  012746  000003                  MOV     #3,-(SP)
032152  104437                          TRAP    C$SVEC
032154  062706  000010                  ADD     #10,SP
032160  005037  032754                  CLR     INCCYL          ;INITIALIZE THE SEEK CYLINDER ADDRESS
032164  005237  032754          T9.1$:  INC     INCCYL          ;INCREMENT THE SEEK CYLINDER ADDRESS
032170  013777  032754  150516          MOV     INCCYL,@RPDC    ;SEEK ADDRESS
032176  005077  157720                  CLR     @PKB            ;START COUNT AT ZERO
032202                          T9.1:
032202  104402                          TRAP    C$BSUB
032204  012777  000105  150446          MOV     #SEEK,@RPCS1    ;START A SEEK
032212  012777  000131  157700          MOV     #131,@PKCS      ;START THE CLOCK
032220  000001                          WAIT                    ;WAIT ON INTERRUPT
032222  017746  157676                  MOV     @PKC,-(SP)      ;STORE THE COUNTED VALUE
032226  042777  000101  157664          BIC     #101,@PKCS      ;STOP CLOCK
032234  012677  157662                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNT
032240  032777  040000  150424          BIT     #BIT14,@RPDS    ;ERR=1?
032246  001426                          BEQ     T9.2$           ;NO--BRANCH
032250  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
032254  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
```

TEST 9: AVERAGE SEEK TIME MEASUREMENT TEST

```
                032260  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                032264  012777  000040  150376          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                032272  013777  002620  150370          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                032300  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
     44         032304  004537  012664                  JSR     R5,ERRANY       ;FINDOUT WHAT ERROR
     45         032310  002620                          DTADPB
     46         032312                          L10057:
                032312  104403                          TRAP    C$ESUB
     47         032314  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
     48         032322  001063                          BNE     T9.4$           ;YES, ABORT TEST
     49         032324  005005                  T9.2$:  CLR     R5              ;SET UP/DOWN SWITCH TO UP
     50         032326  004737  015676                  JSR     PC,COUNT2       ;UPDATE THE COUNT
     51         032332  004737  012450                  JSR     PC,TWOMS        ;STALL 2 MSEC
     52         032336                          T9.2:
                032336  104402                          TRAP    C$BSUB
     53         032340  005077  157556                  CLR     @PKB            ;START THE COUNT AT ZERO
     54         032344  012777  000000  150342          MOV     #0,@RPDC        ;ALWAYS SEEK BACK TO THE FIRST CYLINDER
     55         032352  012777  000105  150300          MOV     #SEEK,@RPCS1    ;START A SEEK
     56         032360  012777  000131  157532          MOV     #131,@PKCS      ;START THE CLOCK
     57         032366  000001                          WAIT                    ;WAIT ON INTERRUPT
     58         032370  017746  157530                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK VALUE
     59         032374  042777  000101  157516          BIC     #101,@PKCS      ;STOP THE CLOCK
     60         032402  012677  157514                  MOV     (SP)+,@PKB      ;NOW RESTORE THE VALUE
     61         032406  032777  040000  150256          BIT     #BIT14,@RPDS    ;ERR=1?
     62         032414  001437                          BEQ     T9.3$           ;NO--BRANCH
     63         032416  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
                032422  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
                032426  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                032432  012777  000040  150230          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                032440  013777  002620  150222          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                032446  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
     64         032452  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
     65         032456  002620                          DTADPB
     66         032460                          L10060:
                032460  104403                          TRAP    C$ESUB
     67         032462  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
     68         032470  001411                          BEQ     T9.3$           ;NO, CONTINUE
     69         032472                          T9.4$:
                032472  012746  004544                  MOV     #POSERR,-(SP)
                032476  012746  000001                  MOV     #1,-(SP)
                032502  010600                          MOV     SP,R0
                032504  104417                          TRAP    C$PNTF
                032506  062706  000004                  ADD     #4,SP
     70         032512  000466                          BR      T9.8$
     71         032514  012705  177777          T9.3$:  MOV     #-1,R5          ;SET UP/DOWN SWITCH TO DOWN
     72         032520  004737  015676                  JSR     PC,COUNT2       ;UPDATE THE COUNT
     73         032524  004737  012450                  JSR     PC,TWOMS        ;STALL 2 MSEC
     74         032530  005301                          DEC     R1              ;DONE?
     75         032532  003214                          BGT     T9.1$           ;NO--BRANCH
     76         032534  000455                          BR      T9.8$           ;YES--EXIT
     77
     78         032536  004737  012324          T9.7$:  JSR     PC,FORSEC       ;RESET TIMER TO 4 SEC, CHANGE CLK SERVICE AD
     79                                                                          ;DROP THE PRIORITY
     80         032542  012700  000000                  MOV     #PR100,R0
                032546  104441                          TRAP    C$SPRI
     81         032550  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
                032554  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
```

```
        032560  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
        032564  012777  000040  150076          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
        032572  013777  002620  150070          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
        032600  016102  000014                  MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
        032604  016237  000036  002266          MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
        032612  116237  000006  002272          MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
        032620  116237  000007  002270          MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
        032626  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    82                                                                  ;SETUP RHXX/RP07 VECTOR
    83  032632  013746  002646                  MOV     RPVEC+2,-(SP)
        032636  012746  022674                  MOV     #ISRV,-(SP)
        032642  013746  002644                  MOV     RPVEC,-(SP)
        032646  012746  000003                  MOV     #3,-(SP)
        032652  104437                          TRAP    C$SVEC
        032654  062706  000010                  ADD     #10,SP
    84  032660  104456                          TRAP    C$ERHRD
        032662  000024                          .WORD   20
        032664  006112                          .WORD   EM20
        032666  007604                          .WORD   DH44
    85  032670                          T9.8$:
        032670  012777  000040  147772          MOV     #CLR,@RPCS2     ;CLEAR THE MASSBUS
        032676  013777  002620  147764          MOV     DTADPB,@RPCS2   ;& SELECT DRIVE
    86  032704  004737  011676                  JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
    87  032710  004437  016370                  JSR     R4,TYPTIM       ;GO TYPE THE TIMES
        032714  002452                          TIMT11                  ;POINTER
    88  032716  004437  016240                  JSR     R4,SPTYP
    89  032722  002516                          SP11
    90                                                                  ;SETUP RHXX/RP07 VECTOR
    91  032724  013746  002646                  MOV     RPVEC+2,-(SP)
        032730  012746  022674                  MOV     #ISRV,-(SP)
        032734  013746  002644                  MOV     RPVEC,-(SP)
        032740  012746  000003                  MOV     #3,-(SP)
        032744  104437                          TRAP    C$SVEC
        032746  062706  000010                  ADD     #10,SP
    92  032752                          L10056:
        032752  104401                          TRAP    C$ETST
    93
    94  032754  000000                  INCCYL: .WORD   0               ;CYL ADR COUNTER
```

```
                                .SBTTL  TEST 10: MAXIMUM SEEK TIMING TEST
                                ;
                                ;;*************************************************************************
                                ;*      THIS TEST WILL COMMAND A FORWARD SEEK FROM CYLINDER 0 TO
                                ;*      CYLINDER 'LC', THEN A REVERSE SEEK FROM CYLINDER 'LC' TO
                                ;*      CYLINDER 0.  BOTH SEEKS ARE TIMED AND CHECKED TO ENSURE
                                ;*      THEY ARE WITHIN THE TOLERANCE ALLOWED FOR THE MAXIMUM SEEK
                                ;*      TIME.  THIS SEQUENCE IS REPEATED 512 TIMES (FOR
                                ;*      A TOTAL OF 1024 SEEKS).  THE MAXIMUM SEEK TIME MUST BE LESS THAN
                                ;*      46 MS.  'LC' DEFAULTS TO 629 (10)
                                ;*      FOR RP07'S.
                                ;;*************************************************************************
                                ;
032756                          T10::
032756  005737  002250                TST     CLKSTA          ;KW11-P CLOCK
032762  003002                        BGT     1$              ;YES--START TEST
032764  104432                        TRAP    C$EXIT
032766  000642                        .WORD   L10061-.
032770  004437  015476        1$:     JSR     R4,SRCH00       ;DO A MASSBUS INIT & RECAL
032774  000402                        BR      2$              ;RETURN HERE IF NO ERROR
032776  104432                        TRAP    C$EXIT
033000  000630                        .WORD   L10061-.
033002  012703  002462        2$:     MOV     #TIMT12,R3      ;PARAMETER POINTER
033006  012701  001000        TEST10: MOV     #512.,R1        ;REPEAT "0-'LC'-0" 512 TIMES
033012  004737  015626                JSR     PC,STRTMR       ;INIT. THE TIMERS
033016  004737  012262                JSR     PC,STOPCK       ;STOP THE CLOCK
                                                            ;SETUP VECTOR IN CASE OF CLOCK OVERFLOW
033022  012746  000300                MOV     #PRI06,-(SP)
033026  012746  033442                MOV     #T10.7$,-(SP)
033032  013746  012126                MOV     PKV,-(SP)
033036  012746  000003                MOV     #3,-(SP)
033042  104437                        TRAP    C$SVEC
033044  062706  000010                ADD     #10,SP
                                                            ;SETUP RHXX/RP07 VECTOR
033050  012746  000000                MOV     #PRI00,-(SP)
033054  012746  015624                MOV     #DORTI,-(SP)
033060  013746  002644                MOV     RPVEC,-(SP)
033064  012746  000003                MOV     #3,-(SP)
033070  104437                        TRAP    C$SVEC
033072  062706  000010                ADD     #10,SP
033076                          T10.1:
033076  104402                        TRAP    C$BSUB
033100  005077  157016        T10.1$: CLR     @PKB            ;START COUNTING FROM ZERO
033104  013777  002206  147602        MOV     LC,@RPDC        ;MAXIMUM CYLINDER
033112  012777  000105  147540        MOV     #SEEK,@RPCS1    ;START A SEEK
033120  012777  000131  156772        MOV     #131,@PKCS      ;START THE CLOCK
033126  000001                        WAIT                    ;WAIT ON INTERRUPT
033130  017746  156770                MOV     @PKC,-(SP)      ;SAVE THE CLOCK
033134  042777  000101  156756        BIC     #101,@PKCS      ;STOP THE CLOCK
033142  012677  156754                MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
033146  032777  040000  147516        BIT     #BIT14,@RPDS    ;ERR=1?
033154  001426                        BEQ     T10.2$          ;NO--BRANCH
033156  004737  010646                JSR     PC,SAVREG       ;;SAVE R0-R5
033162  012702  002620                MOV     #DTADPB,R2      ;DPB POINTER
033166  004737  024472                JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
033172  012777  000040  147470        MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
033200  013777  002620  147462        MOV     DTADPB,@RPCS2   ;SELECT DRIVE
```

```
                033206  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
41              033212  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
42              033216  002620                          DTADPB
43              033220                          L10062:
                033220  104403                          TRAP    C$ESUB
44              033222  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
45              033230  001062                          BNE     T10.4$          ;YES, ABORT TEST
46              033232  005005                  T10.2$: CLR     R5              ;SET THE UP/DOWN SWITCH TO UP
47              033234  004737  016076                  JSR     PC,COUNT        ;UP THE COUNT
48              033240  004737  012450                  JSR     PC,TWOMS        ;STALL FOR TWO MILLISEC
49              033244                          T10.2:
                033244  104402                          TRAP    C$BSUB
50              033246  005077  156650                  CLR     @PKB            ;START COUNT AT ZERO
51              033252  005077  147436                  CLR     @RPDC           ;BEGINNING CYLINDER IS 0
52              033256  012777  000105  147374          MOV     #SEEK,@RPCS1    ;START A SEEK
53              033264  012777  000131  156626          MOV     #131,@PKCS      ;START THE CLOCK
54              033272  000001                          WAIT                    ;WAIT ON INTERRUPT
55              033274  017746  156624                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
56              033300  042777  000101  156612          BIC     #101,@PKCS      ;STOP THE CLOCK
57              033306  012677  156610                  MOV     (SP)+,@PKB      ;NOW RESTORE CLOCK
58              033312  032777  040000  147352          BIT     #BIT14,@RPDS    ;"ERR"=1?
59              033320  001437                          BEQ     T10.3$          ;NO--BRANCH
60              033322  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
                033326  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
                033332  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                033336  012777  000040  147324          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                033344  013777  002620  147316          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                033352  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
61              033356  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
62              033362  002620                          DTADPB
63              033364                          L10063:
                033364  104403                          TRAP    C$ESUB
64              033366  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
65              033374  001411                          BEQ     T10.3$          ;NO, CONTINUE
66              033376                          T10.4$:
                033376  012746  004544                  MOV     #POSERR,-(SP)
                033402  012746  000001                  MOV     #1,-(SP)
                033406  010600                          MOV     SP,R0
                033410  104417                          TRAP    C$PNTF
                033412  062706  000004                  ADD     #4,SP
67              033416  000453                          BR      T10.8$
68              033420  012705  177777          T10.3$: MOV     #-1,R5          ;SET THE UP/DOWN SWITCH TO DOWN
69              033424  004737  016076                  JSR     PC,COUNT        ;UPDATE THE COUNT
70              033430  004737  012450                  JSR     PC,TWOMS        ;STALL FOR TWO MILLISEC
71              033434  005301                          DEC     R1              ;DONE?
72              033436  003220                          BGT     T10.1$          ;NO--BRANCH
73              033440  000442                          BR      T10.8$          ;YES--EXIT
74
75              033442  004737  012324          T10.7$: JSR     PC,FORSEC       ;RESET TIMER TO 4 SEC, CHANGE CLK SERVICE AD
76                                                                              ;DROP THE PRIORITY
77              033446  012700  000000                  MOV     #PR100,R0
                033452  104441                          TRAP    C$SPRI
78              033454  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
                033460  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
                033464  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                033470  012777  000040  147172          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                033476  013777  002620  147164          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
```

```
                033504  016102  000014          MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
                033510  016237  000036  002266  MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
                033516  116237  000006  002272  MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
                033524  116237  000007  002270  MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
                033532  004737  010700          JSR     PC,RESREG       ;;RESTORE R0-R5
     79         033536  104456                  TRAP    C$ERHRD
                033540  000024                  .WORD   20
                033542  006112                  .WORD   EM20
                033544  007604                  .WORD   DH44
     80         033546                  T10.8$:
                033546  012777  000040  147114  MOV     #CLR,@RPCS2     ;CLEAR THE MASSBUS
                033554  013777  002620  147106  MOV     DTADPB,@RPCS2   ;& SELECT DRIVE
     81         033562  004737  011676          JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
     82         033566  004437  016370          JSR     R4,TYPTIM       ;GO TYPE THE TIMES
                033572  002462                  TIMT12                  ;POINTER
     83         033574  004437  016240          JSR     R4,SPTYP
     84         033600  002524                  SP12
     85                                                                  ;SETUP RHXX/RP07 VECTOR
     86         033602  013746  002646          MOV     RPVEC+2,-(SP)
                033606  012746  022674          MOV     #ISRV,-(SP)
                033612  013746  002644          MOV     RPVEC,-(SP)
                033616  012746  000003          MOV     #3,-(SP)
                033622  104437                  TRAP    C$SVEC
                033624  062706  000010          ADD     #10,SP
     87         033630                  L10061:
                033630  104401                  TRAP    C$ETST
```

```
                                .SBTTL  TEST 11: MID-TRANSFER SEEK TEST

                                ;;*****************************************************************************
                                ;THIS TEST EXECUTES READ-DATA COMMMANDS TO EVERY TRACK IN THE
                                ;FIRST(STARTING) CYLINDER.
                                ;
                                ;THE FULL TRACK TRANSFER IS MADE IN 2 PASSES:
                                ;       1ST PASS, SECTORS:  00. THRU 24.
                                ;       2ND PASS, SECTORS:  25. THRU (49. +1)
                                ;
                                ;THE PARAMETERS:
                                ;       STARTING CYLINDER       = FC
                                ;       STARTING TRACK          = FT
                                ;       ENDING TRACK            = LT
                                ;       INCREMENT TRACK         = 1
                                ;       STARTING SECTOR         = 0
                                ;
                                ;;*****************************************************************************

033632                          T11::
033632  004737  020226                  JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
033636  004737  012262                  JSR     PC,STOPCK       ;STOP THE CLOCK
033642  113737  002654  002620          MOVB    DRVNO,DTADPB    ;DRIVE ADDRESS
033650  112737  000171  002622          MOVB    #RDDAT,DTADPB+2 ;READ-DATA COMMAND
033656  013737  002344  002624          MOV     TRKWC,DTADPB+4  ;ASSUME HALF FULL TRACK
033664  012737  042610  002626          MOV     #DBUFF,DTADPB+6 ;BUFFER ADDRESS
033672  112737  000000  002630          MOVB    #0,DTADPB+10    ;SECTOR ADDR
033700  113737  002212  002631          MOVB    FT,DTADPB+11    ;TRACK ADDR
033706  013737  002204  002632          MOV     FC,DTADPB+12    ;CYLINDER ADDRESS
033714  012737  002744  002634          MOV     #REG,DTADPB+14  ;RHXX/RP07 REGISTER
033722  005037  002246                  CLR     DOTWO           ;RESET 2 ITERATIONS CONTROL
033726                          T11.1:
033726  104402                          TRAP    C$BSUB
033730                          T11.2$:
033730  004437  014742                  JSR     R4,DRVCAL       ;START A DATA TRANSFER
033734  005737  002246                  TST     DOTWO           ;DONE HALF TRACK TWICE?
033740  100411                          BMI     2$              ;YES, EXIT 2 ITERATIONS LOOP
033742  005337  002246                  DEC     DOTWO           ;NO, MARK 2ND ITERATION
033746  112737  000031  002630          MOVB    #25.,DTADPB+10  ;TFR 2ND HALF OF TRACK
033754  062737  177400  002624          ADD     #-256.,DTADPB+4 ;YES, SET WC FOR 2ND HALF TRACK + 1 SECTOR
033762  000762                  1$:     BR      T11.2$          ;LOOP TO TFR 2ND HALF TTRACK

033764  005037  002246          2$:     CLR     DOTWO           ;RESET PARAMETERS FOR 1ST LOOP
033770  105037  002630                  CLRB    DTADPB+10       ;RESTART AT SECTOR 0
033774  162737  177400  002624          SUB     #-256.,DTADPB+4 ;WC FOR 1ST HALF TRACK
034002                          L10065:
034002  104403                          TRAP    C$ESUB
034004  113702  002631          T11.5$: MOVB    DTADPB+11,R2    ;UPDATE THE TRACK ADDRESS
034010  063702  002216                  ADD     IT,R2           ;ADD THE DESIRED TRACK NUMBER
034014  023702  002214                  CMP     LT,R2           ;OVER THE TRACK LIMIT?
034020  101403                          BLOS    EXIT11          ;BRANCH IF SO
034022  110237  002631                  MOVB    R2,DTADPB+11    ;TO NEXT TRACK
034026  000740                          BR      T11.2$          ;LOOP BACK
034030  004737  020226          EXIT11: JSR     PC,RPINIT
034034                          L10064:
034034  104401                          TRAP    C$ETST
```

```
                                        .SBTTL  TEST 12: ERROR REGISTER BIT TEST

                                        ;;*****************************************************************************
                                        ;*      THIS TEST FORCES LBT & AOE ERROR BITS THAT ARE NOT FULLY CHECKED BY THE
                                        ;*        MICRO DIAGNOSTICS
                                        ;*      LBT,AOE:  READ THE LAST USER SECTOR WITH A WORD COUNT >256.
                                        ;;*****************************************************************************

 034036                                 T12::
 034036  004737  020226                         JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
 034042  004737  012262                         JSR     PC,STOPCK       ;STOP THE CLOCK
 034046  113737  002254  002620                 MOVB    DRVNO,DTADPB    ;DRIVE AD
 034054  112737  000171  002622                 MOVB    #RDDAT,DTADPB+2 ;SET READ CMD IN DPB
 034062  012737  177400  002624                 MOV     #SCTRWC,DTADPB+4        ;SET WORD COUNT TO READ ONE SECTOR
 034070  012737  042610  002626                 MOV     #DBUFF,DTADPB+6 ;DATA BUFFER
 034076  113737  002264  002630                 MOVB    NS1,DTADPB+10   ;SET LAST USER SECTOR IN DPB
 034104  113737  002262  002631                 MOVB    NT1,DTADPB+11   ;I.E., CYL 629, TRK 31, SEC 49
 034112  013737  002256  002632                 MOV     NC1,DTADPB+12
 034120  012737  002744  002634                 MOV     #REG,DTADPB+14  ;POINT TO RHXX/RP07 REG TABLE SAVED ON CMD DONE
 034126                                 T12.1:
 034126  104402                               TRAP    C$BSUB
 034130  004737  015C44                         JSR     PC,EXECMD       ;EXEC CMD
 034134  032762  002000  000012                 BIT     #LST,12(R2)     ;LBT=1?
 034142  001005                               BNE     TST12           ;OK, SKIP
 034144  104456                               TRAP    C$ERHRD
 034146  000062                               .WORD   50
 034150  007246                               .WORD   EM50
 034152  000000                               .WORD   0
 034154                                 L10067:
 034154  104403                               TRAP    C$ESUB
 034156  032762  040000  000012  TST12:       BIT     #ERR,12(R2)     ;OTHER ERRORS?
 034164  001403                               BEQ     1$              ;NO, SKIP
 034166  004537  012664                       JSR     R5,ERRANY       ;YES, FLAG THEM
 034172  002620                               DTADPB
 034174  062737  177400  002624  1$:          ADD     #SCTRWC,DTADPB+4        ;SET DPB TO READ BEYOND LAST SECTOR
 034202                                 T12.2:
 034202  104402                               TRAP    C$BSUB
 034204  004737  015044                         JSR     PC,EXECMD       ;ATTEMPT TO READ PAST LAST SECTOR
 034210  032762  001000  000014                 BIT     #AOE,14(R2)     ;AOE=1?
 034216  001005                               BNE     TST12A          ;OK, SKIP
 034220  104456                               TRAP    C$ERHRD
 034222  000063                               .WORD   51
 034224  007340                               .WORD   EM51
 034226  000000                               .WORD   0
 034230                                 L10070:
 034230  104403                               TRAP    C$ESUB
 034232  042762  001000  000014  TST12A:      BIC     #AOE,14(R2)     ;CLEAR ERROR IN ERROR TABLE
 034240  001005                               BNE     1$              ;FLAG OTHER ERROR, IF ANY
 034242  032762  000200  000042               BIT     #DVC,42(R2)     ;(ER2)(ER3) = 0 ?
 034250  001001                               BNE     1$              ;NO, FLAG OTHER ERRORS
 034252  000403                               BR      2$              ;SKIP ON (ER1)(ER2)(ER3) = 0
 034254  004537  012664             1$:       JSR     R5,ERRANY       ;FLAG ERRORS
 034260  002620                               DTADPB
 034262                                 2$:
 034262                                 EXIT12:
 034262                                 L10066:
 034262  10440?                               TRAP    C$ETST
```

```
                                        .SBTTL  TEST 13: OFFSET/RETURN-TO-CENTER-LINE TEST

                                        ;;*************************************************************************
                                        ;*      ISSUE AN OFFSET COMMAND, PROCESS THE ATTENTION INTERRUPT AND CHECK FOR
                                        ;*      ERRORS,VERIFY THE ASSERTION OF OM OF RPDS.
                                        ;*      ISSUE THE RETURN TO CENTER LINE COMMAND, PROCESS THE ATTENTION INTERRUPT
                                        ;*      AND CHECK FOR ERRORS, VERIFY THE RESETTING OF OM.
                                        ;;*************************************************************************

034264                                  T13::
034264  004737  020226                          JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
034270  012737  000012  002240                  MOV     #10.,ITCNT      ;SET ITERATION COUNT
034276  013737  002654  002620          TEST13: MOV     DRVNO,DTADPB    ;GET DRIVE NUMBER
034304  113737  002220  002630                  MOVB    FS,DTADPB+10    ;OPERATE ON FS,FT,FC
034312  113737  002212  002631                  MOVB    FT,DTADPB+11
034320  013737  002204  002632                  MOV     FC,DTADPB+12
034326  012737  002744  002634                  MOV     #REG,DTADPB+14  ;POINTER TO RHXX/RP07 REG TABLE SAVED ON CMD DONE
034334  012737  000115  002622                  MOV     #OFFSET,DTADPB+2        ;LOAD OFFSET CMD
034342                                  T13.1:
034342  104402                                  TRAP    C$BSUB
034344  004437  014742                          JSR     R4,DRVCAL       ;START A DATA TRANSFER
034350  013702  002634                          MOV     DTADPB+14,R2    ;POINTER TO RHXX/RP07 REG TBL SAVED ON CMD DONE
034354  032762  000001  000012                  BIT     #OM,12(R2)      ;OM = 1?
034362  001005                                  BNE     TST13           ;OK
034364  104456                                  TRAP    C$ERHRD
034366  000066                                  .WORD   54
034370  007460                                  .WORD   EM54
034372  000000                                  .WORD   0
034374                                  L10072:
034374  104403                                  TRAP    C$ESUB

034376  012737  000117  002622          TST13:  MOV     #RTC,DTADPB+2   ;LOAD RETURN TO CENTER LINE CMD
034404                                  T13.2:
034404  104402                                  TRAP    C$BSUB
034406  004437  014742                          JSR     R4,DRVCAL       ;START A DATA TRANSFER
034412  013702  002634                          MOV     DTADPB+14,R2    ;POINTER TO RHXX/RP07 REG TBL SAVED ON CMD DONE
034416  032762  000001  000012                  BIT     #OM,12(R2)      ;OM   0?
034424  001407                                  BEQ     T13.1$          ;OK
034426  104456                                  TRAP    C$ERHRD
034430  000067                                  .WORD   55
034432  007521                                  .WORD   EM55
034434  000000                                  .WORD   0
034436                                  L10073:
034436  104403                                  TRAP    C$ESUB
034440  104432                                  TRAP    C$EXIT
034442  000010                                  .WORD   L10071-.
034444  005337  002240          T13.1$: DEC     ITCNT           ;DONE ITERATIONS ?
034450  001312                                  BNE     TEST13          ;BR IF NO
034452                                  EXIT13:
034452                                  L10071:
034452  104401                                  TRAP    C$ETST
```

```
                                .SBTTL  TEST 14: RANDOM READ TEST
                                ;
                                ;;*************************************************************************
                                ;THIS TEST RANDOMLY SELECTS A SECTOR ADDRESS: CYL BETWEEN FC AND LC,
                                ;                                             TRK BETWEEN FT AND LT,
                                ;                                             SEC BETWEEN FS AND LS.
                                ;
                                ;IF THERE IS NO P-CLOCK, IT THEN EXECUTES A READ DATA COMMAND  TO 1 SECTOR
                                ;AFTER EACH READ-DATA COMMAND, THE PROGRAM VERIFIES THE
                                ;BUS, DATA  AND VERIOUS RHXX/RP07 REGISTERS.
                                ;IF THERE IS A P-CLOCK,THE PROGRAM PERFORMS AN ADDRESS MARK DETECTION TEST:
                                ;IT VERIFIES THAT DATA CAN BE READ CORRECTLY WITHIN THE SAME DISC REVOLUTION
                                ;AS A SECTOR DETECTION. SEARCH FOR THE LOGICAL SECTOR PRECEDING THE SELECTED
                                ;SECTOR TO READ, THEN READ THE SELECTED SECTOR. TIME THE SEARCH DONE-READ DONE
                                ;TO BE WITHIN A DISC REVOLUTION. FLAG LOST REVOLUTIONS.
                                ;;*************************************************************************
                                ;
034454                          T14::
034454  013737  002244  002240         MOV     XTIMES,ITCNT    ;SET ITERATION COUNT
034462  005737  002250                 TST     CLKSTA          ;P-CLK PRESENT?
034466  003036                       BGT     TST14A          ;YES, EXEC RAND READ TEST + AD MARK DET
034470  004737  020226                 JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
034474  004737  012262                 JSR     PC,STOPCK       ;STOP THE CLOCK
034500  113737  002654  002620         MOVB    DRVNO,DTADPB    ;LOAD THE DRIVE ADDRESS
034506  112737  000171  002622         MOVB    #RDDAT,DTADPB+2 ;EXECUTE READ COMMAND
034514  012737  177400  002624         MOV     #-256.,DTADPB+4 ;WORD COUNT = 1 SECTOR
034522  012737  042610  002626         MOV     #DBUFF,DTADPB+6 ;BUFFER ADDRESS
034530  012737  002744  002634         MOV     #REG,DTADPB+14  ;RHXX/RP07 REGISTER TABLE
                                ;
034536  004437  017544         TEST14: JSR     R4,RANADR       ;GENERATE A STARTING ADDRESS
034542                          T14.1:
034542  104402                       TRAP    C$BSUB
034544  004437  014742                 JSR     R4,DRVCAL       ;START A DATA TRANSFER
034550                          L10075:
034550  104403                       TRAP    C$ESUB
034552  005337  002240         EXIT14: DEC     ITCNT           ;DONE ITERATIONS ?
034556  001367                       BNE     TEST14          ;BR IF NO
034560  104432                       TRAP    C$EXIT
034562  001206                       .WORD   L10074-.
                                ;
034564  004437  015476         TST14A: JSR     R4,SRC400       ;MASS BUS INIT & RECAL
034570  000402                       BR      1$              ;NO RECAL ERROR, CONTINUE
034572  000137  035742                 JMP     XIT14           ;EXIT ON RECAL ERROR
                                ;
034576  004737  015626         1$:     JSR     PC,STRTMR       ;INIT THE TIMERS
034602  042777  000101  155310         BIC     #101,@PKCS      ;STOP THE P-CLOCK
                                                                ;SETUP VECTOR IN CASE OF CLOCK OVERFLOW
034610  012746  000300                 MOV     #PR106,-(SP)
034614  012746  035542                 MOV     #T14.7$,-(SP)
034620  013746  012126                 MOV     PKV,-(SP)
034624  012746  000003                 MOV     #3,-(SP)
034630  104437                       TRAP    C$SVEC
034632  062706  000010                 ADD     #10,SP
                                                                ;SETUP RHXX/RP07 VECTOR
                                ;
034636  012746  000000                 MOV     #PR100,-(SP)
034642  012746  015624                 MOV     #DORTI,-(SP)
034646  013746  002644                 MOV     RPVEC,-(SP)
034652  012746  000003                 MOV     #3,-(SP)
```

TEST 14: RANDOM READ TEST

```
                034656  104437                          TRAP    C$SVEC
                034660  062706  000010                  ADD     #10,SP
     47         034664  005005                          CLR     R5              ;SET COUNT-UP FLAG FOR COUNT SUBR
     48
     49                                                 ;REDUCE THE TARGET SECTOR BY 2, TO COMPUTE THE VALUE OF THE 2ND LOGICAL
     50                                                 ;SECTOR.
     51
     52         034666  004437  017544          T14.1$: JSR     R4,RANADR       ;GEN A RAND ADR: CYL, TRK, SEC
     53         034672  113701  002630                  MOVB    DTADPB+10,R1    ;GET TARGET SECTOR ADDRESS TO READ
     54         034676  032777  000004  145766          BIT     #ILV,@RPDS      ;IS INTERLEAVED SECTOR ENABLED ?
     55         034704  001006                          BNE     2$              ;BR IF YES
     56         034706  162701  000002                  SUB     #2,R1           ;BACKUP THE SECTOR ADDRESS FOR THE SEARCH
     57         034712  002002                          BGE     1$              ;BR IF < SECTOR 0
     58         034714  062701  000062                  ADD     #50.,R1         ;ADJUST FOR ADDRESS BEFORE SECTOR 0
     59         034720  000411                  1$:     BR      4$              ;EXIT
     60
     61         034722  005701                  2$:     TST     R1              ;IS IT SECTOR ADDR 0 ?
     62         034724  001405                          BEQ     3$              ;BR IF YES
     63         034726  162701  000031                  SUB     #25.,R1         ;IS IT SECTOR ADDR 25 ?
     64         034732  001002                          BNE     3$              ;BR IF NO
     65         034734  062701  000031                  ADD     #25.,R1         ;ADJUST FOR THE ADDRESS BEFORE SECTOR 0
     66         034740  062701  000030          3$:     ADD     #24.,R1         ;REDUCE THE TARGET SECTOR BY 2
     67         034744                          4$:
     68                                                 ;PREPARE TO SEARCH
     69         034744                          T1410$:
                034744                          T14.2:
                034744  104402                          TRAP    C$BSUB
     70         034746  013777  002632  145740          MOV     DTADPB+12,@RPDC ;CYL
     71         034754  110146                          MOVB    R1,-(SP)        ;MERGE SECTOR
     72         034756  113766  002631  000001          MOVB    DTADPB+11,1(SP) ;AND TRK
     73         034764  012677  145676                  MOV     (SP)+,@RPDA     ;LOAD TRK/SEC
     74         034770  012777  177400  145664          MOV     #-256.,@RPWC    ;READ 1 SECTOR
     75         034776  012777  042610  145660          MOV     #DBUFF,@RPBA    ;SET DATA BUFFER ADR
     76         035004  012703  002472                  MOV     #T1420,R3       ;TIMING LIMITS FOR COUNT SUBR
     77         035010  012777  000006  155104          MOV     #6,@PKB         ;ALLOW > 6 REVOLUTIONS PER SEARCH:
     78
     79                                                 ;3 FOR IMPLIED MAX SEEK (46 MSEC OR ABOUT 3 REVOLUTIONS)
     80                                                 ;3 FOR WORST CASE SEARCH(SECT CMP ERR OR HDR CRC ERR)
     81
     82         035016  012777  000105  155074          MOV     #105,@PKCS      ;START P-CLOCK:IE,COUNT DOWN,LINE FREQ
     83         035024  012777  000131  145626          MOV     #SEARCH,@RPCS1  ;START A SEARCH
     84         035032  000001                          WAIT                    ;WAIT ON INTERRUPT
     85         035034  017746  155064                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
     86         035040  042777  000101  155052          BIC     #101,@PKCS      ;STOP THE CLOCK
     87         035046  012677  155050                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
     88         035052  032777  040000  145612          BIT     #BIT14,@RPDS    ;ERROR?
     89         035060  001533                          BEQ     T1411$          ;NO--BRANCH
     90         035062  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
                035066  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
                035072  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                035076  012777  000040  145564          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                035104  013777  002620  145556          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                035112  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
     91         035116  004537  012664                  JSR     R5,ERRANY
     92         035122  002620                          DTADPB                  ;FIND OUT WHAT ERROR
     93         035124                          L10076:
                035124  104403                          TRAP    C$ESUB
```

TEST 14: RANDOM READ TEST

```
     94 035126  032737  000210  002254          BIT     #BIT3!BIT7,SVSTAT       ;RETRY ALLOWED ?
     95 035134  001022                          BNE     1$                      ;BRANCH IS SO
     96 035136  012746  004422                  MOV     #SEAERR,-(SP)
        035142  012746  000001                  MOV     #1,-(SP)
        035146  010600                          MOV     SP,R0
        035150  104417                          TRAP    C$PNTF
        035152  062706  000004                  ADD     #4,SP
     97 035156  012746  004525                  MOV     #ABOTST,-(SP)
        035162  012746  000001                  MOV     #1,-(SP)
        035166  010600                          MOV     SP,R0
        035170  104417                          TRAP    C$PNTF
        035172  062706  000004                  ADD     #4,SP
     98 035176  000137  035646                  JMP     T14.8$
     99 035202                          1$:
    100 035202  012737  000020  002340          MOV     #16.,WCEFLG     ;RETRY 16 TIMES
    101 035210  012777  000006  154704  2$:     MOV     #6,@PKB         ;ALLOW > 6 REVOLUTIONS PER SEARCH:
    102
    103                                         ;3 FOR IMPLIED MAX SEEK (46 MSEC OR ABOUT 3 REVOLUTIONS)
    104                                         ;3 FOR WORST CASE SEARCH(SECT CMP ERR OR HDR CRC ERR)
    105
    106 035216  012777  000105  154674          MOV     #105,@PKCS      ;START P-CLOCK:IE,COUNT DOWN,LINE FREQ
    107 035224  012777  000131  145426          MOV     #SEARCH,@RPCS1  ;START A SEARCH
    108 035232  000001                          WAIT                    ;WAIT ON INTERRUPT
    109 035234  017746  154664                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
    110 035240  042777  000101  154652          BIC     #101,@PKCS      ;STOP THE CLOCK
    111 035246  012677  1546?0                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
    112 035252  032777  0400 0  145412          BIT     #BIT14,@RPDS    ;ERROR?
    113 035260  001433                          BEQ     T1411$          ;EXIT IF NONE
    114 035262  012777  000040  145400          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
    115 035270  013777  002620  145372          MOV     DTADPB,@RPCS2   ;DRIVE ADDRESS
    116 035276  005337  002340                  DEC     WCEFLG          ;OVER RETRY LIMIT ?
    117 035302  001342                          BNE     2$              ;BRANCH IF NOT
    118 035304  012746  004461                  MOV     #SEABAD,-(SP)
        035310  012746  000001                  MOV     #1,-(SP)
        035314  010600                          MOV     SP,R0
        035316  104417                          TRAP    C$PNTF
        035320  062706  000004                  ADD     #4,SP
    119 035324  012746  004525                  MOV     #ABOTST,-(SP)
        035330  012746  000001                  MOV     #1,-(SP)
        035334  010600                          MOV     SP,R0
        035336  104417                          TRAP    C$PNTF
        035340  062706  000004                  ADD     #4,SP
    120 035344  000540                          BR      T14.8$          ;EXIT
    121 035346                          T14.3:
        035346  104402                          TRAP    C$BSUB
    122 035350  013777  002630  145310  T1411$: MOV     DTADPB+10,@RPDA ;SET TRK/SECT TO READ
    123 035356  005077  154540                  CLR     @PKB            ;CLEAR P-CLK BUFFER COUNT
    124 035362  012777  000171  145270          MOV     #RDDAT,@RPCS1   ;START A READ
    125 035370  012777  000121  154522          MOV     #121,@PKCS      ;START THE CLOCK:IE=1,UP,SINGLE,10US
    126 035376  000001                          WAIT                    ;WAIT ON INTERRUPT
    127 035400  017746  154520                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
    128 035404  042777  000101  154506          BIC     #101,@PKCS      ;STOP THE CLOCK
    129 035412  012677  154504                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
    130 035416  032777  040000  145246          BIT     #BIT14,@RPDS    ;ERR=1?
    131 035424  001437                          BEQ     T1412$          ;NO--BRANCH
    132 035426  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
        035432  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
```

TEST 14: RANDOM READ TEST

```
                035436  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                035442  012777  000040  145220          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                035450  013777  002620  145212          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                035456  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    133         035462  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
    134         035466  002620                          DTADPB
    135         035470                          L10077:
                035470  104403                          TRAP    C$ESUB
    136         035472  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
    137         035500  001411                          BEQ     T1412$          ;NO, CONTINUE
    138         035502  012746  004544                  MOV     #POSERR,-(SP)
                035506  012746  000001                  MOV     #1,-(SP)
                035512  010600                          MOV     SP,R0
                035514  104417                          TRAP    C$PNTF
                035516  062706  000004                  ADD     #4,SP
    139         035522  000451                          BR      T14.8$
    140
    141         035524  004737  016076          T1412$: JSR     PC,COUNT        ;COUNT TIME SEARCH DONE-READ DONE
    142         035530  021237  002244                  CMP     (R2),XTIMES     ;REPEATED 1024 TIMES?
    143         035534  002044                          BGE     T14.8$          ;YES, CONCLUDE TEST
    144         035536  000137  034666                  JMP     T14.1$          ;NO, CONTINUE
    145
    146         035542  004737  012324          T14.7$: JSR     PC,FORSEC       ;RESET TIMER TO 4 SEC, CHANGE CLK SERVICE AD
    147                                                                         ;DROP THE PRIORITY
    148         035546  012700  000000                  MOV     #PRI00,R0
                035552  104441                          TRAP    C$SPRI
    149         035554  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
                035560  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
                035564  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
                035570  012777  000040  145072          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
                035576  013777  002620  145064          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
                035604  016102  000014                  MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
                035610  016237  000036  002266          MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
                035616  116237  000006  002272          MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
                035624  116237  000007  002270          MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
                035632  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    150         035636  104456                          TRAP    C$ERHRD
                035640  000024                          .WORD   20
                035642  006112                          .WORD   EM20
                035644  007604                          .WORD   DH44
    151         035646                          T14.8$:
                035646  012777  000040  145014          MOV     #CLR,@RPCS2     ;CLEAR THE MASSBUS
                035654  013777  002620  145006          MOV     DTADPB,@RPCS2   ;& SELECT DRIVE
    152         035662  004737  011676                  JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
    153         035666  005737  002310          1$:     TST     TIM.UP+6        ;ANY SEARCH-READ TIMED > 1 REVOLUTION?
    154         035672  001423                          BEQ     4$              ;NO, SKIP
    155         035674  023727  002310  000001          CMP     TIM.UP+6,#1     ;ONLY ONE REV LOST?
    156         035702  001405                          BEQ     2$              ;YES, FLAG SOFT ERROR
    157         035704  104456                          TRAP    C$ERHRD
                035706  000064                          .WORD   52
                035710  007432                          .WORD   EM52
                035712  010532                          .WORD   DH52
    158         035714  000404                          BR      3$
    159         035716                          2$:
                035716  104457                          TRAP    C$ERSOFT
                035720  000065                          .WORD   53
                035722  007432                          .WORD   EM52
```

```
        035724  010532                          .WORD   DH52
    160 035726                          3$:
        035726  004437  016370                  JSR     R4,TYPTIM       ;GO TYPE THE TIMES
        035732  002472                          T1420                   ;POINTER
    161 035734  004437  016240                  JSR     R4,SPTYP
    162 035740  002532                          S1420
    163 035742                          4$:
    164 035742                          XIT14:                          ;SETUP RHXX/RP07 VECTOR
    165 035742  013746  002646                  MOV     RPVEC+2,-(SP)
        035746  012746  022674                  MOV     #ISRV,-(SP)
        035752  013746  002644                  MOV     RPVEC,-(SP)
        035756  012746  000003                  MOV     #3,-(SP)
        035762  104437                          TRAP    C$SVEC
        035764  062706  000010                  ADD     #10,SP
    166 035770                          L10074:
        035770  104401                          TRAP    C$ETST
```

```
                                .SBTTL  TEST 15: FE CYLINDER ADDRESSING TEST
                                ;;*************************************************************************
                                ;       THIS TEST LOCATES THE FE CYLINDERS;
                                ;       THE FE CYLINDERS ARE CYL 630 AND 631.
                                ;
                                ;       AT THE FIRST TEST CYCLE, THE TEST SETS
                                ;       "DMD" BIT OF THE RPMR REGISTER IN ORDER TO ACCESS
                                ;       FE CYLINDERS.
                                ;
                                ;       THEN, THIS TEST EXECUTES READ HEADER AND DATA COMMANDS
                                ;       SEQUENTIALLY TO VERIFY THE ADDRESSING OF THE SECTOR 0
                                ;       OF EACH TRACK ( 0 TO 31 ) ON THE FIRST FE CYLINDER.
                                ;
                                ;       AT THE SECOND TEST CYCLE,
                                ;       A SEEK COMMAND IS EXECUTED TO ACCESS THE SECOND FE CYLINDER.
                                ;;*************************************************************************

035772                          T15::
035772  004737  020226                JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
035776  004737  012262                JSR     PC,STOPCK       ;STOP THE CLOCK
036002  012737  000012  002240        MOV     #10.,ITCNT      ;SET ITERATION COUNT
036010  113737  002654  002620  TEST15: MOVB    DRVNO,DTADPB    ;LOAD THE DRIVE ADDRESS INTO DPB
036016  012737  177400  002624        MOV     #SETRWC,DTADPB+4        ;256 WORDS
036024  012737  042610  002626        MOV     #DBUFF,DTADPB+6 ;BUFFER ADDRESS
036032  012737  000000  002630        MOV     #0,DTADPB+10    ;TRACK 0, SECTOR 0
036040  013737  002260  002632        MOV     NC2,DTADPB+12   ;ASSUME NO FIX HEAD OPTION
036046  013704  00265?                MOV     DRVNO,R4        ;TO FIND OUT FIX HEAD OPTION
036052  122764  000005  020146        CMPB    #5,DRVTYP(R4)   ;BRANCH IF NO FIX HEAD
036060  001411                        BEQ     1$
036062  122764  000004  020146        CMPB    #4,DRVTYP(R4)   ;DOES IT CONTAIN FIX HEAD
036070  001405                        BEQ     1$              ;BRANCH IS SO
036072  104455                        TRAP    C$ERDI
036074  000044                        .WORD   36
036076  006730                        .WORD   EM36
036100  010600                        .WORD   DH25
036102  104444                        TRAP    C$DCLN
036104  052737  100000  002620  1$:   BIS     #DMD,DTADPB     ;SET MAINTENACE MODE FLAG AT THE 2ND BYTE
036112  112737  000105  002622        MOVB    #SEEK,DTADPB+2  ;DO AN EXPLICIT SEEK
036120                          T15.1:
036120  104402                        TRAP    C$BSUB
036122  004437  014742                JSR     R4,DRVCAL       ;START A DATA TRANSFER
036126                          L10101:
036126  104403                        TRAP    C$ESUB
036130  005737  002636                TST     DTADPB+16       ;ANY ERROR CONDITION EXISTS ?
03613.  10?437                        BMI     EXIT15          ;EXIT IF SO
036136                          T15.2:
036136  104402                        TRAP    C$BSUB
036140  112737  000173  002622  TST15:  MOVB    #RDHD,DTADPB+2  ;READ THE HEADER AND DATA
036146  004437  014742                JSR     R4,DRVCAL       ;START A DATA TRANSFER
036152                          L10102:
036152  104403                        TRAP    C$ESUB
036154  0 5737  002636                TST     DTADPB+16       ;ANY ERROR
036160  100425                        BMI     EXIT15          ;EXIT IF SO
036162  123737  002262  002631        CMPB    NT1,DTADPB+11   ;LAST TRACK CHECKED ?
036170  101403                        BLOS    1$              ;BRANCH IF NOT
036172  105237  002631                INCB    DTADPB+11
```

```
     51 036176  000760                          BR      TST15
     52
     53 036200  105037  002631          1$:     CLRB    DTADPB+11       ;RESET TO TRACK 0
     54 036204  005237  002632                  INC     DTADPB+12       ;ACCESS 2ND FE CYL
     55 036210  112737  000105  002622          MOVB    #SEEK,DTADPB+2  ;DO AN EXPLICIT SEEK
     56 036216                          T15.3:
        036216  104402                          TRAP    C$BSUB
     57 036220  004437  014742                  JSR     R4,DRVCAL       ;START A DATA TRANSFER
     58 036224                          L10103:
        036224  104403                          TRAP    C$ESUB
     59 036226  005337  002240                  DEC     ITCNT           ;DONE ITERATIONS ?
     60 036232  001266                          BNE     TEST15          ;BR IF NO
     61 036234  004737  020226          EXIT15: JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
     62 036240  042737  100000  002620          BIC     #DMD,DTADPB     ;CLEAR THE DMD BIT IN THE DPB
     63 036246                          L10100:
        036246  104401                          TRAP    C$ETST
```

```
                                .SBTTL  TEST 16: FE CYLINDER WRITE AND WRITE CHECK TEST
                                ;
                                ;*************************************************************************
                                ;THIS TEST EXECUTES WRITE-DATA SEQUENTIALLY FROM TRACK FT TO TRACK LT
                                ;ON THE FIRST FE CYLINDER WHICH IS ACCESSIBLE IN MAINTENANCE MODE.
                                ;THE PARAMETERS ARE AS FOLLOWS:
                                ;
                                ;THE FULL TRACK TRANSFER IS MADE IN 2 PASSES:
                                ;       1ST PASS, SECTORS:  00. THRU 24.
                                ;       2ND PASS, SECTORS:  25. THRU 49.
                                ;
                                ;       STARTING TRACK          = FT
                                ;       ENDING TRACK            = LT
                                ;       INCREMENT TRACK         = IT
                                ;       STARTING SECTOR         = FS
                                ;*************************************************************************
                                ;
036250                          T16::
036250  004737  020226          T16:    JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
036254  113737  002654  002620        MOVB    DRVNO,DTADPB    ;LOAD THE DRIVE ADDRESS
036262  013737  002344  002624        MOV     TRKWC,DTADPB+4  ;WORD COUNT = HALF TRACK
036270  012737  042610  002626        MOV     #DBUFF,DTADPB+6 ;BUFFER ADDRESS
036276  113737  002212  002631        MOVB    FT,DTADPB+11    ;FIRST  TRACK
036304  013737  002260  002632        MOV     NC2,DTADPB+12   ;FIRST FE CYLINDER W/O FIX H
036312  012737  002744  002634        MOV     #REG,DTADPB+14  ;SAVED RHXX/RP07 REGISTER
036320  105037  002621                CLRB    DTADPB+1        ;CLEAR THE HCI
036324  052737  100000  002620        BIS     #DMD,DTADPB     ;SET THE MAINTENANCE MODE FLAG
036332  004737  012262                JSR     PC,STOPCK       ;STOP THE CLOCK
                                ;
036336  005037  002246          TEST16: CLR     DOTWO           ;RESET 2 ITERATIONS CONTROL
036342  105037  002630                CLRB    DTADPB+10       ;RESTART AT SECTOR 0
036346  013702  002224                MOV     PAT,R2          ;FILL THE DATA PATTERN
036352  013703  002626                MOV     DTADPB+6,R3     ;BUFFER ADDRESS
036356  013704  002624                MOV     DTADPB+4,R4     ;WORD COUNT
036362  010223                  1$:   MOV     R2,(R3)+
036364  005204                        INC     R4
036366  001375                        BNE     1$              ;BRANCH IF PATTERN IS WRITTEN TO ALL BUFF LOC
036370                          T16.1:
036370  104402                        TRAP    C$BSUB
036372  112737  000105  002622  WRPAT:  MOVB    #SEEK,DTADPB+2  ;DO A SEEK FIRST
036400  004437  014742                JSR     R4,DRVCAL       ;START A DATA TRANSFER
036404                          L10105:
036404  104403                        TRAP    C$ESUB
036406                          T16.2:
036406  104402                        TRAP    C$BSUB
036410  112737  000161  002622        MOVB    #WRTDAT,DTADPB+2        ;WRITE DATA COMMAND
036416  004437  014742                JSR     R4,DRVCAL       ;START A DATA TRANSFER
036422  112737  000151  002622        MOVB    #WCKD,DTADPB+2  ;CHANGE TO WRITE CHECK DATA COMMAND
036430  004437  014742                JSR     R4,DRVCAL       ;START A DATA TRANSFER
036434                          L10106:
036434  104403                        TRAP    C$ESUB
036436  005737  002246                TST     DOTWO           ;DONE HALF TRACK TWICE?
036442  100406                        BMI     1$              ;YES, EXIT 2 ITERATIONS LOOP
036444  005337  002246                DEC     DOTWO           ;NO, MARK 2ND ITERATION
036450  112737  000031  002630        MOVB    #25.,DTADPB+10  ;TFR 2ND HALF OF TRACK
036456  000745                        BR      WRPAT           ;LOOP TO TFR 2ND HALF TRACK
```

```
                                                1$:     CLR     DOTWO           ;RESET PARAMETERS FOR 1ST LOOP
                                                        CLRB    DTADPB+10       ;RESTART AT SECTOR 0
                                                2$:     MOV     PAT,R2          ;COMPLEMENT THE PATTERN
                                                        COM     R2
                                                        MOV     DTADPB+6,R3     ;BUFFER ADDRESS
                                                        MOV     DTADPB+4,R4     ;WORD COUNT
                                                3$:     MOV     R2,(R3)+        ;FILL THE BUFFER WITH COMPLEMENT DATA
                                                        INC     R4
                                                        BNE     3$              ;BRANCH IF NOT DONE
                                                T16.3:
                                                        TRAP    C$BSUB
                                                WRPATN: MOVB    #SEEK,DTADPB+2  ;SEEK COMMAND
                                                        JSR     R4,DRVCAL       ;START A DATA TRANSFER
                                                L10107:
                                                        TRAP    C$ESUB
                                                T16.4:
                                                        TRAP    C$BSUB
                                                        MOVB    #WRTDAT,DTADPB+2        ;WRITE DATA FIRST
                                                        JSR     R4,DRVCAL       ;START A DATA TRANSFER
                                                        MOVB    #WCKD,DTADPB+2  ;CHANGE TO WRITE-CHECK
                                                        JSR     R4,DRVCAL       ;START A DATA TRANSFER
                                                L10110:
                                                        TRAP    C$ESUB
                                                        TST     DOTWO           ;DONE HALF TRACK TWICE?
                                                        BMI     1$              ;YES, EXIT 2 ITERATIONS LOOP
                                                        DEC     DOTWO           ;NO, MARK 2ND ITERATION
                                                        MOVB    #25.,DTADPB+10  ;TFR 2ND HALF OF TRACK
                                                        BR      WRPATN          ;2ND ITERATION

                                                1$:     MOVB    DTADPB+11,R2    ;UPDATE THE TRACK ADDRESS
                                                        ADD     IT,R2
                                                        MOVB    R2,DTADPB+11
                                                        CMP     LT,R2
                                                        BHI     TEST16
                                                EXIT16: BIC     #DMD,DTADPB     ;RESET THE MAINTENANCE FLAG
                                                L10104:
                                                        TRAP    C$ETST
```

```
                        .SBTTL  TEST 17: WRITE TEST

                        ;;*****************************************************************************
                        ;THIS TEST EXECUTES WRITE + WRITE CHECK DATA ON EVERY TRACK OF STARTING
                        ;CYLINDER AND ENDING CYLINDER. AFTER EACH WRITE + WRITE CHECK OPERATION,
                        ;THE TRACK ADDRESS IS UPDATE BY THE AMOUNT SPECIFIED IN THE "INCREMENT
                        ;TRACK".
                        ;
                        ;NOTE: CYLINDER 629. WILL NOT BE USED, IN ORDER TO PRESERVE THE BAD
                        ;      SECTOR FILE DATA.
                        ;
                        ;THE FULL TRACK TRANSFER IS MADE IN 2 PASSES:
                        ;       1ST PASS, SECTORS:  00. THRU 24.
                        ;       2ND PASS, SECTORS:  25. THRU 49.
                        ;
                        ;THE PARAMETERS:
                        ;       STARTING CYLINDER
                        ;       ENDING CYLINDER
                        ;       STARTING TRACK
                        ;       ENDING TRACK
                        ;       INCREMENT TRACK
                        ;       STARTING SECTOR
                        ;;*****************************************************************************

036636                  T17::
036636  004737  020226          JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
036642  105737  002235          TSTB    WRTALL          ;DID OPERATOR WANT TO WRITE ON MEDIUM?
036646  001015                  BNE     1$              ;BR IF YES
                                                        ;NOTIFY OPERATOR THAT TEST WAS NOT RUN
036650  013746  002114          MOV     L$TEST,-(SP)
036654  012746  004345          MOV     #WRTENM,-(SP)
036660  012746  000002          MOV     #2,-(SP)
036664  010600                  MOV     SP,R0
036666  104417                  TRAP    C$PNTF
036670  062706  000006          ADD     #6,SP
036674  005000                  CLR     R0              ;CLEAR R0 FOR TRAP
036676  104432                  TRAP    C$EXIT
036700  000256                  .WORD   L10111-.

036702  113737  002654  002620  1$:     MOVB    DRVNO,DTADPB    ;DRIVE ADDRESS
036710  013737  002344  002624          MOV     TRKWC,DTADPB+4  ;HALF TRACK
036716  012737  042610  002626          MOV     #DBUFF,DTADPB+6 ;BUFFER ADDRESS
036724  112737  000000  002630          MOVB    #0,DTADPB+10    ;SECTOR ADDRESS
036732  113737  002212  002631          MOVB    FT,DTADPB+11    ;TRACK ADDRESS
036740  013737  002204  002632          MOV     FC,DTADPB+12    ;CYLINDER ADDRESS
036746  012737  002744  002634          MOV     #REG,DTADPB+14  ;THE SAVED REGISTER TABLE ADDRESS
036754  005037  002246                  CLR     DOTWO           ;RESET 2 ITERATION CONTROL
036760  013702  002224                  MOV     PAT,R2          ;PATTERN IN R2, FILL
036764  013703  002626                  MOV     DTADPB+6,R3     ;BUFFER ADDRESS
036770  013704  002624                  MOV     DTADPB+4,R4     ;TOTAL NUMBER OF WORD COUNT
036774  010223                  2$:     MOV     R2,(R3)+        ;LOAD DATA PATTERN BUFFER
036776  005204                  INC     R4              ;INCREMENT WORD COUNT
037000  001375                  BNE     2$              ;BRANCH IF NOT DONE
037002  004737  012262          JSR     PC,STOPCK       ;STOP THE CLOCK
037006  005005                  CLR     R5              ;1ST PASS FLAG
037010                  T17.1:
037010  104402                  TRAP    C$BSUB
```

```
037012  023727  002632  001165  TEST17: CMP     DTADPB+12,#629. ;IS THIS THE LAST USER CYLINDER ?
037020  001002                          BNE     1$              ;BR IF NO
037022  005337  002632                  DEC     DTADPB+12       ;DON'T WRITE ON LAST USER CYLINDER
037026  112737  000161  002622  1$:     MOVB    #WRTDAT,DTADPB+2        ;WRITE DATA COMMAND
037034  004437  014742                  JSR     R4,DRVCAL       ;DO THE WRITE COMMAND
037040  112737  000151  002622          MOVB    #WCKD,DTADPB+2  ;DO THE WRITE CHECK COMMAND
037046  004437  014742                  JSR     R4,DRVCAL       ;DO THE WRITE CHECK COMMAND
037052                          L10112:
037052  104403                          TRAP    C$ESUB
037054  005737  002246                  TST     DOTWO           ;DONE HALF TRACK TWICE?
037060  100406                          BMI     3$              ;YES, EXIT 2 ITERATIONS LOOP
037062  005337  002246                  DEC     DOTWO           ;NO, MARK 2ND ITERATION
037066  112737  000031  002630          MOVB    #25.,DTADPB+10  ;GET STARTING SECTOR FOR 2ND HALF OF TRACK
037074  000746                  2$:     BR      TEST17          ;LOOP TO XFER 2ND HALF OF TRACK

037076  005037  002246          3$:     CLR     DOTWO           ;RESET PARAMETERS FOR 1ST LOOP
037102  105037  002630                  CLRB    DTADPB+10       ;RESTART AT SECTOR 0
037106  113702  002631          4$:     MOVB    DTADPB+11,R2    ;UPDATE THE TRACK ADDRESS
037112  063702  002216                  ADD     IT,R2           ;INCREMENT BY THE SPECIFIED AMOUNT
037116  023702  002214                  CMP     LT,R2           ;OVER THE LIMIT ?
037122  103403                          BLO     5$              ;BRANCH IF SO
037124  110237  002631                  MOVB    R2,DTADPB+11    ;UPDATE THE TRACK ADDRESS
037130  000730                          BR      TEST17          ;LOOP BACK

037132  005705                  5$:     TST     R5              ;IS IT 2ND PASS?
037134  001010                          BNE     EXIT17          ;YES, EXIT
037136  005205                          INC     R5              ;NO, FLAG 2ND PASS
037140  113737  002212  002631          MOVB    FT,DTADPB+11    ;RESET THE STARTING TRACK
037146  013737  002206  002632          MOV     LC,DTADPB+12    ;UPDATE THE CYLINDER ADDRESS TO LC
037154  000716                          BR      TEST17          ;LOOP BACK

037156                          EXIT17:
037156                          L10111:
037156  104401                          TRAP    C$ETST
```

```
                        .SBTTL  TEST 18: RANDOM WRITE TEST
                        ;
                        ;*************************************************************************
                        ;THIS TEST EXECUTES WRITE + WRITE CHECK DATA RANDOMLY;
                        ;IN THE PACK AREA BONDED BY THE (STARTING CYLINDER, ENDING CYLINDER)
                        ;                              (STARTING TRACK, ENDING TRACK)
                        ;                              (STARTING SECTOR, ENDING SECTOR)
                        ;THE TRANSFER SIZE IS ALWAYS EQUAL TO ONE SECTOR.
                        ;
                        ;IF THERE IS A P-CLOCK,THE PROGRAM PERFORMS AN ADDRESS MARK DETECTION TEST:
                        ;IT VERIFIES THAT DATA CAN BE WRITTEN CORRECTLY WITHIN THE SAME DISC REVOLUTION
                        ;AS A SECTOR DETECTION. SEARCH FOR THE SECOND LOGICAL SECTOR PRECEDING THE
                        ;SELECTED SECTOR TO WRITE, THEN WRITE THE SELECTED SECTOR. TIME THE SEARCH
                        ;DONE-WRITE DONE TO BE WITHIN A DISC REVOLUTION. FLAG LOST REVOLUTIONS.
                        ;
                        ;NOTE: CYLINDER 629. WILL NOT BE USED, IN ORDER TO PRESERVE THE BAD
                        ;      SECTOR FILE DATA.
                        ;
                        ;PARAMETERS:
                        ;       STARTING CYLINDER
                        ;       ENDING CYLINDER
                        ;       STARTING TRACK
                        ;       ENDING TRACK
                        ;       STARTING SECTOR
                        ;       ENDING SECTOR
                        ;       PATTERN
                        ;*************************************************************************
                        ;
037160                  T18::
037160  004737  020226          JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
037164  105737  002235          TSTB    WRTALL          ;DID OPERATOR WANT TO WRITE ON MEDIUM?
037170  001015                  BNE     1$              ;BR IF YES
                                                        ;NOTIFY OPERATOR THAT TEST WAS NOT RUN
037172  013746  002114          MOV     L$TEST,-(SP)
037176  012746  004345          MOV     #WRTENM,-(SP)
037202  012746  000002          MOV     #2,-(SP)
037206  010600                  MOV     SP,R0
037210  104417                  TRAP    C$PNTF
037212  062706  000006          ADD     #6,SP
037216  005000                  CLR     R0              ;CLEAR R0 FOR TRAP
037220  104432                  TRAP    C$EXIT
037222  001600                  .WORD   L10113-.
                        ;
037224  013737  002244  002240  1$:     MOV     XTIMES,ITCNT    ;SET ITERATION COUNT
037232  113737  002654  002620          MOVB    DRVNO,DTADPB    ;YES, PROCEED:  SET UP THE PAPAMETERS
037240  012737  177400  002624          MOV     #-256.,DTADPB+4 ;WORD COUNT SET TO ONE SECTOR
037246  012737  042610  002626          MOV     #DBUFF,DTADPB+6 ;BUFFER ADDRESS
037254  012737  002744  002634          MOV     #REG,DTADPB+14  ;THE SAVED RHXX/RP07 REGISTER TABLE
037262  013702  002624                  MOV     DTADPB+4,R2     ;WORD COUNT
037266  013703  002626                  MOV     DTADPB+6,R3     ;BUFFER ADDRESS
037272  013704  002224                  MOV     PAT,R4          ;PATTERN
037276  010423                  2$:     MOV     R4,(R3)+        ;FILL THE BUFFER WITH DEFAULT PATTERN
037300  005202                  INC     R2              ;INCREMENT THE WORD COUNT
037302  001375                  BNE     2$              ;LOOP IF NOT DONE
037304  005737  002250          TST     CLKSTA          ;P-CLK PRESENT?
037310  003055                  BGT     TST18A          ;YES, EXEC RAND WRT TST + AD MRK DET TST
037312  004737  020226          JSR     PC,RPINIT       ;INITIALIZE THE SUB-SYSTEM
```

```
037316  004737  012262          TEST18: JSR     PC,STOPCK       ;STOP THE CLOCK
037322  004437  017544          1$:     JSR     R4,RANADR       ;GENERATE THE RANDOM STARTING ADDRESS
                                                                ;MAKE SURE YOU DON'T WRITE IN THE BAD SEC FILE
037326  123727  002631  000037          CMPB    DTADPB+11,#31.  ;IS THIS THE LAST TRACK ?
037334  001004                          BNE     2$              ;BR IF NO
037336  023727  002632  001165          CMP     DTADPB+12,#629. ;IS THIS THE LAST USER CYLINDER ?
037344  001766                          BEQ     1$              ;BR IF YES
037346  105737  002234          2$:     TSTB    RANPAT          ;SELECT RANDOM PATTERN ?
037352  001413                          BEQ     5$              ;BRANCH IF NOT
037354  013702  002624                  MOV     DTADPB+4,R2     ;WORD COUNT 2'S COMPLEMENT
037360  013703  002626                  MOV     DTADPB+6,R3     ;BUFFER ADDRESS
037364  004737  011610          3$:     JSR     PC,RAND         ;GERERATE NEW RANDOM NUMBER
037370  013723  011672          4$:     MOV     $RP1,(R3)+      ;FILL THE BUFFER WITH RANDOM PATTERN
037374  062702  000001                  ADD     #1,R2           ;FINISH ?
037400  100773                          BMI     4$              ;LOOP BACK , IF NOT DONE
037402                          5$:
037402                          T18.1:
037402  104402                          TRAP    C$BSUB
037404  112737  000161  002622          MOVB    #WRTDAT,DTADPB+2        ;DO A WRITE DATA
037412  004437  014742                  JSR     R4,DRVCAL
037416  112737  000151  002622          MOVB    #WCKD,DTADPB+2  ;DO A WRITE CHECK DATA
037424  004437  014742                  JSR     R4,DRVCAL
037430                          L10114:
037430  104403                          TRAP    C$ESUB
037432  005337  002240                  DEC     ITCNT           ;DONE ITERATIONS ?
037436  001327                          BNE     TEST18          ;BR IF NO
037440                          EXIT18:
037440  104432                          TRAP    C$EXIT
037442  001360                          .WORD   L10113-.

037444  004437  015476          TST18A: JSR     R4,SRCH00       ;MASS BUS INIT & RECAL
037450  000402                          BR      1$              ;NO RECAL ERROR, CONTINUE
037452  000137  040774                  JMP     XIT18           ;EXIT ON RECAL ERROR
037456  004737  015626          1$:     JSR     PC,STRTMR       ;INIT THE TIMERS
037462  042777  000101  152430          BIC     #101,@PKCS      ;STOP THE P-CLOCK
                                                                ;SETUP VECTOR IN CASE OF CLOCK OVERFLOW
037470  012746  000300                  MOV     #PRI06,-(SP)
037474  012746  040574                  MOV     #T18OFL,-(SP)
037500  013746  012126                  MOV     PKV,-(SP)
037504  012746  000003                  MOV     #3,-(SP)
037510  104437                          TRAP    C$SVEC
037512  062706  000010                  ADD     #10,SP
                                                                ;SETUP RHXX/RP07 VECTOR
037516  012746  000000                  MOV     #PRI00,-(SP)
037522  012746  015624                  MOV     #DORTI,-(SP)
037526  013746  002644                  MOV     RPVEC,-(SP)
037532  012746  000003                  MOV     #3,-(SP)
037536  104437                          TRAP    C$SVEC
037540  062706  000010                  ADD     #10,SP
037544  005005                          CLR     R5              ;SET COUNT-UP FLAG FOR COUNT SUBR

037546  105737  002234          TST18B: TSTB    RANPAT          ;SELECT RANDOM PATTERN ?
037552  001413                          BEQ     2$              ;BRANCH IF NOT
037554  013702  002624                  MOV     DTADPB+4,R2     ;WORD COUNT 2'S COMPLEMENT
037560  013703  002626                  MOV     DTADPB+6,R3     ;BUFFER ADDRESS
037564  004737  011610                  JSR     PC,RAND         ;GERERATE NEW RANDOM NUMBER
```

```
TEST 18: RANDOM WRITE TEST

     96 037570  013723  011672          1$:     MOV     $RP1,(R3)+      ;FILL THE BUFFER WITH RANDOM PATTERN
     97 037574  062702  000001                  ADD     #1,R2           ;FINISH ?
     98 037600  100773                          BMI     1$              ;LOOP BACK , IF NOT DONE
     99
    100                                         ;REDUCE THE TARGET SECTOR BY 2, TO COMPUTE THE VALUE OF THE 2ND LOGICAL
    101                                         ;SECTOR.
    102
    103 037602  004437  017544          2$:     JSR     R4,RANADR       ;GEN A RAND ADR: CYL, TRK, SEC
    104                                                                 ;MAKE SURE YOU DON'T WRITE IN THE BAD SEC FILE
    105 037606  123727  002631  000037          CMPB    DTADPB+11,#31.  ;IS THIS THE LAST TRACK ?
    106 037614  001004                          BNE     3$              ;BR IF NO
    107 037616  023727  002632  001165          CMP     DTADPB+12,#629. ;IS THIS THE LAST USER CYLINDER ?
    108 037624  001766                          BEQ     2$              ;BR IF YES
    109 037626  113701  002630          3$:     MOVB    DTADPB+10,R1    ;GET TARGET SECTOR ADDRESS TO WRITE
    110 037632  032777  000004  143032          BIT     #ILV,@RPDS      ;IS INTERLEAVED SECTOR ENABLED ?
    111 037640  001006                          BNE     5$              ;BR IF YES
    112 037642  162701  000002                  SUB     #2,R1           ;BACKUP THE SECTOR ADDRESS FOR THE SEARCH
    113 037646  002002                          BGE     4$              ;BR IF < SECTOR 0
    114 037650  062701  000062                  ADD     #50.,R1         ;ADJUST FOR THE ADDRESS BEFORE SECTOR 0
    115 037654  000411                  4$:     BR      7$              ;EXIT
    116
    117 037656  005701                  5$:     TST     R1              ;IS IT SECTOR ADDR 0 ?
    118 037660  001405                          BEQ     6$              ;BR IF YES
    119 037662  162701  000031                  SUB     #25.,R1         ;IS IT SECTOR ADDR 25 ?
    120 037666  001002                          BNE     6$              ;BR IF NO
    121 037670  062701  000031                  ADD     #25.,R1         ;ADJUST FOR THE ADDRESS BEFORE SECTOR 0
    122 037674  062701  000030          6$:     ADD     #24.,R1         ;REDUCE THE TARGET SECTOR BY 2
    123
    124                                         ;PREPARE TO SEARCH
    125 037700                          7$:
        037700                          T18.2:
        037700  1[illegible]                     TRAP    C$BSUB
    126 037702  013777  002632  143004          MOV     DTADPB+12,@RPDC ;CYL
    127 037710  110146                          MOVB    R1,-(SP)        ;MERGE SECTOR
    128 037712  113766  002631  000001          MOVB    DTADPB+11,1(SP) ;AND TRK
    129 037720  012677  142742                  MOV     (SP)+,@RPDA     ;LOAD TRK/SEC
    130 037724  013777  002624  142730          MOV     DTADPB+4,@RPWC  ;WRITE 1 SECTOR
    131 037732  013777  002626  142724          MOV     DTADPB+6,@RPBA  ;SET DATA BUFFER ADR
    132 037740  012703  002472                  MOV     #T1420,R3       ;TIMING LIMITS FOR COUNT SUBR
    133 037744  012777  000006  152150          MOV     #6,@PKB         ;ALLOW > 6 REVOLUTIONS PER SEARCH:
    134
    135                                         ;3 FOR IMPLIED MAX SEEK (46 MSEC OR ABOUT 3 REVOLUTIONS)
    136                                         ;3 FOR WORST CASE SEARCH(SECT CMP ERR OR HDR CRC ERR)
    137
    138 037752  012777  000105  152140          MOV     #105,@PKCS      ;START P-CLOCK:IE=1,COUNT DOWN,LINE FREQ
    139 037760  012777  000131  142672          MOV     #SEARCH,@RPCS1  ;START A SEARCH
    140 037766  000001                          WAIT                    ;WAIT ON INTERRUPT
    141 037770  017746  152130                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
    142 037774  042777  000101  152116          BIC     #101,@PKCS      ;STOP THE CLOCK
    143 040002  012677  152114                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
    144 040006  032777  040000  142456          BIT     #BIT14,@RPDS    ;ERROR?
    145 040014  001534                          BEQ     T18$11          ;NO--BRANCH
    146 040016  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
        040022  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
        040026  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
        040032  012777  000040  142630          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
        040040  013777  002620  142622          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
```

TEST 18: RANDOM WRITE TEST

```
                040046  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
147             040052  004537  012664                  JSR     R5,ERRANY
148             040056  002620                          DTADPB                  ;FIND OUT WHAT ERROR
149             040060                          L10115:
                040060  104403                          TRAP    C$ESUB
150             040062  032737  000210  002254          BIT     #BIT3!BIT7,SVSTAT       ;RETRY ALLOWED ?
151             040070  001022                          BNE     8$              ;BRANCH IS SO
152             040072  012746  004422                  MOV     #SEAERR,-(S )
                040076  012746  000001                  MOV     #1,-(SP)
                040102  010600                          MOV     SP,R0
                040104  104417                          TRAP    C$PNTF
                040106  062706  000004                  ADD     #4,SP
153             040112  012746  004525                  MOV     #ABOTST,-(SP)
                040116  012746  000001                  MOV     #1,-(SP)
                040122  010600                          MOV     SP,R0
                040124  104417                          TRAP    C$PNTF
                040126  062706  000004                  ADD     #4,SP
154             040132  000137  040700                  JMP     T18END
155
156             040136  012737  000020  002340  8$:     MOV     #16.,WCEFLG     ;RETRY 16 TIMES
157             040144  012777  000006  151750  9$:     MOV     #6,@PKB         ;ALLOW > 6 REVOLUTIONS PER SEARCH:
158
159                                                     ;3 FOR IMPLIED MAX SEEK (46 MSEC   ` ABOUT 3 REVOLUTIONS)
160                                                     ;3 FOR WORST CASE SEARCH (SECT CMP .?R OR HDR CRC ERR)
161
162             040152  012777  000105  151740          MOV     #105,@PKCS      ;START P-CLOCK:IE,COUNT DOWN,LINE FREQ
163             040160  012777  000131  142472          MOV     #SEARCH,@RPCS1  ;START A SEARCH
164             040166  000001                          WAIT                    ;WAIT ON INTERRUPT
165             040170  017746  151730                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
166             040174  042777  000101  151716          BIC     #101,@PKCS      ;STOP THE CLOCK
167             040202  012677  151714                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
168             040206  032777  040000  142456          BIT     #BIT14,@RPDS    ;ERROR?
169             040214  001434                          BEQ     T1811$          ;EXIT IF NONE
170             040216  012777  000040  142444          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
171             040224  013777  002620  142436          MOV     DTADPB,@RPCS2   ;DRIVE ADDRESS
172             040232  005337  002340                  DEC     WCEFLG          ;OVER RETRY LIMIT ?
173             040236  001342                          BNE     9$              ;BRANCH IF NOT
174             040240  012746  004461                  MOV     #SEABAD,-(SP)
                040244  012746  000001                  MOV     #1,-(SP)
                040250  010600                          MOV     SP,R0
                040252  104417                          TRAP    C$PNTF
                040254  062706  000004                  ADD     #4,SP
175             040260  012746  004525                  MOV     #ABOTST,-(SP)
                040264  012746  000001                  MOV     #1,-(SP)
                040270  010600                          MOV     SP,R0
                040272  104417                          TRAP    C$PNTF
                040274  062706  000004                  ADD     #4,SP
176             040300  000137  040700                  JMP     T18END          ;OTHERWISE EXIT
177             040304                          T18.3:
                040304  104402                          TRAP    C$BSUB
178             040306  013777  002630  142352  T1811$: MOV     DTADPB+10,@RPDA ;SET TRK/SECT TO WRITE
179             040314  005077  151602                  CLR     @PKB            ;CLEAR P-CLK BUFFER COUNT
180             040320  012777  000161  142332          MOV     #WRTDAT,@RPCS1  ;START A WRITE
181             040326  012777  000121  151564          MOV     #121,@PKCS      ;START THE CLOCK:IE=1,UP,SINGLE,10US
182             040334  000001                          WAIT                    ;WAIT ON INTERRUPT
183             040336  017746  151562                  MOV     @PKC,-(SP)      ;SAVE THE CLOCK
184             040342  042777  000101  151550          BIC     #101,@PKCS      ;STOP THE CLOCK
```

```
    040350  012677  151546                  MOV     (SP)+,@PKB      ;AND RESTORE THE COUNTED VALUE
    040354  032777  040000  142310          BIT     #BIT14,@RPDS    ;ERR=1?
    040362  001437                          BEQ     T1812$          ;NO--BRANCH
    040364  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
    040370  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
    040374  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
    040400  012777  000040  142262          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
    040406  013777  002620  142254          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
    040414  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    040420  004537  012664                  JSR     R5,ERRANY       ;FIND OUT WHAT ERROR
    040424  002620                          DTADPB
    040426                          L10116:
    040426  104403                          TRAP    C$ESUB
    040430  032737  000040  002254          BIT     #BIT5,SVSTAT    ;POSITION ERROR?
    040436  001411                          BEQ     T1812$          ;NO, CONTINUE
    040440  012746  004544                  MOV     #POSERR,-(SP)
    040444  012746  000001                  MOV     #1,-(SP)
    040450  010600                          MOV     SP,R0
    040452  104417                          TRAP    C$PNTF
    040454  062706  000004                  ADD     #4,SP
    040460  000507                          BR      T18END

    040462  004737  016076          T1812$: JSR     PC,COUNT        ;COUNT TIME SEARCH DONE-WRITE DONE
                                                                    ;SETUP RHXX/RP07 VECTOR
    040466  013746  002646                  MOV     RPVEC+2,-(SP)
    040472  012746  022674                  MOV     #ISRV,-(SP)
    040476  013746  002644                  MOV     RPVEC,-(SP)
    040502  012746  000003                  MOV     #3,-(SP)
    040506  104437                          TRAP    C$SVEC
    040510  062706  000010                  ADD     #10,SP
    040514  112737  000151  002622          MOVB    #WCKD,DTADPB+2  ;DO A WRITE CHECK DATA CMD
    040522  104404                          TRAP    C$BSEG
    040524  004437  014742                  JSR     R4,DRVCAL       ;DO RECALIBRATE
    040530                          10000$:
    040530  104405                          TRAP    C$ESEG
    040532  023737  002316  002244          CMP     TIM.UP+14,XTIMES        ;REPEATED 1024 TIMES?
    040540  002057                          BGE     T18END          ;YES, CONCLUDE TEST
                                                                    ;SETUP RHXX/RP07 VECTOR
    040542  013746  002646                  MOV     RPVEC+2,-(SP)
    040546  012746  015624                  MOV     #DORTI,-(SP)
    040552  013746  002644                  MOV     RPVEC,-(SP)
    040556  012746  000003                  MOV     #3,-(SP)
    040562  104437                          TRAP    C$SVEC
    040564  062706  000010                  ADD     #10,SP
    040570  000137  037546                  JMP     TST18B          ;CONTINUE

    040574  004737  012324          T180FL: JSR     PC,FORSEC       ;RESET TIMER TO 4 SEC, CHANGE CLK SERVICE AD
                                                                    ;DROP THE PRIORITY
    040600  012700  000000                  MOV     #PRI00,R0
    040604  104441                          TRAP    C$SPRI
    040606  004737  010646                  JSR     PC,SAVREG       ;;SAVE R0-R5
    040612  012702  002620                  MOV     #DTADPB,R2      ;DPB POINTER
    040616  004737  024472                  JSR     PC,SVRHXX       ;SAVE ALL THE RHXX/RP07 REGISTERS
    040622  012777  000040  142040          MOV     #CLR,@RPCS2     ;MASSBUS CLEAR
    040630  013777  002620  142032          MOV     DTADPB,@RPCS2   ;SELECT DRIVE
    040636  016102  000014                  MOV     14(R1),R2       ;ADDRESS OF SAVED REGISTER TABLE
    040642  016237  000036  002266          MOV     36(R2),CYL.RD   ;GET CURRENT CYLINDER
```

TEST 18: RANDOM WRITE TEST

```
        040650  116237  000006  002272          MOVB    6(R2),SEC.RD    ;GET CURRENT SECTOR
        040656  116237  000007  002270          MOVB    7(R2),TRK.RD    ;GET CURRENT TRACK
        040664  004737  010700                  JSR     PC,RESREG       ;;RESTORE R0-R5
    214 040670  104456                          TRAP    C$ERHRD
        040672  000024                          .WORD   20
        040674  006112                          .WORD   EM20
        040676  007604                          .WORD   DH44
    215 040700                          T18END:
        040700  012777  000040  141762          MOV     #CLR,@RPCS2     ;CLEAR THE MASSBUS
        040706  013777  002620  141754          MOV     DTADPB,@RPCS2   ;& SELECT DRIVE
    216 040714  004737  011676                  JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
    217
    218 040720  005737  002310          TST18C: TST     TIM.UP+6        ;ANY SEARCH-WRITE TIMED > 1 REVOLUTION?
    219 040724  001423                          BEQ     3$              ;NO, SKIP
    220 040726  023727  002310  000001          CMP     TIM.UP+6,#1     ;ONLY ONE LOST REV?
    221 040734  001405                          BEQ     1$              ;YES, FLAG SOFT ERROR
    222 040736  104456                          TRAP    C$ERHRD
        040740  000064                          .WORD   52
        040742  007432                          .WORD   EM52
        040744  010532                          .WORD   DH52
    223 040746  000404                          BR      2$
    224 040750                          1$:
        040750  104457                          TRAP    C$ERSOFT
        040752  000065                          .WORD   53
        040754  007432                          .WORD   EM52
        040756  010532                          .WORD   DH52
    225 040760                          2$:
        040760  004437  016370                  JSR     R4,TYPTIM       ;GO TYPE THE TIME>
        040764  002472                          T1420                   ;POINTER
    226 040766  004437  016240                  JSR     R4,SPTYP
    227 040772  002532                          S1420
    228 040774                          3$:
    229 040774                          XIT18:                          ;SETUP RHXX/RP07 VECTOR
    230 040774  013746  002646                  MOV     RPVEC+2,-(SP)
        041000  012746  022674                  MOV     #ISRV,-(SP)
        041004  013746  002644                  MOV     RPVEC,-(SP)
        041010  012746  000003                  MOV     #3,-(SP)
        041014  104437                          TRAP    C$SVEC
        041016  062706  000010                  ADD     #10,SP
    231
    237
    249
    250                                         .EVEN
    251
    252 041022                          L10113:
        041022  104401                          TRAP    C$ETST
    253
```

```
      1
      3
```

```
      2                                 .TITLE PARAMETER CODING
     13
     14                                 .SBTTL  HARDWARE PARAMETER CODING SECTION
     42
     44                                 ;++
     45                                 ; THE HARDWARE PARAMETER CODING SECTION CONTAINS MACROS
     46                                 ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
     47                                 ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
     48                                 ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
     49                                 ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
     50                                 ; WITH THE OPERATOR.
     51                                 ;--
     52
     53 041024  000022                          .WORD L10117-L$HARD/2
        041026                          L$HARD::
     54                                                          ;PRINT 'RPCS1 ADRS?'
     55 041026  000031                          .WORD   T$CODE
        041030  041072                          .WORD   MESG1
        041032  160000                          .WORD   T$LOLIM
        041034  177777                          .WORD   T$HILIM
     56                                                          ;PRINT 'VECTOR ADRS?'
     57 041036  001031                          .WORD   T$CODE
        041040  041105                          .WORD   MESG2
        041042  000000                          .WORD   T$LOLIM
        041044  000377                          .WORD   T$HILIM
     58                                                          ;PRINT 'BR LEVEL?'
     59 041046  002032                          .WORD   T$CODE
        041050  041121                          .WORD   MESG3
        041052  000340                          .WORD   340
        041054  000000                          .WORD   T$LOLIM
        041056  000007                          .WORD   T$HILIM
     60                                                          ;PRINT 'DRIVE #?'
     61 041060  003032                          .WORD   T$CODE
        041062  041132                          .WORD   MESG4
        041064  000007                          .WORD   7
        041066  000000                          .WORD   T$LOLIM
        041070  000007                          .WORD   T$HILIM
     62                                         .EVEN
        041072                          L10117:
     63
     67 041072      122     120     103 MESG1:  .ASCIZ  /RPCS1 ADRS/
     68 041105      126     105     103 MESG2:  .ASCIZ  /VECTOR ADRS/
     69 041121      102     122     040 MESG3:  .ASCIZ  /BR LEVEL/
     70 041132      104     122     111 MESG4:  .ASCIZ  /DRIVE #/
     71
     72                                         .EVEN
     76
     86
```

```
                                .SBTTL  SOFTWARE PARAMETER CODING SECTION

                                ;++
                                ; THE SOFTWARE PARAMETER CODING SECTION CONTAINS MACROS
                                ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
                                ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
                                ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
                                ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
                                ; WITH THE OPERATOR.
                                ;--

041142  000116                          .WORD L10120-L$SOFT/2
041144                          L$SOFT::
                                                        ;PRINT 'CHANGE DRIVE PARAMETERS?'
041144  015130                          .WORD   T$CODE
041146  041400                          .WORD   PARMSG
041150  000001                          .WORD   1
                                                        ;GO TO 1$ IF NO
041152  056044                          .WORD   T$CODE
                                                        ;PRINT 'STARTING  CYL?'
041154  000052                          .WORD   T$CODE
041156  041430                          .WORD   FCMSG
041160  001777                          .WORD   1777
041162  000000                          .WORD   T$LOLIM
041164  001164                          .WORD   T$HILIM
                                                        ;PRINT 'ENDING    CYL?'
041166  001052                          .WORD   T$CODE
041170  041446                          .WORD   LCMSG
041172  001777                          .WORD   1777
041174  000001                          .WORD   T$LOLIM
041176  001165                          .WORD   T$HILIM
                                                        ;PRINT 'INCREMENT CYL?'
041200  002052                          .WORD   T$CODE
041202  041464                          .WORD   ICMSG
041204  001777                          .WORD   1777
041206  000001                          .WORD   T$LOLIM
041210  001164                          .WORD   T$HILIM
                                                        ;PRINT 'STARTING  TRK?'
041212  003052                          .WORD   T$CODE
041214  041502                          .WORD   FTMSG
041216  000037                          .WORD   37
041220  000000                          .WORD   T$LOLIM
041222  000036                          .WORD   T$HILIM
                                                        ;PRINT 'ENDING    TRK?'
041224  004052                          .WORD   T$CODE
041226  041520                          .WORD   LTMSG
041230  000037                          .WORD   37
041232  000001                          .WORD   T$LOLIM
041234  000037                          .WORD   T$HILIM
                                                        ;PRINT 'INCREMENT TRK?'
041236  005052                          .WORD   T$CODE
041240  041536                          .WORD   ITMSG
041242  000037                          .WORD   37
041244  000001                          .WORD   T$LOLIM
041246  000036                          .WORD   T$HILIM
                                                        ;PRINT 'STARTING  SEC?'
041250  006052                          .WORD   T$CODE
```

```
                041252  041554                          .WORD   FSMSG
                041254  000077                          .WORD   77
                041256  000000                          .WORD   T$LOLIM
                041260  000060                          .WORD   T$HILIM
           31
           32   041262  007052                          .WORD   T$CODE
                041264  041572                          .WORD   LSMSG
                041266  000077                          .WORD   77
                041270  000001                          .WORD   T$LOLIM
                041272  000061                          .WORD   T$HILIM
           33
           34   041274  010032                          .WORD   T$CODE
                041276  041610                          .WORD   PATMSG
                041300  177777                          .WORD   177777
                041302  000000                          .WORD   T$LOLIM
                041304  177777                          .WORD   T$HILIM
           35   041306                          1$:
           37
           38   041306  014130                          .WORD   T$CODE
                041310  041626                          .WORD   WRITMG
                041312  000400                          .WORD   400
           39
           40   041314  007044                          .WORD   T$CODE
           41
           42
           43
           44   041316  014120                          .WORD   T$CODE
                041320  041675                          .WORD   WRSAFM
                041322  000400                          .WORD   400
           46
           47   041324  014130                          .WORD   T$CODE
                041326  042030                          .WORD   RPATMG
                041330  000001                          .WORD   1
           48   041332                          2$:
           49   041332  011130                          .WORD   T$CODE
                041334  042107                          .WORD   RDHDMG
                041336  000001                          .WORD   1
           50
           51   041340  011130                          .WORD   T$CODE
                041342  042157                          .WORD   TIMMSG
                041344  000400                          .WORD   400
           52
           53   041346  013130                          .WORD   T$CODE
                041350  042201                          .WORD   STOMSG
                041352  000400                          .WORD   400
           54
           55   041354  012130                          .WORD   T$CODE
                041356  042233                          .WORD   STLTM
                041360  000001                          .WORD   1
           56
           57   041362  012130                          .WORD   T$CODE
                041364  042327                          .WORD   STALMG
                041366  000400                          .WORD   400
           58
           59   041370  004044                          .WORD   T$CODE
           60   041372  013130                          .WORD   T$CODE
                041374  042414                          .WORD   STALRM

                                ;PRINT 'ENDING    SEC?'

                                ;PRINT 'DATA  PATTERN?'

                                ;PRINT 'DO YOU WANT TO WRITE DATA ANYWHERE ON MEDIA?

                                ;GO TO 2$ IF NO

                                ;PRINT '! CUSTOMER DATA WILL BE OVERWRITTEN !
                                ;       ---------------------------------
                                ;  CONTINUE?'

                                ;PRINT 'USE RANDOM DATA PATTERNS FOR RANDOM WRITE -
                                ;       TEST?'

                                ;PRINT 'PERFORM READ HEADER & DATA DURING SEEKS?'

                                ;PRINT 'TYPE TIME REPORTS?'

                                ;PRINT 'INHIBIT SOFTWARE TIMEOUTS?'

                                ;PRINT 'TIMING TESTS, STALL BETWEEN SEEKS: RANDOM IN

                                ;PRINT 'STALL AFTER EVERY DRIVE FUNCTION IN NON-TIMI

                                ;GO TO 3$ IF NO
```

```
                041376  000001                          .WORD   1
     61         041400                          3$:
     62
     71                                                  .EVEN
                041400                          L10120:
     72
     76         041400      103     110     101  PARMSG: .ASCIZ  /CHANGE DRIVE PARAMETERS/
     77         041430      123     124     101  FCMSG:  .ASCIZ  /STARTING  CYL/
     78         041446      105     116     104  LCMSG:  .ASCIZ  /ENDING    CYL/
     79         041464      111     116     103  ICMSG:  .ASCIZ  /INCREMENT CYL/
     80         041502      123     124     101  FTMSG:  .ASCIZ  /STARTING  TRK/
     81         041520      105     116     104  LTMSG:  .ASCIZ  /ENDING    TRK/
     82         041536      111     116     103  ITMSG:  .ASCIZ  /INCREMENT TRK/
     83         041554      123     124     101  FSMSG:  .ASCIZ  /STARTING  SEC/
     84         041572      105     116     104  LSMSG:  .ASCIZ  /ENDING    SEC/
     85         041610      104     101     124  PATMSG: .ASCIZ  /DATA  PATTERN/
     87         041626      104     117     040  WRITMG: .ASCIZ  /DO YOU WANT TO WRITE ANYWHERE ON MEDIA/
     88         041675      007     011     041  WRSAFM: .ASCII  <BELL>/ ! CUSTOMER DATA WILL BE OVERWRITTEN !/<CR><LF>
     89         041746      007     011     055          .ASCII  <BELL>/ ----------------------------------/<CR><LF>
     90         042017      103     117     116          .ASCIZ  /CONTINUE/
     92         042030      125     123     105  RPATMG: .ASCIZ  /USE RANDOM DATA PATTERNS FOR RANDOM WRITE TEST/
     93         042107      120     105     122  RDHDMG: .ASCIZ  /PERFORM READ HEADER & DATA DURING SEEKS/
     94         042157      124     131     120  TIMMSG: .ASCIZ  /TYPE TIME REPORTS/
     95         042201      111     116     110  STOMSG: .ASCIZ  /INHIBIT SOFTWARE TIMEOUTS/
     96         042233      124     111     115  STLTIM: .ASCIZ  /TIMING TESTS, STALL BETWEEN SEEKS: RANDOM INSTEAD OF 2 MSEC/
     97         042327      123     124     101  STALMG: .ASCIZ  /STALL AFTER EVERY DRIVE FUNCTION IN NON-TIMING TESTS/
     98         042414      125     123     105  STALRM: .ASCIZ  /USE RANDOM STALL TIMES/
     99
    100                                                  .EVEN
    110
    111         042444                          $PATCH::.BLKW   50.             ;PROGRAM PATCH AFEA (50. WORDS)
    112
    113         042610                          DBUFF:: .BLKW   256.*25.        ;DATA BUFFER FOR HALF A TRACK
    114         073610                                  .BLKW   256.            ;ONE SECTOR EXTRA FOR MID-TRANSFER SEEK TEST
    115
    122                                                  .EVEN
                074610  074630                          .WORD T$FREE
                074612  000006                          .WORD T$SIZE
                074614                          L$LAST::
```

```
      1
     14
     16 074614  000000                        .WORD   0
        074616  000004                        .WORD   L10123-./2-1
        074620                        L10121:
     17 074620  176700                        .WORD   176700
     18 074622  000254                        .WORD   254
     19 074624  000240                        .WORD   240
     20 074626  000000                        .WORD   0
     21 074630                        L10123:
     23         000001                .END
```

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SYMBOL TABLE

```
ABOPAS  015272          CI7     022364          C$RDBU= 000007          DRVTYP  020146          ERRABO  015100
ABORT   026162          CI7B    022400          C$REFG= 000047          DSNMSG  004316 G        ERRANY  012664
ABOTST  004525 G        CI8     022452          C$RESE= 000033          DTADPB  002620 G        ERRVEC= 000004
ACTDRV  020202          CLKSTA  002250 G        C$REVI= 000003          DTE     = 010000 G      EVL     = 000004 G
ACTSTR  020203          CLR     = 000040 G      C$RFLA= 000021          DTUW    020224          EWN     = 000002 G
ADJUST  014206          CLRQUE  025176          C$RPT = 000025          DVA     = 004000 G      EXECMD  015044
ADR     = 000020 G      CMOD    = 100000 G      C$SEFG= 000046          DVC     = 000200 G      EXINIT  026236
AOE     = 001000 G      CONTIN  026124          C$SPRI= 000041          ECH     = 000100 G      EXIT1   026654
ASSEMB= 000010          COUNT   016076          C$SVEC= 000037          ECI     = 004000 G      EXIT11  034030
ATA     = 100000 G      COUNT2  015676          C$TPRI= 000013          EF.CON= 000036 G        EXIT12  034262
ATABIT  002734 G        CR      = 000015 G      DBUFF   042610 G        EF.NEW= 000035 G        EXIT13  034452
AVERAG  017106          CRLF    003054 G        DCK     = 100000 G      EF.PWR= 000034 G        EXIT14  034552
AVERGE  004721 G        CYL.DS  002274 G        DCU     = 000040 G      EF.RES= 000037 G        EXIT15  036234
AVGVAL  017167          CYL.RD  002266 G        DELTA   002342 G        EF.STA= 000040 G        EXIT16  036626
A16     = 000400 G      C$AU    = 000052        DFPTBL  002172 G        EMPTYQ  025260          EXIT17  037156
A17     = 001000 G      C$AUTO= 000061          DH25    010600 G        EM1     005331 G        EXIT18  037440
BELL    = 000007 G      C$BRK   = 000022        DH25A   003057 G        EM11    005644 G        EXIT2   026764
BITS    002352 G        C$BSEG= 000004          DH44    007604 G        EM12    005666 G        EXIT3   027210
BIT0    = 000001 G      C$BSUB= 000002          DH44A   003075 G        EM13    005707 G        EXIT4   027424
BIT00   = 000001 G      C$CEFG= 000045          DH44B   003114 G        EM14    005730 G        EXIT5   027662
BIT01   = 000002 G      C$CLCK= 000062          DH44C   003133 G        EM15    005765 G        EXIT6   027770
BIT02   = 000004 G      C$CLEA= 000012          DH44D   003152 G        EM16    006032 G        EXIT7   031020
BIT03   = 000010 G      C$CLOS= 000035          DH44E   003201 G        EM17    006065 G        E$END   = 002100
BIT04   = 000020 G      C$CLP1= 000006          DH44F   003272 G        EM2     005376 G        E$LOAD= 000035
BIT05   = 000040 G      C$CVEC= 000036          DH44G   003352 G        EM20    006112 G        FC      002204
BIT06   = 000100 G      C$DCLN= 000044          DH44H   003443 G        EM21    006161 G        FCMSG   041430
BIT07   = 000200 G      C$DODU= 000051          DH44I   003523 G        EM22    006205 G        FER     = 000020 G
BIT08   = 000400 G      C$DRPT= 000024          DH44J   003615 G        EM23    006235 G        FMTRK   = 000163 G
BIT09   = 001000 G      C$DU    = 000053        DH44K   003677 G        EM24    006271 G        FMT16   = 010000 G
BIT1    = 000002 G      C$EDIT= 000003          DH44L   003717 G        EM25    006330 G        FORSEC  012324
BIT10   = 002000 G      C$ERDF= 000055          DH45    010340 G        EM26    006366 G        FS      002220
BIT11   = 004000 G      C$ERHR= 000056          DH45A   003736 G        EM27    006436 G        FSMSG   041554
BIT12   = 010000 G      C$ERRO= 000060          DH45B   003764 G        EM3     005440 G        FT      002212
BIT13   = 020000 G      C$ERSF= 000054          DH45C   004021 G        EM30    006475 G        FTMSG   041502
BIT14   = 040000 G      C$ERSO= 000057          DH45D   004076 G        EM31    006552 G        FWD     005100 G
BIT15   = 100000 G      C$ESCA= 000010          DH52    010532 G        EM32    006614 G        F$AU    = 000015
BIT2    = 000004 G      C$ESEG= 000005          DH52A   004164 G        EM33    006637 G        F$AUTO= 000020
BIT3    = 000010 G      C$ESUB= 000003          DIAG    = 000135 G      EM34    006657 G        F$BGN   = 000040
BIT4    = 000020 G      C$ETST= 000001          DIAGMC= 000000          EM35    006674 G        F$CLEA= 000007
BIT5    = 000040 G      C$EXIT= 000032          DLT     = 100000 G      EM36    006730 G        F$DU    = 000016
BIT6    = 000100 G      C$GETB= 000026          DMD     = 100000 G      EM4     005516 G        F$END   = 000041
BIT7    = 000200 G      C$GETW= 000027          DORTI   015624          EM41    006765 G        F$HARD= 000004
BIT8    = 000400 G      C$GMAN= 000043          DOTWO   002246 G        EM42    007020 G        F$HW    = 000013
BIT9    = 001000 G      C$GPHR= 000042          DPB.A   002540 G        EM43    007045 G        F$INIT= 000006
BOE     = 000400 G      C$GPLO= 000030          DPB.B   002560 G        EM44    007067 G        F$JMP   = 000050
BSE     = 100000 G      C$GPRI= 000040          DPB.C   002600 G        EM45    007135 G        F$MOD   = 000000
BYPASS  002252 G        C$INIT= 000011          DPE     = 000010 G      EM46    007166 G        F$MSG   = 000011
CALL.A  014260          C$INLP= 000020          DPINT   020156          EM47    007216 G        F$PROT= 000021
CALL.B  014376          C$MANI= 000050          DPRQS   020166          EM5     005540 G        F$PWR   = 000017
CALL.C  014560          C$MEM   = 000031        DRVACT  020126          EM50    007246 G        F$RPT   = 000012
CHANGE  002236          C$MSG   = 000023        DRVCAL  014742          EM51    007340 G        F$SEG   = 000003
CHKTIM  017462          C$OPEN= 000034          DRVCLR= 000111 G        EM52    007432 G        F$SOFT= 000005
CI1     021456          C$PNTB= 000014          DRVINT  020414          EM54    007460 G        F$SRV   = 000010
CI3     021642          C$PNTF= 000017          DRVNO   002654 G        EM55    007521 G        F$SUB   = 000002
CI4     021754          C$PNTS= 000016          DRVQUE  025300          EM6     005560 G        F$SW    = 000014
CI5     022300          C$PNTX= 000015          DRVSN   002656 G        EM7     005616 G        F$TEST= 000001
CI6     022322          C$QIO   = 000377        DRVSTA  020136          ERR     - 040000 G      GETREG= 000141 G
```

```
GETREQ  025354
G$CNTO= 000200
G$DELM= 000372
G$DISP= 000003
G$EXCP= 000400
G$HILI= 000002
G$LOLI= 000001
G$NO  = 000000
G$OFFS= 000400
G$OFSI= 000376
G$PRMA= 000001
G$PRMD= 000002
G$PRML= 000000
G$RADA= 000140
G$RADB= 000000
G$RADD= 000040
G$RADL= 000120
G$RADO= 000020
G$XFER= 000004
G$YES = 000010
HCE   = 000200 G
HCI   = 002000 G
HCRC  = 000400 G
HELP  = 000000
HERTZ   012142
HOE   = 100000 G
IAE   = 002000 G
IBE   = 010000 G
IC      002210
ICMSG   041464
IDU   = 000040 G
IE    = 000100 G
IER   = 020000 G
ILF   = 000001 G
ILLCMD= 000143 G
ILR   = 000002 G
ILV   = 000004 G
INCCYL  032754
ISR   = 000100 G
ISRCNT  002242 G
ISRV    022674
IT      002216
ITCNT   002240 G
ITMSG   041536
IXE   = 004000 G
IXU   = 000100 G
I$AU  = 000041
I$AUTO= 000041
I$CLN = 000041
I$DU  = 000041
I$HRD = 000041
I$INIT= 000041
I$MOD = 000041
I$MSG = 000041
I$PROT= 000040
I$PTAB= 000041
I$PWR = 000041
I$RPT = 000041
I$SEG = 000041
I$SETU= 000041
I$SFT = 000041
I$SRV = 000041
I$SUB = 000041
I$TST = 000041
J$JMP = 000167
KWSRV   012312
LBC   = 002000 G
LC      002206
LCE   = 001000 G
LCLKTB  012132
LCMSG   041446
LDCMD   012622
LF    = 000012 G
LKS     012134
LKV     012136
LOE   = 040000 G
LOT   = 000010 G
LS      002222
LSMSG   041572
LST   = 002000 G
LT      002214
LTMSG   041520
L$ACP   002110 G
L$APT   002036 G
L$AU    026602 G
L$AUT   002070 G
L$AUTO  026502 G
L$CCP   002106 G
L$CLEA  026504 G
L$CO    002032 G
L$DEPO  002011 G
L$DESC  003026 G
L$DESP  002076 G
L$DEVP  002060 G
L$DISP  002124 G
L$DLY   002116 G
L$DTP   002040 G
L$DTYP  002034 G
L$DU    026574 G
L$DUT   002072 G
L$DVTY  003020 G
L$EF    002052 G
L$ENVI  002044 G
L$ETP   002102 G
L$EXP1  002046 G
L$EXP4  002064 G
L$EXP5  002066 G
L$HARD  041026 G
L$HIME  002120 G
L$HPCP  002016 G
L$HPTP  002022 G
L$HW    002172 G
L$ICP   002104 G
L$INIT  025460 G
L$LADP  002026 G
L$LAST  074614 G
L$LOAD  002100 G
L$LUN   002074 G
L$MREV  002050 G
L$NAME  002000 G
L$PRIO  002042 G
L$PROT  025452 G
L$PRT   002112 G
L$REPP  002062 G
L$REV   002010 G
L$RPT   025444 G
L$SOFT  041144 G
L$SPC   002056 G
L$SPCP  002020 G
L$SPTP  002024 G
L$STA   002030 G
L$SW    002204 G
L$TEST  002114 G
L$*IML  002014 G
L$UNIT  002012 G
L10000  002202
L10001  002240
L10002  010336
L10003  010530
L10004  010576
L10005  010644
L10006  012322
L10007  012414
L10010  012566
L10011  015624
L10012  022742
L10013  025450
L10015  026500
L10016  026502
L10017  026572
L10020  026600
L10021  026606
L10022  026656
L10023  026654
L10024  026764
L10025  026710
L10026  026744
L10027  027216
L10030  027100
L10031  027164
L10032  027432
L10033  027314
L10034  027400
L10035  027662
L10036  027504
L10037  027514
L10040  027556
L10041  027566
L10042  027630
L10043  027640
L10044  027770
L10045  027736
L10046  027746
L10047  031046
L10050  030254
L10051  030560
L10052  032036
L10053  031134
L10054  031362
L10055  031554
L10056  032752
L10057  032312
L10060  032460
L10061  033630
L10062  033220
L10063  033364
L10064  034034
L10065  034002
L10066  034262
L10067  034154
L10070  034230
L10071  034452
L10072  034374
L10073  034436
L10074  035770
L10075  034550
L10076  035124
L10077  035470
L10100  036246
L10101  036126
L10102  036152
L10103  036224
L10104  036634
L10105  036404
L10106  036434
L10107  036530
L10110  036560
L10111  037156
L10112  037052
L10113  041022
L10114  037430
L10115  040060
L10116  040426
L10117  041072
L10120  041400
L10121  074620
L10123  074630
MAINT = 000145 G
MARK    005033 G
MCPE  = 020000 G
MESG1   041072
MESG2   041105
MESG3   041121
MESG4   041132
MPE   = 000400 G
MSGABV  017257
MSGAVG  017156
MSGBEL  017202
MSGMAX  017133
MSGMIN  017110
MSGNON  017443
MSGNUM  017334
MSGOPE  017411 G
MSGSEA  017361
MSG10X  005132 G
MSG11X  005132 G
MSG12X  005132 G
MSG14X  005132 G
MSG7X   005132 G
MSPGE = 002000 G
MSSC  = 100000 G
MXF   = 001000 G
MXSEEK  004766 G
NC1     002256 G
NC2     002260 G
NED   = 010000 G
NEDMSG  005201 G
NEM   = 004000 G
NOCLK   004232 G
NOOP  = 000101 G
NOTMSG  005273 G
NS1     002264 G
NT1     002262 G
OCTHEX  011430
OFFSET= 000115 G
OFLMSG  005240 G
OM    = 000001 G
ONECYL  004647 G
ONEFIL= 000001
OPI   = 020000 G
OPT     021212
O$APTS= 000000
O$AU  = 000000
O$BGNR= 000000
O$BGNS= 000001
O$DU  = 000000
O$ERRT= 000000
O$GNSW= 000001
O$POIN= 000001
O$SETU= 000001
PARMSG  041400
PAT     002224
PATMSG  041610
PCLKTB  012116
PGE   = 100000 G
PHF   = 000400 G
PKB     012122
PKC     012124
PKCS    012120
PKV     012126
PNT   = 001000 G
POPQUE  025376
POSERR  004544 G
PRI   = 002000 G
PRIOO = 000000 G
```

SYMBOL TABLE

```
PRIO1 = 000040 G        RPEC2   002726 G        STALLF  002231          TST12   034156          T$$SUB= 010116
PRIO2 = 000100 G        RPER1   002674 G        STALL1  002346 G        TST12A  034232          T$$SW = 010001
PRIO3 = 000140 G        RPER2   002720 G        STALL2  002350 G        TST13   034376          T$$TES= 010113
PRIO4 = 000200 G        RPER3   002722 G        STALMG  042327          TST14A  034564          T1      026610 G
PRIO5 = 000240 G        RPINIT  020226          STALRD  002232          TST15   036140          T1.1    026634
PRIO6 = 000300 G        RPLA    002700 G        STALRM  042414          TST18A  037444          T10     032756 G
PRIO7 = 000340 G        RPMR1   002704 G        STLTIM  042233          TST18B  037546          T10.1   033076
PSTACK  011564          RPOF    002712 G        STO     024026          TST18C  040720          T10.1$  033100
QCNT    024704          PPSN    002710 G        STOFLG  002233          TWOMS   012450          T10.2   033244
QDRV0   024776          RPSTU0  020026          STOMSG  042201          TYPTIM  016370          T10.2$  033232
QDRV1   025016          RPSTU1  020036          STOPCK  012262          T$ARGC= 000001          T10.3$  033420
QDRV2   025036          RPSTU2  020046          STRTMR  015626          T$CODE= 013130          T10.4$  033376
QDRV3   025056          RPSTU3  020056          ST.CLK  011676          T$ERRN= 000065          T10.7$  033442
QDRV4   025076          RPSTU4  020066          ST.LCL  012216          T$EXCP= 000000          T10.8$  033546
QDRV5   025116          RPSTU5  020076          ST.PCL  012144          T$FLAG= 000040          T11     033632 G
QDRV6   025136          RPSTU6  020106          SVCGBL= 000000          T$FREE= 074630          T11.1   033726
QDRV7   025156          RPSTU7  020116          SVCINS= 000000          T$GMAN= 000000          T11.2$  033730
QINPT   024714          RPTMR   023732          SVCSUB= 000000          T$HILI= 177777          T11.5$  034004
QOUTPT  024734          RPVEC   002644 G        SVCTAG= 000000          T$LAST= 000001          T12     034036 G
QSTART  024754          RPWC    002662 G        SVCTST= 000000          T$LOLI= 000000          T12.1   034126
QSTOP   024756          RPO7    020750          SVRHXX  024472          T$LSYM= 010000          T12.2   034202
QTERP = 025176          RTC   = 000117 G        SVSTAT  002254 G        T$LTNO= 000022          T13     034264 G
RANADR  017544          RWU1  = 002000 G        S$LSYM= 010000          T$NEST= 177777          T13.1   034342
RAND    011610          RWU2  = 004000 G        S1420   002532 G        T$NS0 = 000000          T13.1$  034444
RANPAT  002234          RWU3  = 010000 G        TD      022744          T$NS1 = 000005          T13.2   034404
RDDAT = 000171 G        SAVREG  010646          TEST1   026616          T$NS2 = 000003          T14     034454 G
RDHD  = 000173 G        SC      023132          TEST10  033006          T$PCNT= 000000          T14.1   034542
RDHDMG  042107          SCTRWC= 177400 G        TEST13  034276          T$PTAB= 010122          T14.1$  034666
RDTD  = 000175 G        SC11    023440          TEST14  034536          T$PTHV= 000001          T14.2   034744
RDY   = 000200 G        SC12    023530          TEST15  036010          T$PTNU= 000001          T14.3   035346
RD.RP   024254          SC13    023614          TEST16  036336          T$SAVL= 177777          T14.7$  035542
READIN= 000121 G        SC3     023202          TEST17  037012          T$SEGL= 177777          T14.8$  035646
RECAL = 000107 G        SC4     023206          TEST18  037316          T$SEK0= 010000          T1410$  034744
REDHDR  002226          SC5     023220          TEST3   027010          T$SIZE= 000006          T1411$  035350
REG     002744 G        SC6     023362          TEST4   027242          T$SUBN= 000003          T1412$  035524
RELSE = 000113 G        SC8     023410          TEST5   027464          T$TAGL= 177777          T1420   002472 G
RESREG  010700          SDF   = 000020 G        TEST6   027714          T$TAGN= 010124          T15     035772 G
REV     005115 G        SEABAD  004461 G        TEST7   030024          T$TEMP= 000000          T15.1   036120
RHEXT   002650 G        SEAERR  004422 G        TEST8   031100          T$TEST= 000022          T15.2   036136
RHTYPE  002652 G        SEARCH= 000131 G        TEST9   032070          T$TSTM= 177777          T15.3   036216
RMR   = 000004 G        SEC.DS  002276 G        TICKMS  012112          T$TSTS= 000001          T16     036250 G
ROTATE  004605 G        SEC.RD  002272 G        TICKUS  012114          T$$AU = 010021          T16.1   036370
RPADR   002642 G        SEEK  = 000105 G        TIMER   020204          T$$AUT- 010016          T16.2   036406
RPAS    002676 G        SETFOR= 000147 G        TIMMSG  042157          T$$CLE= 010017          T16.3   036514
RPATMG  042030          SET.IE  024632          TIMSTL  002230          T$$DAT= 010123          T16.4   036532
RPBA    002664 G        SFPTBL  002204 G        TIMTYP  002227          T$$DU = 010020          T17     036636 G
RPBAE   002730 G        SIZE70  010732          TIMT10  002442 G        T$$HAR= 010117          T17.1   037010
RPCC    002716 G        SKI   = 040000 G        TIMT11  002452 G        T$$HW = 010000          T18     037160 G
RPCS1   002660 G        SNDIGT  004342 G        TIMT12  002462 G        T$$INI= 010015          T18END  040700
RPCS2   002670 G        SPTYP   016240          TIM.DN  002320 G        T$$MSG= 010005          T18OFL  040574
RPCS3   002732 G        SP10    002510 G        TIM.PT  002336 G        T$$PC = 000001          T18.1   037402
RPDA    002666 G        SP11    002516 G        TIM.UP  002302 G        T$$PRO= 010014          T18.2   037700
RPDB    002702 G        SP12    002524 G        TRE   = 040000 G        T$$PTA= 010122          T18.3   040304
RPDC    002714 G        SP7     002502 G        TRKWC   002344 G        T$$RPT= 010013          T1811$  040306
RPDS    002672 G        SRCHWT  020200          TRK.DS  002300 G        T$$SEG= 010000          T1812$  040462
RPDT    002706 G        SRCH00  015476          TRK.RD  002270 G        T$$SOF= 010120          T2      026660 G
RPEC1   002724 G        STALL   015274          TRNSWT  020176          T$$SRV= 010012          T2.1    026702
```

```
PARAMETER CODING MACRO V04.00 1-JAN-83 11:06:45 PAGE 69-4                                                    SEQ 016
SYMBOL TABLE

T2.11   026702          T6      027664 G        T8.10$  031610          T9.8$   032670          WRTDAT= 000161 G
T2.2    026736          T6.1    027730          T8.2    031240          UAM    = 000200 G       WRTENM  004345 G
T2.21   026736          T6.11   027732          T8.2$   031374          UNIT    002640 G        WRTTD = 000165 G
T3      026766 G        T6.2    027740          T8.3    031432          UNS    = 040000 G       WRT.RP  024346
T3.1    027072          T7      027772 G        T8.3$   031406          UNSMSG  005150 G        WRYUNS= 000400 G
T3.11   027074          T7A     002432 G        T8.4$   031416          UPE    = 020000 G       XIT14   035742
T3.2    027102          T7.1    030140          T8.5$   031136          VERIFY  015354          XIT18   040774
T4      027220 G        T7.1$   030142          T8.6$   031622          WCE    = 040000 G       XTIMES  002244 G
T4.1    027306          T7.10$  030266          T8.7$   031650          WCEFLG  002340 G       X$ALWA= 000000
T4.2    027316          T7.2    030444          T8.8$   031754          WLF    = 000040 G       X$FALS= 000040
T5      027434 G        T7.2$   030446          T8.9$   031566          WCKD   = 000151 G       X$OFFS= 000400
T5.1    027476          T7.20$  030402          T9      032040 G        WCKHD  = 000153 G       X$TRUE= 000020
T5.11   027500          T7.3$   030644          T9.1    032202          WLE    = 004000 G       $DIV    011074
T5.2    027506          T7.44$  030332          T9.1$   032164          WOR    = 001000 G       $MULT   011316
T5.3    027550          T7.7$   030660          T9.2    032336          WRITMG  041626          $PATCH  042444 G
T5.31   027552          T7.8$   030764          T9.2$   032324          WRPAT   036372          $RNCON  011670
T5.4    027560          T8      031050 G        T9.3$   032514          WRPATN  036516          $RP1    011672
T5.5    027622          T8.1    031126          T9.4$   032472          WRSAFM  041675          $RP2    011674
T5.51   027624          T8.1$   031224          T9.7$   032536          WRTALL  002235          $$FLG   017542
T5.6    027632

. ABS.  074630      000
        000000      001
ERRORS DETECTED:  0

VIRTUAL MEMORY USED:  30464 WORDS  ( 119 PAGES)
DYNAMIC MEMORY AVAILABLE FOR  70 PAGES
CZRJLA.BIC,CZRJLA/C=[20,0]SVC34R.MLB,[20,12]CZRJLA.DOC,CZRJLA.HIS,CZRJLA
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CROSS REFERENCE TABLE (CREF V04.00)

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$$$MFG   2-16     2-29     6-3      7-267    7-320    64-27    65-31    68-36    68-86
$$FLG    31-37    31-43    31-101*  31-114*  31-117#
$DIV     20-25#   30-84    31-50    31-107   50-39    51-36
$MULT    21-14#   30-77
$PATCH   68-111#
$RNCON   23-10*   23-13    23-25#
$RP1     23-8     23-15*   23-26#   24-160   28-60    32-9     32-34    32-59    50-34    51-31    65-67    65-96
$RP2     23-14    23-18    23-21*   23-27#
A16      12-7#    19-31    19-36
A17      12-8#    19-31    19-36
ABOPAS   28-45#   42-11    42-139
ABORT    42-35    42-93#   42-135
ABOTST   16-68#   54-61    54-74    61-97    61-119   65-153   65-175
ACTDRV   33-104#  34-148*  34-197*  36-5*    36-14*   36-202
ACTSTR   33-110#  36-204*  36-218*
ADJUST   25-24    26-6#
ADR      11-57#
AOE      12-88#   25-108   59-33    59-37
ASSEMB    7-278    7-278
ATA      12-74#
ATABIT   15-37#   34-113   34-210   35-74    36-36    36-134   36-140   36-141   36-170
AVERAG   31-54*   31-55    31-75#
AVERGE   13-90    16-73#
AVGVAL   31-55    31-83#
BELL     16-14    68-88    68-89
BITO     11-57#   22-14    25-170
BITOO    11-57    11-57#   13-50    13-66
BITO1    11-57    11-57#   13-51    13-67    34-188   35-206
BITO2    11-57    11-57#   13-52    13-68
BITO3    11-57    11-57#   13-53    13-69
BITO4    11-57    11-57#   13-54    13-70
BITO5    11-57    11-57#   13-55    13-71
BITO6    11-57    11-57#   13-56    13-72    34-122   34-178   34-250   36-45    36-393
BITO7    11-57    11-57#   13-57    13-73    34-122   35-150   36-26    36-138   36-357
BITO8    11-57    11-57#   13-58    34-122
BITO9    11-57    11-57#   13-59
BIT1     11-57#   25-173   28-17
BIT10    11-57#   13-60    28-29    35-209
BIT11    11-57#   13-61    28-29    34-77    35-176
BIT12    11-57#   13-62    28-33    34-71    34-104   34-122   34-191   34-225   35-204   36-294   36-329   36-394
BIT13    11-57#   13-63    36-102   36-296
BIT14    11-57#   13-64    28-33    34-185   34-222   35-181   36-262   36-391   54-52    54-67    54-84    54-95    55-50    55-78
         56-41    56-61    57-38    57-58    61-88    65-112   61-130   65-144   65-168   65-186
BIT15    11-57#   13-65    30-50    30-51    34-185   34-188   34-191   34-222   34-225   35-38    35-41    35-62    35-65    35-160
         35-163   35-176   35-206   35-209   36-45    36-181   36-247   36-250   36-262   36-269
BIT2     11-57#   25-176   28-21    36-269
BIT3     11-57#   25-180   36-333   54-58    54-90    61-94    65-150
BIT4     11-57#   25-183
BIT5     11-57#   25-186   55-56    55-84    56-47    56-67    57-44    57-64    61-136   65-192
BIT6     11-57#   25-189
BIT7     11-57#   25-192   26-37    26-66    26-106   54-58    54-90    61-94    65-150
BIT8     11-57#   25-195   34-217   36-186
BIT9     11-57#   28-25    36-247   36-250
BITS     13-50#
BOE      11-57#
BSE      12-166#  25-198
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CROSS REFERENCE TABLE (CREF V04.00)

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BYPASS  13-13#  28-37   42-11*  42-135* 42-139*
C$AU     7-278# 46-34
C$AUTO   7-278# 43-17
C$BRK    7-278#
C$BSEG   7-278# 65-201
C$BSUB   7-278# 48-62   49-18   49-25   50-46   50-49   51-41   51-44   52-27   52-30   52-42   52-45   52-57   52-60
        53-15   53-18   54-44   54-76   55-25   55-41   55-69   56-34   56-52   57-29   57-49   58-32   59-20   59-31
        60-19   60-28   61-30   61-69   61-121  62-37   62-42   62-56   63-38   63-42   63-63   63-67   64-52   65-70
        65-125  65-177
C$CEFG   7-278#
C$CLCK   7-278# 24-16   24-35
C$CLEA   7-278# 44-26
C$CLOS   7-278#
C$CLPI   7-278#
C$CVEC   7-278# 42-98   42-100  42-101  44-18   44-21   44-23
C$DCLN   7-278# 28-45   42-102  62-34
C$DODU   7-278#
C$DRPT   7-278#
C$DU     7-278# 45-33
C$EDIT   7-278#  7-323
C$ERDF   7-278# 28-19   28-23   28-27   28-31   28-35   62-33
C$ERHR   7-278# 25-27   25-32   25-39   25-44   25-49   25-58   25-63   25-68   25-73   25-84   25-89   25-92   25-95
        25-100  25-105  25-110  25-115  25-120  25-125  25-132  25-137  25-144  25-147  25-152  25-157  25-162  25-167
        25-200  29-22   54-112  55-102  56-84   57-79   59-24   59-35   60-24   60-33   61-150  61-157  65-214  65-222
C$ERRO   7-278#
C$ERSF   7-278#
C$ERSO   7-278# 61-159  65-224
C$ESCA   7-278#
C$ESEG   7-278# 65-203
C$ESUB   7-278# 48-67   49-20   49-27   50-48   50-64   51-43   51-60   52-29   52-32   52-44   52-47   52-59   52-62
        53-17   53-20   54-57   54-89   55-27   55-55   55-83   56-46   56-66   57-43   57-63   58-44   59-25   59-36
        60-25   60-34   61-32   61-93   61-135  62-39   62-45   62-58   63-41   63-47   63-66   63-72   64-60   65-75
        65-149  65-191
C$ETST   7-278# 48-68   49-31   50-71   51-67   52-67   53-25   54-120  55-110  56-92   57-87   58-52   59-45   60-38
        61-166  62-63   63-85   64-83   65-252
C$EXIT   7-278# 42-91   42-103  42-165  44-24   54-26   55-15   55-18   56-18   56-21   57-17   57-20   60-35   61-35
        64-33   65-37   65-78
C$GETB   7-278#
C$GETW   7-278#
C$GMAN   7-278#
C$GPHR   7-278# 42-39
C$GPLO   7-278#
C$GPRI   7-278# 34-18   34-145  34-209
C$INIT   7-278# 42-180
C$INLP   7-278#
C$MANI   7-278#
C$MEM    7-278#
C$MSG    7-278# 17-27   17-36   17-42   17-48
C$OPEN   7-278#
C$PNTB   7-278# 17-4    17-5    17-6    17-10   17-26   17-30   17-31   17-35   17-39   17-41   17-45   17-47
C$PNTF   7-278# 30-165  30-168  30-171  30-173  31-29   31-32   31-34   31-39   31-40   31-45   31-46   31-55   31-62
        31-64   31-66   42-29   42-71   42-73   42-75   42-77   42-85   42-114  42-127  42-132  54-60   54-61   54-73
        54-74   55-86   56-69   57-66   61-96   61-97   61-118  61-119  61-138  64-31   65-35   65-152  65-153  65-174
        65-175  65-194
C$PNTS   7-278#
C$PNTX   7-278# 17-12   17-13   17-15   17-16   17-18   17-19   17-23   17-24   17-32   17-33
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CROSS REFERENCE TABLE (CREF V04.00)

CROSS REFERENCE TABLE (CREF V04.00)

	61-151	62-23*	62-24*	62-25*	62-26*	62-27*	62-35*	62-36*	62-40	62-43*	62-46	62-48	62-50*	62-53*
	62-54*	62-55*	62-62*	63-20*	63-21*	63-22*	63-23*	63-24*	63-25*	63-26*	63-27*	63-31*	63-33	63-34
	63-39*	63-43*	63-45*	63-51*	63-55*	63-58	63-59	63-64*	63-68*	63-70*	63-76*	63-79	63-81*	63-84*
	64-36*	64-37*	64-38*	64-39*	64-40*	64-41*	64-42*	64-45	64-46	64-53	64-55*	64-56*	64-58*	64-64*
	64-68*	64-69	64-73*	64-79*	64-80*	65-41*	65-42*	65-43*	65-44*	65-45	65-46	65-58	65-60	65-64
	65-65	65-71*	65-73*	65- 3	65-94	65-105	65-107	65-109	65-126	65-128	65-130	65-131	65-146	65-146
	65-148	65-171	65-178	65-188	65-188	65-190	65-200*	65-213	65-213	65-215				
DTE	12-91#	25-76												
DTUW	33-129#	34-27	34-235	35-49*	35-188*	35-199	35-213	35-215*	35-221*	36-8	36-20*	36-237	36-254*	
DVA	12-57#													
DVC	12-161#	59-39												
ESEND	7-278#													
ESLOAD	7-278#	7-323												
ECH	12-85#	25-80	25-129	25-130										
ECI	12-172#													
EF.CON	11-57#	42-20												
EF.NEW	11-57#	42-25												
EF.PWR	11-57#	42-16												
EF.RES	11-57#													
EF.STA	11-57#													
EM1	16-92#	25-27												
EM11	16-100#	25-68												
EM12	16-101#	25-73												
EM13	16-102#	25-92												
EM14	16-103#	25-100												
EM15	16-104#	25-105												
EM16	16-105#	25-110												
EM17	16-106#	25-120												
EM2	16-93#	25-32												
EM20	16-108#	54-112	55-102	56-84	57-79	61-150	65-214							
EM21	16-109#	25-125												
EM22	16-110#	25-132												
EM23	16-111#	25-137												
EM24	16-112#	25-144												
EM25	16-113#	28-19												
EM26	16-114#	28-23												
EM27	16-115#	28-27												
EM3	16-94#	25-39												
EM30	16-117#	28-31												
EM31	16-118#	28-35												
EM32	16-119#	25-152												
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EM34	16-121#	25-162												
EM35	16-122#	25-167												
EM36	16-123#	62-33												
EM4	16-95#	25-44												
EM41	16-125#	25-115												
EM42	16-126#	29-22												
EM43	16-127#	25-89												
EM44	16-128#	25-200												
EM45	16-129#	25-95												
EM46	16-130#	25-147												
EM47	16-131#	25-84												
EM5	16-96#	25-49												
EM50	16-133#	59-24												
EM51	16-134#	59-35												

CROSS REFERENCE TABLE (CREF V04.00)

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        51-41   51-41   51-43   51-43   51-44   51-44   51-60   51-60   51-67   51-67   52-17   52-17   52-17   52-27
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        52-47   52-57   52-57   52-59   52-59   52-60   52-60   52-62   52-62   52-67   52-67   53-8    53-8    53-8
        53-15   53-15   53-17   53-17   53-18   53-18   53-20   53-20   53-25   53-25   54-23   54-23   54-23   54-26
        54-44   54-44   54-57   54-57   54-76   54-76   54-89   54-89   54-120  54-120  55-12   55-12   55-12   55-15
        55-18   55-25   55-25   55-27   55-27   55-41   55-41   55-55   55-55   55-69   55-69   55-83   55-83   55-110
        55-110  56-15   56-15   56-15   56-18   56-21   56-34   56-34   56-46   56-46   56-52   56-52   56-66   56-66
        56-92   56-92   57-14   57-14   57-14   57-17   57-20   57-29   57-29   57-43   57-43   57-49   57-49   57-63
        57-63   57-87   57-87   58-20   58-20   58-20   58-32   58-32   58-44   58-44   58-52   58-52   59-9    59-9
        59-9    59-20   59-20   59-25   59-25   59-31   59-31   59-36   59-36   59-45   59-45   60-10   60-10   60-10
        60-19   60-19   60-25   60-25   60-28   60-28   60-34   60-34   60-35   60-38   60-38   61-17   61-17   61-17
        61-30   61-30   61-32   61-32   61-35   61-69   61-69   61-93   61-93   61-121  61-121  61-135  61-135  61-166
        61-166  62-19   62-19   62-19   62-37   62-37   62-39   62-39   62-42   62-42   62-45   62-45   62-56   62-56
        62-58   62-58   62-63   62-63   63-18   63-18   63-18   63-38   63-53   63-41   63-41   63-42   63-42   63-47
        63-47   63-63   63-63   63-66   63-66   63-67   63-67   63-72   63-72   63-85   63-85   64-25   64-25   64-25
        64-33   64-52   64-52   64-60   64-60   64-83   64-83   65-29   65-29   65-29   65-37   65-70   65-70   65-75
        65-75   65-78   65-125  65-125  65-149  65-149  65-177  65-177  65-191  65-191  65-203  65-252  65-252  66-2
        67-43   67-62   68-71   68-123  69-15   69-16   69-21   69-22
F$HARD   7-278#  67-53   67-62   68-16   68-40   68-59
F$HW     7-278#   9-9     9-21
F$INIT   7-278#  42-8    42-180
F$JMP    7-278#  40-61   40-61   42-91   42-103  42-165  44-24   45-18   45-18   46-19   46-19   54-26   55-15   55-18
        56-18   56-21   57-17   57-20   60-35   61-35   64-33   65-37   65-78
F$MOD    7-278#   7-304  10-40   11-51   39-1    40-41   46-35   48-38   66-2    67-43   68-123
F$MSG    7-278#  17-3    17-27   17-29   17-36   17-38   17-42   17-44   17-48
F$PROT   7-278#  41-8    41-12
F$PWR    7-278#
F$RPT    7-278#  40-47   40-76
F$SEG    7-278#  65-201  65-203
F$SOFT   7-278#  68-12   68-16   68-40   68-59   68-71
F$SRV    7-278#  24-112  24-115  24-130  24-133  24-165  24-168  30-34   30-36   36-4    36-15
F$SUB    7-278#  48-62   48-67   49-18   49-20   49-25   49-27   50-46   50-48   50-49   50-64   51-41   51-43   51-44
        51-60   52-27   52-29   52-30   52-32   52-42   52-44   52-45   52-47   52-57   52-59   52-60   52-62   53-15
        53-17   53-18   53-20   54-44   54-57   54-76   54-89   55-25   55-27   55-41   55-55   55-69   55-83   56-34
        56-46   56-52   56-66   57-29   57-43   57-49   57-63   58-32   58-44   59-20   59-25   59-31   59-36   60-19
        60-25   60-28   60-34   61-30   61-32   61-69   61-93   61-121  61-135  62-37   62-39   62-42   62-45   62-56
        62-58   63-38   63-41   63-42   63-47   63-63   63-66   63-67   63-72   64-52   64-60   65-70   65-75   65-125
        65-149  65-177  65-191
F$SW     7-278#  10-8    10-39
F$TEST   7-278#  48-57   48-68   49-14   49-31   50-23   50-71   51-22   51-67   52-17   52-67   53-8    53-25   54-23
        54-120  55-12   55-110  56-15   56-92   57-14   57-87   58-20   58-52   59-9    59-45   60-10   60-38   61-17
        61-166  62-19   62-63   63-18   63-85   64-25   64-83   65-29   65-252
FC      10-9#   32-66   32-69   32-72   49-17   49-29   50-27   50-28   50-38   51-26   51-35   53-13   53-23   54-40
        55-21   55-22   55-67   58-29   60-16   64-41
FCMSG   68-18   68-77#
FER     12-83#  25-129  25-130  25-135
FMT16   12-173#
FMTRK   12-213#
FORSEC  24-123#  54-108  55-98   56-78   57-75   61-146  65-210
FS      10-15#  32-16   32-19   32-22   49-15   52-18   53-9    54-41   60-14
FSMSG   68-30   68-83#
FT      10-12#  32-41   32-44   32-46   49-16   50-25   50-68   51-24   51-64   52-19   53-10   54-42   58-28   60-15
        63-23   64-40   64-79
FTMSG   68-24   68-80#
FWD     16-76#
G$CNTO   7-278#
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CROSS REFERENCE TABLE (CREF V04.00)

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G$DELM   7-278#
G$DISP   7-278#
G$EXCP   7-278#
G$HILI   7-278#
G$LOLI   7-278#
G$NO     7-278#  68-44
G$OFFS   7-278#  67-55   67-57   67-59   67-61   68-14   68-18   68-20   68-22   68-24   68-26   68-28   68-30   68-32
        68-34    68-38   68-44   68-47   68-49   68-51   68-53   68-55   68-57   68-60
G$OFSI   7-278#  67-55   67-57   67-59   67-61   68-14   68-18   68-20   68-22   68-24   68-26   68-28   68-30   68-32
        68-34    68-38   68-44   68-47   68-49   68-51   68-53   68-55   68-57   68-60
G$PRMA   7-278#  67-55   67-57
G$PRMD   7-278#  67-59   67-61   68-18   68-20   68-22   68-24   68-26   68-28   68-30   68-32   68-34
G$PRML   7-278#  68-14   68-38   68-44   68-47   68-49   68-51   68-53   68-55   68-57   68-60
G$RADA   7-278#
G$RADB   7-278#
G$RADD   7-278#  68-18   68-20   68-22   68-24   68-26   68-28   68-30   68-32
G$RADL   7-278#  68-14   68-38   68-44   68-47   68-49   68-51   68-53   68-55   68-57   68-60
G$RADO   7-278#  67-55   67-57   67-59   67-61   68-34
G$XFER   7-278#  68-16   68-40   68-59
G$YES    7-278#  67-55   67-57   67-59   67-61   68-14   68-18   68-20   68-22   68-24   68-26   68-28   68-30   68-32
        68-34    68-38   68-47   68-49   68-51   68-53   68-55   68-57   68-60
GETREG  12-223#  35-122
GETREQ  34-212   35-201   36-37   36-83   36-120  36-125  36-180  36-244  36-259  36-266  38-68#
HCE     12-86#   25-129   25-130  25-140
HCI     12-171#
HCRC    12-87#   25-129   25-130  25-140  25-142
HELP     7-259#   7-273    7-295   7-312   7-326   8-10    9-15   10-32   11-4#   11-41   12-232  15-50   16-19   16-29
        16-143   16-155   17-50   38-94   38-103  38-110  40-4#  40-49   40-63   41-14   42-141  42-167  43-11   45-9
        45-20    46-10    46-21   47-5#   48-45   48-52   65-232  65-238  65-254  67-5#   67-77   67-87   68-63   68-104
        68-116   69-2
HERTZ   24-14*   24-30*   24-45*  24-53   24-78#
HOE     11-57#
I$AU     7-278#  46-9#    46-34#
I$AUTO   7-278#  43-10#   43-17#
I$CLN    7-278#  44-8#    44-24   44-26#
I$DU     7-278#  45-8#    45-33#
I$HRD   67-53#   67-62#
I$INIT   7-278#  42-8#    42-91   42-103  42-165  42-180#
I$MOD    7-278#   7-304    7-304#  10-40   10-40#  11-51   11-51#  39-1    39-1#   40-41   40-41#  46-35   46-35#  48-38
        48-38#   66-2     66-2#   67-43   67-43#  68-123  68-123#
I$MSG    7-278#  17-3#    17-27#  17-29#  17-36#  17-38#  17-42#  17-44#  17-48#
I$PROT   7-278#  41-8#
I$PTAB   7-278#  69-16    69-16#  69-21   69-21#
I$PWR    7-278#
I$RPT    7-278#  40-47#   40-76#
I$SEG    7-278#  48-57    48-62   49-14   49-18   49-25   50-23   50-46   50-49   51-22   51-41   51-44   52-17   52-27
        52-30    52-42    52-45   52-57   52-60   53-8    53-15   53-18   54-23   54-44   54-76   55-12   55-25   55-41
        55-69    56-15    56-34   56-52   57-14   57-29   57-49   58-20   58-32   59-9    59-20   59-31   60-10   60-19
        60-28    61-17    61-30   61-69   61-121  62-19   62-37   62-42   62-56   63-18   63-38   63-42   63-63   63-67
        64-25    64-52    65-29   65-70   65-125  65-177  65-201# 65-203#
I$SETU   7-278#  69-15    69-15#  69-16   69-22   69-22#
I$SFT   68-12#   68-71#
I$SRV    7-278#  24-112#  24-115#  24-130#  24-133#  24-165#  24-168#  30-34#  30-36#  36-4#   36-15#
I$SUB    7-278#  48-57    48-62   48-62#  48-67   48-67#  48-67#  49-14   49-18   49-18#  49-20   49-20#  49-20#  49-25
        49-25#   49-27    49-27#  49-27#  50-23   50-46   50-46#  50-48   50-48#  50-48#  50-49   50-49#  50-64   50-64#
        50-64#   51-22    51-41   51-41#  51-43   51-43#  51-43#  51-44   51-44#  51-60   51-60#  51-60#  52-17   52-27
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CROSS REFERENCE TABLE (CREF V04.00)

	52-27#	52-29	52-29#	52-29#	52-30	52-30#	52-32	52-32#	52-32#	52-42	52-42#	52-44	52-44#	52-44#
	52-45	52-45#	52-47	52-47#	52-47#	52-57	52-57#	52-59	52-59#	52-59#	52-60	52-60#	52-62	52-62#
	52-62#	53-8	53-15	53-15#	53-17	53-17#	53-17#	53-18	53-18#	53-20	53-20#	53-20#	54-23	54-44
	54-44#	54-57	54-57#	54-57#	54-76	54-76#	54-89	54-89#	54-89#	55-12	55-25	55-25#	55-27	55-27#
	55-27#	55-41	55-41#	55-55	55-55#	55-55#	55-69	55-69#	55-83	55-83#	55-83#	56-15	56-34	56-34#
	56-46	56-46#	56-46#	56-52	56-52#	56-66	56-66#	56-66#	57-14	57-29	57-29#	57-43	57-43#	57-43#
	57-49	57-49#	57-63	57-63#	57-63#	58-20	58-32	58-[illegible]#	58-44	58-44#	58-44#	59-9	59-20	59-20#
	59-25	59-25#	59-25#	59-31	59-31#	59-36	59-36#	59-36#	60-10	60-19	60-19#	60-25	60-25#	60-25#
	60-28	60-28#	60-34	60-34#	60-34#	61-17	61-30	61-30#	61-32	61-32#	61-32#	61-69	61-69#	61-93
	61-93#	61-93#	61-121	61-121#	61-135	61-135#	61-135#	62-19	62-37	62-37#	62-39	62-39#	62-39#	62-42
	62-42#	62-45	62-45#	62-45#	62-56	62-56#	62-58	62-58#	62-58#	63-18	63-38	63-38#	63-41	63-41#
	63-41#	63-42	63-42#	63-47	63-47#	63-47#	63-63	63-63#	63-66	63-66#	63-66#	63-67	63-67#	63-72
	63-72#	63-72#	64-25	64-52	64-52#	64-60	64-60#	64-60#	65-29	65-70	65-70#	65-75	65-75#	65-75#
	65-125	65-125#	65-149	65-149#	65-149#	65-177	65-177#	65-191	65-191#	65-191#				
I$TST	7-278#	48-57	48-57#	48-62	48-68	48-68#	48-68#	49-14	49-14#	49-18	49-25	49-31	49-31#	49-31#
	50-23	50-23#	50-46	50-49	50-71	50-71#	50-71#	51-22	51-22#	51-41	51-44	51-67	51-67#	51-67#
	52-17	52-17#	52-27	52-30	52-42	52-45	52-57	52-60	52-67	52-67#	52-67#	53-8	53-8#	53-15
	53-18	53-25	53-25#	53-25#	54-23	54-23#	54-26	54-44	54-76	54-120	54-120#	54-120#	55-12	55-12#
	55-15	55-18	55-25	55-41	55-69	55-110	55-110#	55-110#	56-15	56-15#	56-18	56-21	56-34	56-52
	56-92	56-92#	56-92#	57-14	57-14#	57-17	57-20	57-29	57-49	57-87	57-87#	57-87#	58-20	58-20#
	58-32	58-52	58-52#	58-52#	59-9	59-9#	59-20	59-31	59-45	59-45#	59-45#	60-10	60-10#	60-19
	60-28	60-35	60-38	60-38#	60-38#	61-17	61-17#	61-30	61-35	61-69	61-121	61-166	61-166#	61-166#
	62-19	62-19#	62-37	62-42	62-56	62-63	62-63#	62-63#	63-18	63-18#	63-38	63-42	63-63	63-67
	63-85	63-85#	63-85#	64-25	64-25#	64-33	64-52	64-83	64-83#	64-83#	65-29	65-29#	65-37	65-70
	65-78	65-125	65-177	65-252	65-252#	65-252#								
IAE	12-89#	25-108												
IBE	11-57#													
IC	10-11#	49-21	49-28											
ICMSG	68-22	68-79#												
IDU	11-57#													
IE	12-5#													
IER	11-57#													
ILF	12-79#	25-103												
ILLCMD	12-209#													
ILR	12-80#	25-103												
ILV	12-64#	61-54	65-110											
INCCYL	56-30*	56-31*	56-32	56-94#										
ISR	11-57#													
ISRCNT	13-9#	36-6*	42-14*											
ISRV	34-36	36-5#	42-89	54-119	55-109	56-83	56-91	57-86	61-165	65-199	65-230			
IT	10-14#	58-46	63-80	64-70										
ITCNT	13-8#	42-13*	48-58*	48-65*	50-24*	50-69*	51-23*	51-65*	60-12*	60-36*	61-18*	61-33*	62-22*	62-59*
	65-40*	65-76*												
ITMSG	68-28	68-82#												
IXE	11-57#													
IXU	12-160#	25-160												
J$JMP	7-278#	40-61	45-18	46-19										
KWSRV	24-84	24-94	24-113#											
L$ALP	7-323#													
L$APT	7-323#													
L$AU	46-9#													
L$AUT	7-323#													
L$AUTO	7-323	43-10#												
L$CCP	7-323#													
L$CLEA	7-323	44-8#												
L$CO	7-323#													

CROSS REFERENCE TABLE (CREF V04.00)

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L$DESP    7-323#
L$DEVP    7-323#
L$DISP    7-323     8-8#
L$DLY     7-323#
L$DTP     7-323#
L$DTYP    7-323#
L$DU     45-8#
L$DUT     7-323#
L$DVTY    7-323    16-17#
L$EF      7-323#
L$ENVI    7-323#
L$ETP     7-323#
L$EXP1    7-323#
L$EXP4    7-323#
L$EXP5    7-323#
L$HARD    7-323    67-53     67-53#
L$HIME    7-323#
L$HPCP    7-323#
L$HPTP    7-323#
L$HW      7-323     9-9       9-9#
L$ICP     7-323#
L$INIT    7-323    42-8#
L$LADP    7-323#
L$LAST    7-323    68-122#   69-22
L$LOAD    7-323#
L$LUN     7-323#
L$MREV    7-323#
L$NAME    7-323#
L$PRIO    7-323#
L$PROT    7-323    41-8#
L$PRT     7-323#
L$REPP    7-323#
L$REV     7-323#
L$RPT    40-47#
L$SOFT    7-323    68-12     68-12#
L$SPC     7-323#
L$SPCP    7-323#
L$SPTP    7-323#
L$STA     7-323#
L$SW      7-323    10-8      10-8#
L$TEST    7-323#   30-138    31-56     31-58     31-60     31-102    64-31     65-35
L$TIML    7-323#
L$UNIT    7-323#   42-34
L10000    9-9       9-21#
L10001   10-8      10-39#
L10002   17-27#
L10003   17-36#
L10004   17-42#
L10005   17-48#
L10006   24-115#
L10007   24-133#
L10010   24-168#
L10011   30-36#
L10012   36-15#
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CROSS REFERENCE TABLE (CREF V04.00)

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L10017  44-24    44-26#
L10020  45-18    45-33#
L10021  46-19    46-34#
L10022  48-68#
L10023  48-67#
L10024  49-31#
L10025  49-20#
L10026  49-27#
L10027  50-71#
L10030  50-48#
L10031  50-64#
L10032  51-67#
L10033  51-43#
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L10036  52-29#
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L10040  52-44#
L10041  52-47#
L10042  52-59#
L10043  52-62#
L10044  53-25#
L10045  53-17#
L10046  53-20#
L10047  54-26    54-120#
L10050  54-57#
L10051  54-89#
L10052  55-15    55-18    55-110#
L10053  55-27#
L10054  55-55#
L10055  55-83#
L10056  56-18    56-21    56-92#
L10057  56-46#
L10060  56-66#
L10061  57-17    57-20    57-87#
L10062  57-43#
L10063  57-63#
L10064  58-52#
L10065  58-44#
L10066  59-45#
L10067  59-25#
L10070  59-36#
L10071  60-35    60-38#
L10072  60-25#
L10073  60-34#
L10074  61-35    61-166#
L10075  61-32#
L10076  61-93#
L10077  61-135#
L10100  62-63#
L10101  62-39#
L10102  62-45#
L10103  62-58#
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CROSS REFERENCE TABLE (CREF V04.00)

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L10105  63-41#
L10106  63-47#
L10107  63-66#
L10110  63-72#
L10111  64-33    64-83#
L10112  64-60#
L10113  65-37    65-78    65-252#
L10114  65-75#
L10115  65-149#
L10116  65-191#
L10117  67-53    67-62#
L10120  68-12    68-71#
L10121  69-16#
L10123  69-16    69-21#
LBC     12-164#  25-61
LC      10-10#   30-81    32-64    32-74    49-22    49-24    50-28    50-36    51-33    53-14    55-39    57-31    64-80
LCE     12-163#  25-118
LCLKTB  24-41*   24-73#
LCMSG   68-20    68-78#
LDCMD   24-184#  42-134
LF      16-13    68-88    68-89
LKS     24-42*   24-75#   24-95*   24-107*
LKV     24-44*   24-76#   24-94    42-100   44-21
LOE     11-57#
LOT     11-57#
LS      10-16#   32-14    32-24    52-20    53-11
LSMSG   68-32    68-84#
LST     12-69#   59-22
LT      10-13#   32-39    32-48    50-66    51-62    52-21    53-12    58-47    63-82    64-71
LTMSG   68-26    68-81#
MAINT   12-225#  35-137
MARK    13-100   16-75#
MCPE    12-10#   25-25
MESG1   67-55    67-67#
MESG2   67-57    67-68#
MESG3   67-59    67-69#
MESG4   67-61    67-70#
MPE     12-33#   25-30
MSG10X  13-115   16-80#
MSG11X  13-119   16-81#
MSG12X  13-123   16-83#
MSG14X  13-127   16-82#
MSG7X   13-110   16-79#
MSGABV  31-45    31-85#
MSGAVG  31-46    31-82#
MSGBEL  31-39    31-84#
MSGMAX  30-171   31-40    31-81#
MSGMIN  30-168   31-34    31-80#
MSGNON  31-32    31-89#
MSGNUM  31-62    31-86#
MSGOPE  31-66    31-88#
MSGSEA  31-64    31-87#
MSPGE   12-35#   25-35
MSSC    12-12#
MXF     12-34#   25-35
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MXSEEK  13-95    16-74#
NC1     13-17#   52-35    52-50    52-65    56-23    59-18
NC2     13 18#   62-27    63-24
NED     12-37#   25-35
NEDMSG  16-86#   42-75
NEM     12-36#   25-35
NOCLK   16-62#   42-85
NOOP    12-199#
NOTMSG  16-88#   42-71
NS1     13-20#   26-8     50-56    51-51    59-16
NT1     13-19#   26-11    59-17    62-48
O$APTS   7-278#   7-323
O$AU     7-278#   7-323
O$BGNR   7-278#   7-323
O$BGNS   7-278#   7-310#   7-323
O$DU     7-278#   7-323
O$ERRT   7-278#   7-323
O$GNSW   7-278#   7-310#   7-323
O$POIN   7-278#   7-310    7-310#   7-310#   7-310#   7-323
O$SETU   7-278#   7-310#   7-323    68-122
OCTHEX  17-9     22-4#
OFFSET  12-204#  35-96    60-18
OFLMSG  16-87#   42-73
OM      12-62#   60-22    60-31
ONECYL  13-85    16-72#
ONEFIL   2-4#     2-8      4-903    5-1      7-263#   7-299    10-41    11-1     11-8#    11-13    39-2     40-1     40-8#    40-13
        46-36    47-1     47-9#    48-3     66-4     67-1     67-9#    67-15
OPI     12-92#   25-113
OPT     34-168   34-208#  36-40    36-145   36-194
PARMSG  68-14    68-76#
PAT     10-17#   63-32    63-56    64-44    65-47
PATMSG  68-34    68-85#
PCLKTB  24-22*   24-64#
PGE     12-151#  25-56
PHF     12-162#  25-165
PKB     24-24*   24-25*   24-67#   24-85*   24-127*  24-136*  24-156*  24-162*  24-171*  54-45*   54-51*   54-77*   54-83*   55-42*
        55-49*   55-70*   55-77*   56-33*   56-40*   56-53*   56-60*   57-30*   57-37*   57-50*   57-57*   61-77*   61-87*   61-101*
        61-111*  61-123*  61-129*  65-133*  65-143*  65-157*  65-167*  65-179*  65-185*
PKC     24-26*   24-27*   24-68#   30-76    30-91    30-93    30-95    30-96    30-99    30-101   30-102   30-121   30-123   30-124
        30-128   30-130   30-131   30-135   30-146   54-49    54-81    55-47    55-75    56-38    56-58    57-35    57-55    61-85
        61-109   61-127   65-141   65-165   65-183
PKCS    24-23*   24-66#   24-86*   24-105*  24-123*  24-128*  24-131*  24-152*  24-163*  24-166*  54-46*   54-50*   54-79*   54-82*
        55-45*   55-48*   55-73*   55-76*   56-36*   56-39*   56-56*   56-59*   57-33*   57-36*   57-53*   57-56*   61-42*   61-82*
        61-86*   61-106*  61-110*  61-125*  61-128*  65-84*   65-138*  65-142*  65-162*  65-166*  65-181*  65-184*
PKV     24-29*   24-69#   24-84    24-124   24-126   24-135   24-153   24-155   24-170   42-98    44-18    54-37    55-32    56-27
        57-26    61-44    65-86
PNT     11-57#
POPQUE  34-221   35-12    35-149   36-137   36-183   38-83#
POSERR  16-69#   55-86    56-69    57-66    61-138   65-194
PRI     11-57#
PRI00   11-57#   54-39    54-110   55-34    55-100   56-29    56-80    57-28    57-77    61-46    61-148   65-88    65-212
PRI01   11-57#
PRI02   11-57#
PRI03   11-57#
PRI04   11-57#
PRI05   11-57#   34-20
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CROSS REFERENCE TABLE (CREF V04.00)

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RPCS3   15-31#
RPDA    15-13#  30-28*  54-43*  61-73*  61-122* 65-129* 65-178*
RPDB    15-19#
RPDC    15-24#  30-29*  54-40*  55-43*  55-71*  56-32*  56-54*  57-21*  57-51*  61-70*  65-126*
RPDS    15-15#  34-217  36-152  36-186  54-52   54-67   54-84   54-95   55-50   55-78   56-41   56-61   57-38   57-58
        61-54   61-88   61-112  61-130  65-110  65-144  65-168  65-186
RPDT    15-21#
RPEC1   15-28#
RPEC2   15-29#
RPER1   15-16#  36-153
RPER2   15-26#  36-154
RPER3   15-27#  36-155
RPINIT  34-15#  42-62   58-21   58-51   59-10   60-11   61-21   62-20   62-61   63-19   64-26   65-30   65-53
RPLA    15-18#  50-51   51-46
RPMR1   15-20#
RPOF    15-23#
RPSN    15-22#  42-115
RPSTU0  33-11#  34-22   36-98   36-152* 36-153* 36-154* 36-155*
RPSTU1  33-11#
RPSTU2  33-
RPSTU3  33-
RPSTU4  33-1
RPSTU5  33-11#
RPSTU6  33-11#
RPSTU7  33-11#
RPTMR   24-114  36-202#
RPVEC   15-4#   34-36   34-36   34-147  42-58*  42-59*  42-89   42-89   42-101  44-23   54-39   54-119  54-119  55-34
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        65-199  65-199  65-207  65-207  65-230  65-230
RPWC    15-11#  61-74*  65-130*
RTC     12-205# 35-109  60-27
RWU1    12-148# 25-150
RWU2    12-149# 25-150
RWU3    12-150# 25-150
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        43-17#  44-26#  45-33#  46-34#  48-67#  48-68#  49-20#  49-27#  49-31#  50-48#  50-64#  50-71#  51-43#  51-60#
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S1420   13-127#  61-162  65-227
SAVREG  18-6#   30-43   34-15   34-149  34-208  35-191  36-7    36-205  36-348  38-7    54-54   54-86   54-111  55-52
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SC11    36-122  36-132#
SC12    36-85   36-91   36-148#
SC13    36-80   36-166#
SC3     36-70#  36-74
SC4     36-72#  36-111  36-115  36-130  36-146  36-195
SC5     36-71   36-77#
SC6     36-90   36-117#
SC8     36-107  36-123#  36-164
SCTRWC  12-219# 59-14   59-30   62-24
SDF     12-158#
SEABAD  16-67#  54-73   61-118  65-174
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SEC.RD  13-24#   17-6     17-33    25-20*   26-6     26-8*    26-14*   28-14*   29-17*   54-111*  55-101*  56-81*   57-78*   61-149*
        65-213*
SEEK    12-200#  24-190   24-191   35-88    50-26    50-26    55-24    55-44    55-72    56-35    56-55    57-32    57-52    62-36
        62-55    63-39    63-64
SET.IE  34-73    34-180   34-252   35-230   36-64    36-191   36-387#
SETFOR  12-226#  35-111   42-137   48-59    50-26    51-25
SFPTBL  10-8#
SIZE70  19-9#    42-47
SKI     12-165#  25-118
SNDIGT  16-64#   42-127
SP10    13-115#  55-107
SP11    13-119#  56-89
SP12    13-123#  57-84
SP7     13-110#  54-117
SPTYP   30-161#  54-116   55-106   56-88    57-83    61-161   65-226
SRCH00  30-10#   54-27    55-16    56-19    57-18    61-37    65-80
SRCHWT  33-98#   34-210*  35-74*   36-134   36-141*
ST.CLK  24-13#   34-16    42-90    54-114   55-104   56-86    57-81    61-152   65-216
ST.LCL  24-47    24-90#
ST.PCL  24-32    24-?U#
STALL   26-85    26-125   27-26    28-56#
STALL1  13-46#   26-86    ?6-126
STALL2  13-47#   27-27
STALLF  10-22#   26-83    2?-123   27-24
STALMG  68-57    68-97#
STALRD  10-24#   28-57
STALRM  68-60    68-98#
STLTIM  68-55    68-96#
STO     36-212   36-232#
STOFLG  10-25#   24-81    24-91
STOMSG  68-53    68-95#
STOPCK  24-102#  42-93    44-13    54-35    55-30    56-25    57-24    58-22    59-11    61-22    62-21    63-28    64-50    65-55
STRTMR  30-43#   54-34    55-29    56-24    57-23    61-41    65-83
SVCGBL  7-278#   7-287#   7-323    7-323    7-323    7-323    7-323    7-323    7-323    7-323    7-323    7-323    7-323    7-323
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CROSS REFERENCE TABLE (CREF V04.00)

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CROSS REFERENCE TABLE (CREF V04.00)

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31-39	31-39	31-39	31-39	31-39	31-39	31-39	31-39	31-40	31-40	31-40	31-40	31-40	31-40
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34-20	34-20	34-36	34-36	34-36	34-36	34-36	34-36	34-36	34-36	34-36	34-36	34-36	34-36
34-45	34-45	34-45	34-45	34-145	34-145	34-145	34-145	34-147	34-147	34-147	34-147	34-199	34-199
34-199	34-199	34-209	34-209	34-209	34-209	34-254	34-254	34-254	34-254	36-15	36-15	40-61	40-61
40-61	40-61	40-76	40-76	42-10	42-10	42-16	42-16	42-16	42-16	42-18	42-18	42-20	42-20
42-20	42-20	42-22	42-22	42-25	42-25	42-25	42-25	42-27	42-27	42-29	42-29	42-29	42-29
42-29	42-29	42-29	42-29	42-29	42-29	42-39	42-39	42-39	42-39	42-39	42-39	42-40	42-40
42-71	42-71	42-71	42-71	42-71	42-71	42-71	42-71	42-71	42-71	42-71	42-71	42-73	42-73
42-73	42-73	42-73	42-73	42-73	42-73	42-73	42-73	42-73	42-73	42-75	42-75	42-75	42-75
42-75	42-75	42-75	42-75	42-75	42-75	42-75	42-75	42-77	42-77	42-77	42-77	42-77	42-77
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42-114	42-114	42-114	42-114	42-114	42-114	42-127	42-127	42-127	42-127	42-127	42-127	42-127	42-127
42-127	42-127	42-127	42-127	42-132	42-132	42-132	42-132	42-132	42-132	42-132	42-132	42-132	42-132
42-165	42-165	42-165	42-165	42-180	42-180	43-17	43-17	44-10	44-10	44-10	44-10	44-18	44-18
44-18	44-18	44-21	44-21	44-21	44-21	44-23	44-23	44-23	44-23	44-24	44-24	44-24	44-24
44-26	44-26	45-18	45-18	45-18	45-18	45-33	45-33	46-19	46-19	46-19	46-19	46-34	46-34
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57-77	57-77	57-77	57-77	57-79	57-79	57-79	57-79	57-79	57-79	57-79	57-79	57-86	57-86

PARAMETER CODING MACRO V04.00 1-JAN-83 11:06:45 PAGE S-19 SEQ 0183
CROSS REFERENCE TABLE (CREF V04.00)

57-86	57-86	57-86	57-86	57-86	57-86	57-86	57-86	57-86	57-86	57-87	57-87	58-32	58-32
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61-165	61-165	61-165	61-165	61-165	61-165	61-165	61-165	61-166	61-166	62-33	62-33	62-33	62-33
62-33	62-33	62-33	62-33	62-34	62-34	62-37	62-37	62-39	62-39	62-42	62-42	62-45	62-45
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65-153	65-153	65-153	65-153	65-153	65-153	65-174	65-174	65-174	65-174	65-174	65-174	65-174	65-174
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65-230	65-230	65-230	65-230	65-230	65-230	65-230	65-230	65-230	65-230	65-252	65-252	67-53	67-53
67-55	67-55	67-55	67-55	67-55	67-55	67-55	67-55	67-57	67-57	67-57	67-57	67-57	67-57
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68-57	68-57	68-57	68-57	68-57	68-57	68-59	68-59	68-60	68-60	68-60	68-60	68-60	68-60
68-71	68-71	68-122	68-122	68-122	68-122	68-122	68-122	69-16	69-16	69-16	69-16		
SVCSUB 7-278#	7-286#	48-62	48-62	48-62	49-18	49-18	49-18	49-25	49-25	49-25	50-46	50-46	50-46
50-49	50-49	50-49	51-41	51-41	51-41	51-44	51-44	51-44	52-27	52-27	52-27	52-30	52-30
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55-41	55-41	55-41	55-69	55-69	55-69	56-34	56-34	56-34	56-52	56-52	56-52	57-29	57-29
57-29	57-49	57-49	57-49	58-32	58-32	59-20	59-20	59-20	59-31	59-31	59-31	60-19	
60-19	60-19	60-28	60-28	60-28	61-30	61-30	61-30	61-69	61-69	61-69	61-121	61-121	61-121
62-37	62-37	62-37	62-42	62-42	62-42	62-56	62-56	62-56	63-38	63-38	63-38	63-42	63-42
63-42	63-63	63-63	63-63	63-67	63-67	63-67	64-52	64-52	64-52	65-70	65-70	65-70	65-125

CROSS REFERENCE TABLE (CREF V04.00)

	65-125	65-125	65-177	65-177	65-177									
SVCTAG	7-278#	7-288#	9-21	9-21	9-21	10-39	10-39	10-39	17-27	17-27	17-27	17-36	17-36	17-36
	17-42	17-42	17-42	17-48	17-48	17-48	24-115	24-115	24-115	24-133	24-133	24-133	24-168	24-168
	24-168	30-36	30-36	30-36	36-15	36-15	36-15	40-76	40-76	40-76	42-180	42-180	42-180	43-17
	43-17	43-17	44-26	44-26	44-26	45-33	45-33	45-33	46-34	46-34	46-34	48-67	48-67	48-67
	48-68	48-68	48-68	49-20	49-20	49-20	49-27	49-27	49-27	49-31	49-31	49-31	50-48	50-48
	50-48	50-64	50-64	50-64	50-71	50-71	50-71	51-43	51-43	51-43	51-60	51-60	51-60	51-67
	51-67	51-67	52-29	52-29	52-29	52-32	52-32	52-32	52-44	52-44	52-44	52-47	52-47	52-47
	52-59	52-59	52-59	52-62	52-62	52-62	52-67	52-67	52-67	53-17	53-17	53-17	53-20	53-20
	53-20	53-25	53-25	53-25	54-57	54-57	54-57	54-89	54-89	54-89	54-120	54-120	54-120	55-27
	55-27	55-27	55-55	55-55	55-55	55-83	55-83	55-83	55-110	55-110	55-110	56-46	56-46	56-46
	56-66	56-66	56-66	56-92	56-92	56-92	57-43	57-43	57-43	57-63	57-63	57-63	57-87	57-87
	57-87	58-44	58-44	58-44	58-52	58-52	58-52	59-25	59-25	59-25	59-36	59-36	59-36	59-45
	59-45	59-45	60-25	60-25	60-25	60-34	60-34	60-34	60-38	60-38	60-38	61-32	61-32	61-32
	61-93	61-93	61-93	61-135	61-135	61-135	61-166	61-166	61-166	62-39	62-39	62-39	62-45	62-45
	62-45	62-58	62-58	62-58	62-63	62-63	62-63	63-41	63-41	63-41	63-47	63-47	63-47	63-66
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	65-75	65-75	65-75	65-149	65-149	65-149	65-191	65-191	65-191	65-203	65-203	65-203	65-252	65-252
	65-252	67-62	67-62	67-62	68-71	68-71	68-71	69-16	69-16	69-16	69-21	69-21	69-21	
SVCTST	7-278#	7-285#	48-57	48-57	48-57	49-14	49-14	49-14	50-23	50-23	50-23	51-22	51-22	51-22
	52-17	52-17	52-17	53-8	53-8	53-8	54-23	54-23	54-23	55-12	55-12	55-12	56-15	56-15
	56-15	57-14	57-14	57-14	58-20	58-20	58-20	59-9	59-9	59-9	60-10	60-10	60-10	61-17
	61-17	61-17	62-19	62-19	62-19	63-18	63-18	63-18	64-25	64-25	64-25	65-29	65-29	65-29
SVRHXX	35-151	36-33	36-47	36-84	36-139	36-182	36-251	36-270	36-348#	54-54	54-86	54-111	55-52	55-80
	55-101	56-43	56-63	56-81	57-40	57-60	57-78	61-90	61-132	61-149	65-146	65-188	65-213	
SVSTAT	13-15#	25-16*	25-170*	25-173*	25-176*	25-180*	25-183*	25-186*	25-189*	25-192*	25-195*	26-37	26-66	26-106
	54-58	54-90	55-56	55-84	56-47	56-67	57-44	57-64	61-94	61-136	65-150	65-192		
T$$AU	46-9#	46-19	46-34											
T$$AUT	43-10#	43-17												
T$$CLE	44-8#	44-24	44-26											
T$$DAT	69-16	69-16#	69-21											
T$$DU	45-8#	45-18	45-33											
T$$HAR	67-53	67-53#	67-62											
T$$HW	9-9	9-9#	9-21											
T$$INI	42-8#	42-91	42-103	42-165	42-180									
T$$MSG	17-3#	17-27	17-29#	17-36	17-38#	17-42	17-44#	17-48						
T$$PC	69-15#	69-22												
T$$PRO	41-8#													
T$$PTA	69-15#	69-16	69-16#											
T$$RPT	40-47#	40-61	40-76											
T$$SEG	65-201	65-201#	65-203	65-203#										
T$$SOF	68-12	68-12#	68-71											
T$$SRV	24-112#	24-115	24-130#	24-133	24-165#	24-168	30-34#	30-36	36-4#	36-15				
T$$SUB	48-62#	48-67	49-18#	49-20	49-25#	49-27	50-46#	50-48	50-49#	50-64	51-41#	51-43	51-44#	51-60
	52-27#	52-29	52-30#	52-32	52-42#	52-44	52-45#	52-47	52-57#	52-59	52-60#	52-62	53-15#	53-17
	53-18#	53-20	54-44#	54-57	54-76#	54-89	55-25#	55-27	55-41#	55-55	55-69#	55-83	56-34#	56-46
	56-52#	56-66	57-29#	57-43	57-49#	57-63	58-32#	58-44	59-20#	59-25	59-31#	59-36	60-19#	60-25
	60-28#	60-34	61-30#	61-32	61-69#	61-93	61-121#	61-135	62-37#	62-39	62-42#	62-45	62-56#	62-58
	63-38#	63-41	63-42#	63-47	63-63#	63-66	63-67#	63-72	64-52#	64-60	65-70#	65-75	65-125#	65-149
	65-177#	65-191												
T$$SW	10-8	10-8#	10-39											
T$$TES	48-57#	48-68	49-14#	49-31	50-23#	50-71	51-22#	51-67	52-17#	52-67	53-8#	53-25	54-23#	54-26
	54-120	55-12#	55-15	55-18	55-110	56-15#	56-18	56-21	56-92	57-14#	57-17	57-20	57-87	58-20#
	58-52	59-9#	59-45	60-10#	60-35	60-38	61-17#	61-35	61-166	62-19#	62-63	63-18#	63-85	64-25#
	64-33	64-83	65-29#	65-37	65-78	65-252								
T$ARGC	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323#	7-323#	7-323#

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	7-323#	7-323#	7-323#	17-4	17-4	17-4	17-4#	17-4#	17-5	17-5	17-5	17-5#	17-5#	17-6
	17-6	17-6	17-6#	17-6#	17-10	17-10	17-10	17-10	17-10	17-10	17-10#	17-10#	17-10#	17-10#
	17-10#	17-12	17-12	17-12#	17-13	17-13	17-13	17-13	17-13	17-13	17-13	17-13	17-13	17-13#
	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-15	17-15	17-15#	17-16	17-16	17-16	17-16
	17-16	17-16	17-16	17-16	17-16	17-16#	17-16#	17-16#	17-16#	17-16#	17-16#	17-16#	17-16#	17-18
	17-18	17-18#	17-19	17-19	17-19	17-19	17-19	17-19	17-19	17-19	17-19	17-19#	17-19#	17-19#
	17-19#	17-19#	17-19#	17-19#	17-19#	17-23	17-23	17-23#	17-24	17-24	17-24	17-24	17-24#	17-24#
	17-24#	17-26	17-26	17-26#	17-30	17-30	17-30#	17-31	17-31	17-31	17-31	17-31	17-31	17-31#
	17-31#	17-31#	17-31#	17-31#	17-32	17-32	17-32#	17-33	17-33	17-33	17-33	17-33	17-33	17-33
	17-33	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-35	17-35	17-35#	17-39	17-39	17-39
	17-39#	17-39#	17-41	17-41	17-41#	17-45	17-45	17-45	17-45#	17-45#	17-47	17-47	17-47#	30-165
	30-165	30-165#	30-168	30-168	30-168	30-168#	30-168#	30-171	30-171	30-171	30-171#	30-171#	30-173	30-173
	30-173#	31-29	31-29	31-29#	31-32	31-32	31-32#	31-34	31-34	31-34	31-34#	31-34#	31-39	31-39
	31-39	31-39	31-39#	31-39#	31-39#	31-40	31-40	31-40	31-40#	31-40#	31-45	31-45	31-45	31-45
	31-45#	31-45#	31-45#	31-46	31-46	31-46#	31-55	31-55	31-55	31-55#	31-55#	31-62	31-62	31-62
	31-62#	31-62#	31-64	31-64	31-64	31-64#	31-64#	31-66	31-66	31-66	31-66#	31-66#	42-29	42-29
	42-29#	42-71	42-71	42-71	42-71#	42-71#	42-73	42-73	42-73	42-73#	42-73#	42-75	42-75	42-75
	42-75#	42-75#	42-77	42-77	42-77	42-77#	42-77#	42-85	42-85	42-85#	42-114	42-114	42-114	42-114#
	42-114#	42-127	42-127	42-127	42-127#	42-127#	42-132	42-132	42-132#	54-60	54-60	54-60#	54-61	54-61
	54-61#	54-73	54-73	54-73#	54-74	54-74	54-74#	55-86	55-86	55-86#	56-69	56-69	56-69#	57-66
	57-66	57-66#	61-96	61-96	61-96#	61-97	61-97	61-97#	61-118	61-118	61-118#	61-119	61-119	61-119#
	61-138	61-138	61-138#	64-31	64-31	64-31	64-31#	64-31#	65-35	65-35	65-35	65-35#	65-35#	65-152
	65-152	65-152#	65-153	65-153	65-153#	65-174	65-174	65-174#	65-175	65-175	65-175#	65-194	65-194	65-194#
T$CODE	67-55	67-55	67-55	67-55#	67-55#	67-55#	67-57	67-57	67-57	67-57#	67-57#	67-57#	67-59	67-59
	67-59	67-59#	67-59#	67-59#	67-61	67-61	67-61	67-61#	67-61#	67-61#	68-14	68-14	68-14	68-14#
	68-14#	68-14#	68-16	68-16	68-16	68-16	68-16	68-16	68-16#	68-16#	68-16#	68-16#	68-18	68-18
	68-18	68-18#	68-18#	68-18#	68-20	68-20	68-20	68-20#	68-20#	68-20#	68-22	68-22	68-22	68-22#
	68-22#	68-22#	68-24	68-24	68-24	68-24#	68-24#	68-24#	68-26	68-26	68-26	68-26#	68-26#	68-26#
	68-28	68-28	68-28	68-28#	68-28#	68-28#	68-30	68-30	68-30	68-30#	68-30#	68-30#	68-32	68-32
	68-32	68-32#	68-32#	68-32#	68-34	68-34	68-34	68-34#	68-34#	68-34#	68-38	68-38	68-38	68-38#
	68-38#	68-38#	68-40	68-40	68-40	68-40	68-40	68-40	68-40#	68-40#	68-40#	68-40#	68-44	68-44
	68-44	68-44#	68-44#	68-44#	68-47	68-47	68-47	68-47#	68-47#	68-47#	68-49	68-49	68-49	68-49#
	68-49#	68-49#	68-51	68-51	68-51	68-51#	68-51#	68-51#	68-53	68-53	68-53	68-53#	68-53#	68-53#
	68-55	68-55	68-55	68-55#	68-55#	68-55#	68-57	68-57	68-57	68-57#	68-57#	68-57#	68-59	68-59
	68-59	68-59	68-59	68-59	68-59#	68-59#	68-59#	68-59#	68-60	68-60	68-60	68-60#	68-60#	68-60#
T$ERRN	7-278#	25-27	25-27#	25-32	25-32#	25-39	25-39#	25-44	25-44#	25-49	25-49#	25-58	25-58#	25-63
	25-63#	25-68	25-68#	25-73	25-73#	25-84	25-84#	25-89	25-89#	25-92	25-92#	25-95	25-95#	25-100
	25-100#	25-105	25-105#	25-110	25-110#	25-115	25-115#	25-120	25-120#	25-125	25-125#	25-132	25-132#	25-137
	25-137#	25-144	25-144#	25-147	25-147#	25-152	25-152#	25-157	25-157#	25-162	25-162#	25-167	25-167#	25-200
	25-200#	28-19	28-19#	28-23	28-23#	28-27	28-27#	28-31	28-31#	28-35	28-35#	29-22	29-22#	54-112
	54-112#	55-102	55-102#	56-84	56-84#	57-79	57-79#	59-24	59-24#	59-35	59-35#	60-24	60-24#	60-33
	60-33#	61-150	61-150#	61-157	61-157#	61-159	61-159#	62-33	62-33#	65-214	65-214#	65-222	65-222#	65-224
	65-224#													
T$EXCP	67-55	67-55#	67-57	67-57#	67-59	67-59#	67-61	67-61#	68-18	68-18#	68-20	68-20#	68-22	68-22#
	68-24	68-24#	68-26	68-26#	68-28	68-28#	68-30	68-30#	68-32	68-32#	68-34	68-34#		
T$FLAG	40-61	40-61#	40-61#	42-91	42-91	42-91#	42-91#	42-103	42-103	42-103#	42-103#	42-165	42-165	42-165#
	42-165#	44-24	44-24	44-24#	44-24#	45-18	45-18#	45-18#	46-19	46-19#	46-19#	54-26	54-26	54-26#
	54-26#	55-15	55-15	55-15#	55-15#	55-18	55-18	55-18#	55-18#	56-18	56-18	56-18#	56-18#	56-21
	56-21	56-21#	56-21#	57-17	57-17	57-17#	57-17#	57-20	57-20	57-20#	57-20#	60-35	60-35	60-35#
	60-35#	61-35	61-35	61-35#	61-35#	64-33	64-33	64-33#	64-33#	65-37	65-37	65-37#	65-37#	65-78
	65-78	65-78#	65-78#											
T$FREE	68-122	69-22#												
T$GMAN	7-278#													
T$HILI	67-55	67-55#	67-57	67-57#	67-59	67-59#	67-61	67-61#	68-18	68-18#	68-20	68-20#	68-22	68-22#
	68-24	68-24#	68-26	68-26#	68-28	68-28#	68-30	68-30#	68-32	68-32#	68-34	68-34#		
T$LAST	7-278#	68-122#	69-15											

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CROSS REFERENCE TABLE (CREF V04.00)

T$LOLI 67-55 67-55# 67-57 67-57# 67-59 67-59# 67-61 67-61# 68-18 68-18# 68-20 68-20# 68-22 68-22#
68-24 68-24# 68-26 68-26# 68-28 68-28# 68-30 68-30# 68-32 68-32# 68-34 68-34#

T$LSYM 7-278 7-278# 9-21 10-39 17-27 17-36 17-42 17-48 24-115 24-133 24-168 30-36 36-15 40-76
42-180 43-17 44-26 45-33 46-34 48-67 48-68 49-20 49-27 49-31 50-48 50-64 50-71 51-43
51-60 51-67 52-29 52-32 52-44 52-47 52-59 52-62 52-67 53-17 53-20 53-25 54-57 54-89
54-120 55-27 55-55 55-83 55-110 56-46 56-66 56-92 57-43 57-63 57-87 58-44 58-52 59-25
59-36 59-45 60-25 60-34 60-38 61-32 61-93 61-135 61-166 62-39 62-45 62-58 62-63 63-41
63-47 63-66 63-72 63-85 64-60 64-83 65-75 65-149 65-191 65-252 67-62 68-71

T$LTNO 68-122#

T$NEST 7-278# 7-304 7-304 7-304# 9-9 9-9 9-9# 9-21 9-21 9-21 9-21# 10-8 10-8 10-8#
10-39 10-39 10-39 10-39# 10-40 10-40 10-40 10-40# 11-51 11-51 11-51# 17-3 17-3 17-3#
17-27 17-27 17-27 17-27# 17-29 17-29 17-29# 17-36 17-36 17-36 17-36# 17-38 17-38 17-38#
17-42 17-42 17-42 17-42# 17-44 17-44 17-44# 17-48 17-48 17-48 17-48# 24-112 24-112 24-112#
24-115 24-115 24-115 24-115# 24-130 24-130 24-130# 24-133 24-133 24-133 24-133# 24-165 24-165 24-165#
24-168 24-168 24-168 24-168# 30-34 30-34 30-34# 30-36 30-36 30-36 30-36# 36-4 36-4 36-4#
36-15 36-15 36-15 36-15# 39-1 39-1 39-1 39-1# 40-41 40-41 40-41# 40-47 40-47 40-47#
40-76 40-76 40-76 40-76# 41-8 41-8 41-8# 41-12 41-12 41-12 41-12# 42-8 42-8 42-8#
42-180 42-180 42-180 42-180# 43-10 43-10 43-10# 43-17 43-17 43-17 43-17# 44-8 44-8 44-8#
44-26 44-26 44-26 44-26# 45-8 45-8 45-8# 45-33 45-33 45-33 45-33# 46-9 46-9 46-9#
46-34 46-34 46-34 46-34# 46-35 46-35 46-35 46-35# 48-38 48-38 48-38# 48-57 48-57 48-57#
48-62 48-62 48-62# 48-67 48-67 48-67 48-67# 48-68 48-68 48-68 48-68# 49-14 49-14 49-14#
49-18 49-18 49-18# 49-20 49-20 49-20 49-20# 49-25 49-25 49-25# 49-27 49-27 49-27 49-27#
49-31 49-31 49-31 49-31# 50-23 50-23 50-23# 50-46 50-46 50-46# 50-48 50-48 50-48 50-48#
50-49 50-49 50-49# 50-64 50-64 50-64 50-64# 50-71 50-71 50-71 50-71# 51-22 51-22 51-22#
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51-67 51-67 51-67 51-67# 52-17 52-17 52-17# 52-27 52-27 52-27# 52-29 52-29 52-29 52-29#
52-30 52-30 52-30# 52-32 52-32 52-32 52-32# 52-42 52-42 52-42# 52-44 52-44 52-44 52-44#
52-45 52-45 52-45# 52-47 52-47 52-47 52-47# 52-57 52-57 52-57# 52-59 52-59 52-59 52-59#
52-60 52-60 52-60# 52-62 52-62 52-62 52-62# 52-67 52-67 52-67 52-67# 53-8 53-8 53-8#
53-15 53-15 53-15# 53-17 53-17 53-17 53-17# 53-18 53-18 53-18# 53-20 53-20 53-20 53-20#
53-25 53-25 53-25 53-25# 54-23 54-23 54-23# 54-44 54-44 54-44# 54-57 54-57 54-57 54-57#
54-76 54-76 54-76# 54-89 54-89 54-89 54-89# 54-120 54-120 54-120 54-120# 55-12 55-12 55-12#
55-25 55-25 55-25# 55-27 55-27 55-27 55-27# 55-41 55-41 55-41# 55-55 55-55 55-55 55-55#
55-69 55-69 55-69# 55-83 55-83 55-83 55-83# 55-110 55-110 55-110 55-110# 56-15 56-15 56-15#
56-34 56-34 56-34# 56-46 56-46 56-46 56-46# 56-52 56-52 56-52# 56-66 56-66 56-66 56-66#
56-92 56-92 56-92 56-92# 57-14 57-14 57-14# 57-29 57-29 57-29# 57-43 57-43 57-43 57-43#
57-49 57-49 57-49# 57-63 57-63 57-63 57-63# 57-87 57-87 57-87 57-87# 58-20 58-20 58-20#
58-32 58-32 58-32# 58-44 58-44 58-44 58-44# 58-52 58-52 58-52 58-52# 59-9 59-9 59-9#
59-20 59-20 59-20# 59-25 59-25 59-25 59-25# 59-31 59-31 59-31# 59-36 59-36 59-36 59-36#
59-45 59-45 59-45 59-45# 60-10 60-10 60-10# 60-19 60-19 60-19# 60-25 60-25 60-25 60-25#
60-28 60-28 60-28# 60-34 60-34 60-34 60-34# 60-38 60-38 60-38 60-38# 61-17 61-17 61-17#
61-30 61-30 61-30# 61-32 61-32 61-32 61-32# 61-69 61-69 61-69# 61-93 61-93 61-93 61-93#
61-121 61-121 61-121# 61-135 61-135 61-135 61-135# 61-166 61-166 61-166 61-166# 62-19 62-19 62-19#
62-37 62-37 62-37# 62-39 62-39 62-39 62-39# 62-42 62-42 62-42# 62-45 62-45 62-45 62-45#
62-56 62-56 62-56# 62-58 62-58 62-58 62-58# 62-63 62-63 62-63 62-63# 63-18 63-18 63-18#
63-38 63-38 63-38# 63-41 63-41 63-41 63-41# 63-42 63-42 63-42# 63-47 63-47 63-47 63-47#
63-63 63-63 63-63# 63-66 63-66 63-66 63-66# 63-67 63-67 63-67# 63-72 63-72 63-72 63-72#
63-85 63-85 63-85 63-85# 64-25 64-25 64-25# 64-52 64-52 64-52# 64-60 64-60 64-60 64-60#
64-83 64-83 64-83 64-83# 65-29 65-29 65-29# 65-70 65-70 65-70# 65-75 65-75 65-75 65-75#
65-125 65-125 65-125# 65-149 65-149 65-149 65-149# 65-177 65-177 65-177# 65-191 65-191 65-191 65-191#
65-201 65-201 65-201# 65-203 65-203 65-203 65-203# 65-252 65-252 65-252 65-252# 66-2 66-2 66-2
66-2# 67-43 67-43 67-43# 67-53 67-53 67-53# 67-62 67-62 67-62 67-62# 68-12 68-12 68-12#
68-16 68-40 68-59 68-71 68-71 68-71 68-71# 68-123 68-123 68-123 68-123#

T$NS0 7-304# 10-40 11-51# 39-1 40-41# 46-35 48-38# 66-2 67-43# 68-123

T$NS1 9-9# 9-21 10-8# 10-39 17-3# 17-27 17-29# 17-36 17-38# 17-42 17-44# 17-48 24-112# 24-115
24-130# 24-133 24-165# 24-168 30-34# 30-36 36-4# 36-15 40-47# 40-76 41-8# 41-12 42-8# 42-180

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	43-10#	43-17	44-8#	44-26	45-8#	45-33	46-9#	46-34	48-57#	48-68	49-14#	49-31	50-23#	50-71
	51-22#	51-67	52-17#	52-67	53-8#	53-25	54-23#	54-120	55-12#	55-110	56-15#	56-92	57-14#	57-87
	58-20#	58-52	59-9#	59-45	60-10#	60-38	61-17#	61-166	62-19#	62-63	63-18#	63-85	64-25#	64-83
	65-29#	65-252	67-53#	67-62	68-12#	68-16	68-40	68-59	68-71					
T$NS2	48-62#	48-67	49-18#	49-20	49-25#	49-27	50-46#	50-48	50-49#	50-64	51-41#	51-43	51-44#	51-60
	52-27#	52-29	52-30#	52-32	52-42#	52-44	52-45#	52-47	52-57#	52-59	52-60#	52-62	53-15#	53-17
	53-18#	53-20	54-44#	54-57	54-76#	54-89	55-25#	55-27	55-41#	55-55	55-69#	55-83	56-34#	56-46
	56-52#	56-66	57-29#	57-43	57-49#	57-63	58-32#	58-44	59-20#	59-25	59-31#	59-36	60-19#	60-25
	60-28#	60-34	61-30#	61-32	61-69#	61-93	61-121#	61-135	62-37#	62-39	62-42#	62-45	62-56#	62-58
	63-38#	63-41	63-42#	63-47	63-63#	63-66	63-67#	63-72	64-52#	64-60	65-70#	65-75	65-125#	65-149
	65-177#	65-191	65-201#	65-203										
T$PCNT	69-15#	69-16	69-16	69-16#										
T$PTAB	69-16	69-16#												
T$PTHV	7-323	69-22#												
T$PTNU	7-278#	69-16	69-16#	69-22	69-22									
T$SAVL	7-278#													
T$SEGL	7-278#	65-201	65-201	65-201#	65-203	65-203	65-203	65-203	65-203#					
T$SEKO	65-201#	65-203												
T$SIZE	68-122	69-22#												
T$SUBN	7-278#	48-57#	48-62	48-62	48-62#	49-14#	49-18	49-18	49-18#	49-25	49-25	49-25#	50-23#	50-46
	50-46	50-46#	50-49	50-49	50-49#	51-22#	51-41	51-41	51-41#	51-44	51-44	51-44#	52-17#	52-27
	52-27	52-27#	52-30	52-30	52-30#	52-42	52-42	52-42#	52-45	52-45	52-45#	52-57	52-57	52-57#
	52-60	52-60	52-60#	53-8#	53-15	53-15	53-15#	53-18	53-18	53-18#	54-23#	54-44	54-44	54-44#
	54-76	54-76	54-76#	55-12#	55-25	55-25	55-25#	55-41	55-41	55-41#	55-69	55-69	55-69#	56-15#
	56-34	56-34	56-34#	56-52	56-52	56-52#	57-14#	57-29	57-29	57-29#	57-49	57-49	57-49#	58-20#
	58-32	58-32	58-32#	59-9#	59-20	59-20	59-20#	59-31	59-31	59-31#	60-10#	60-19	60-19	60-19#
	60-28	60-28	60-28#	61-17#	61-30	61-30	61-30#	61-69	61-69	61-69#	61-121	61-121	61-121#	62-19#
	62-37	62-37	62-37#	62-42	62-42	62-42#	62-56	62-56	62-56#	63-18#	63-38	63-38	63-38#	63-42
	63-42	63-42#	63-63	63-63	63-63#	63-67	63-67	63-67#	64-25#	64-52	64-52	64-52#	65-29#	65-70
	65-70	65-70#	65-125	65-125	65-125#	65-177	65-177	65-177#						
T$TAGL	7-278#													
T$TAGN	7-278#	9-9	9-9	9-9#	10-8	10-8	10-8#	17-3	17-3	17-3#	17-29	17-29	17-29#	17-38
	17-38	17-38#	17-44	17-44	17-44#	24-112	24-112	24-112#	24-130	24-130	24-130#	24-165	24-165	24-165#
	30-34	30-34	30-34#	36-4	36-4	36-4#	40-47	40-47	40-47#	41-8	41-8	41-8#	42-8	42-8
	42-8#	43-10	43-10	43-10#	44-8	44-8	44-8#	45-8	45-8	45-8#	46-9	46-9	46-9#	48-57
	48-57	48-57#	48-62	48-62	48-62#	49-14	49-14	49-14#	49-18	49-18	49-18#	49-25	49-25	49-25#
	50-23	50-23	50-23#	50-46	50-46	50-46#	50-49	50-49	50-49#	51-22	51-22	51-22#	51-41	51-41
	51-41#	51-44	51-44	51-44#	52-17	52-17	52-17#	52-27	52-27	52-27#	52-30	52-30	52-30#	52-42
	52-42	52-42#	52-45	52-45	52-45#	52-57	52-57	52-57#	52-60	52-60	52-60#	53-8	53-8	53-8#
	53-15	53-15	53-15#	53-18	53-18	53-18#	54-23	54-23	54-23#	54-44	54-44	54-44#	54-76	54-76
	54-76#	55-12	55-12	55-12#	55-25	55-25	55-25#	55-41	55-41	55-41#	55-69	55-69	55-69#	56-15
	56-15	56-15#	56-34	56-34	56-34#	56-52	56-52	56-52#	57-14	57-14	57-14#	57-29	57-29	57-29#
	57-49	57-49	57-49#	58-20	58-20	58-20#	58-32	58-32	58-32#	59-9	59-9	59-9#	59-20	59-20
	59-20#	59-31	59-31	59-31#	60-10	60-10	60-10#	60-19	60-19	60-19#	60-28	60-28	60-28#	61-17
	61-17	61-17#	61-30	61-30	61-30#	61-69	61-69	61-69#	61-121	61-121	61-121#	62-19	62-19	62-19#
	62-37	62-37	62-37#	62-42	62-42	62-42#	62-56	62-56	62-56#	63-18	63-18	63-18#	63-38	63-38
	63-38#	63-42	63-42	63-42#	63-63	63-63	63-63#	63-67	63-67	63-67#	64-25	64-25	64-25#	64-52
	64-52	64-52#	65-29	65-29	65-29#	65-70	65-70	65-70#	65-125	65-125	65-125#	65-177	65-177	65-177#
	67-53	67-53	67-53#	68-12	68-12	68-12#	69-15	69-15	69-15#	69-16	69-16	69-16	69-16	69-16#
	69-16#													
T$TEMP	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8
	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8
	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#
	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	8-8#	9-21
	9-21#	10-39	10-39#	10-40	10-40#	17-27	17-27#	17-36	17-36#	17-42	17-42#	17-48	17-48#	24-115
	24-115#	24-133	24-133#	24-168	24-168#	30-36	30-36#	36-15	36-15#	39-1	39-1#	40-61	40-61#	40-76

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CROSS REFERENCE TABLE (CREF V04.00)

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                40-76#  41-12   41-12#  42-91   42-91#  42-103  42-103#  42-165  42-165#  42-180  42-180#  43-17   43-17#  44-24
                44-24#  44-26   44-26#  45-18   45-18#  45-33   45-33#   46-19   46-19#   46-34   46-34#   46-35   46-35#  48-67
                48-67#  48-68   48-68#  49-20   49-20#  49-27   49-27#   49-31   49-31#   50-48   50-48#   50-64   50-64#  50-71
                50-71#  51-43   51-43#  51-60   51-60#  51-67   51-67#   52-29   52-29#   52-32   52-32#   52-44   52-44#  52-47
                52-47#  52-59   52-59#  52-62   52-62#  52-67   52-67#   53-17   53-17#   53-20   53-20#   53-25   53-25#  54-26
                54-26#  54-57   54-57#  54-89   54-89#  54-120  54-120#  55-15   55-15#   55-18   55-18#   55-27   55-27#  55-55
                55-55#  55-83   55-83#  55-110  55-110# 56-18   56-18#   56-21   56-21#   56-46   56-46#   56-66   56-66#  56-92
                56-92#  57-17   57-17#  57-20   57-20#  57-43   57-43#   57-63   57-63#   57-87   57-87#   58-44   58-44#  58-52
                58-52#  59-25   59-25#  59-36   59-36#  59-45   59-45#   60-25   60-25#   60-34   60-34#   60-35   60-35#  60-38
                60-38#  61-32   61-32#  61-35   61-35#  61-93   61-93#   61-135  61-135#  61-166  61-166#  62-39   62-39#  62-45
                62-45#  62-58   62-58#  62-63   62-63#  63-41   63-41#   63-47   63-47#   63-66   63-66#   63-72   63-72#  63-85
                63-85#  64-33   64-33#  64-60   64-60#  64-83   64-83#   65-37   65-37#   65-75   65-75#   65-78   65-78#  65-149
                65-149# 65-191  65-191# 65-203  65-203# 65-252  65-252#  66-2    66-2#    67-55   67-55    67-55   67-55#  67-55#
                67-55#  67-57   67-57   67-57   67-57#  67-57#  67-57#   67-59   67-59    67-59   67-59#   67-59#  67-59#  67-61
                67-61   67-61   67-61#  67-61#  67-61#  67-62   67-62#   68-14   68-14    68-14   68-14#   68-14#  68-14#  68-18
                68-18   68-18   68-18#  68-18#  68-18#  68-20   68-20    68-20   68-20#   68-20#  68-20#   68-22   68-22   68-22
                68-22#  68-22#  68-22#  68-24   68-24   68-24   68-24#   68-24#  68-24#   68-26   68-26    68-26   68-26#  68-26#
                68-26#  68-28   68-28   68-28   68-28#  68-28#  68-28#   68-30   68-30    68-30   68-30#   68-30#  68-30#  68-32
                68-32   68-32   68-32#  68-32#  68-32#  68-34   68-34    68-34   68-34#   68-34#  68-34#   68-38   68-38   68-38
                68-38#  68-38#  68-38#  68-44   68-44   68-44   68-44#   68-44#  68-44#   68-47   68-47    68-47   68-47#  68-47#
                68-47#  68-49   68-49   68-49   68-49#  68-49#  68-49#   68-51   68-51    68-51   68-51#   68-51#  68-51#  68-53
                68-53   68-53   68-53#  68-53#  68-53#  68-55   68-55    68-55   68-55#   68-55#  68-55#   68-57   68-57   68-57
                68-57#  68-57#  68-57#  68-60   68-60   68-60   68-60#   68-60#  68-60#   68-71   68-71#   68-123  68-123#
T$TEST           7-278#  48-57   48-57   48-57#  48-62   49-14   49-14    49-14#  49-18    49-25   50-23    50-23   50-23#  50-46
                50-49   51-22   51-22   51-22#  51-41   51-44   52-17    52-17   52-17#   52-27   52-30    52-42   52-45   52-57
                52-60   53-8    53-8    53-8#   53-15   53-18   54-23    54-23   54-23#   54-44   54-76    55-12   55-12   55-12#
                55-25   55-41   55-69   56-15   56-15   56-15#  56-34    56-52   57-14    57-14   57-14#   57-29   57-49   58-20
                58-20   58-20#  58-32   59-9    59-9    59-9#   59-20    59-31   60-10    60-10   60-10#   60-19   60-28   61-17
                61-17   61-17#  61-30   61-69   61-121  62-19   62-19    62-19#  62-37    62-42   62-56    63-18   63-18   63-18#
                63-38   63-42   63-63   63-67   64-25   64-25   64-25#   64-52   65-29    65-29   65-29#   65-70   65-125  65-177
                68-122
T$TSTM           7-278#  17-4    17-5    17-6    17-10   17-12   17-13    17-15   17-16    17-18   17-19    17-23   17-24   17-26
                17-27   17-30   17-31   17-32   17-33   17-35   17-36    17-39   17-41    17-42   17-45    17-47   17-48   24-16
                24-35   24-84   24-94   24-126  24-135  24-155  24-170   25-27   25-32    25-39   25-44    25-49   25-58   25-63
                25-68   25-73   25-84   25-89   25-92   25-95   25-100   25-105  25-110   25-115  25-120   25-125  25-132  25-137
                25-144  25-147  25-152  25-157  25-162  25-167  25-200   28-19   28-23    28-27   28-31    28-35   28-45   29-22
                30-165  30-168  30-171  30-173  31-29   31-32   31-34    31-39   31-40    31-45   31-46    31-55   31-62   31-64
                31-66   34-18   34-20   34-36   34-45   34-145  34-147   34-199  34-209   34-254  40-76    42-10   42-16   42-20
                42-25   42-29   42-39   42-71   42-73   42-75   42-77    42-85   42-89    42-91   42-98    42-100  42-101  42-102
                42-103  42-114  42-127  42-132  42-165  42-180  43-17    44-10   44-18    44-21   44-23    44-24   44-26   45-33
                46-34   48-62   48-67   48-68   49-18   49-20   49-25    49-27   49-31    50-46   50-48    50-49   50-64   50-71
                51-41   51-43   51-44   51-60   51-67   52-27   52-29    52-30   52-32    52-42   52-44    52-45   52-47   52-57
                52-59   52-60   52-62   52-67   53-15   53-17   53-18    53-20   53-25    54-26   54-37    54-39   54-44   54-57
                54-60   54-61   54-73   54-74   54-76   54-89   54-110   54-112  54-119   54-120  55-15    55-18   55-25   55-27
                55-32   55-34   55-41   55-55   55-69   55-83   55-86    55-100  55-102   55-109  55-110   56-18   56-21   56-27
                56-29   56-34   56-46   56-52   56-66   56-69   56-80    56-83   56-84    56-91   56-92    57-17   57-20   57-26
                57-28   57-29   57-43   57-49   57-63   57-66   57-77    57-79   57-86    57-87   58-32    58-44   58-52   59-20
                59-24   59-25   59-31   59-35   59-36   59-45   60-19    60-24   60-25    60-28   60-33    60-34   60-35   60-38
                61-30   61-32   61-35   61-44   61-46   61-69   61-93    61-96   61-97    61-118  61-119   61-121  61-135  61-138
                61-148  61-150  61-157  61-159  61-165  61-166  62-33    62-34   62-37    62-39   62-42    62-45   62-56   62-58
                62-63   63-38   63-41   63-42   63-47   63-63   63-66    63-67   63-72    63-85   64-31    64-33   64-52   64-60
                64-83   65-35   65-37   65-70   65-75   65-78   65-86    65-88   65-125   65-149  65-152   65-153  65-174  65-175
                65-177  65-191  65-194  65-199  65-201  65-203  65-207   65-212  65-214   65-222  65-224   65-230  65-252
T$TSTS           7-278#  48-57#  49-14#  50-23#  51-22#  52-17#  53-8#    54-23#  55-12#   56-15#  57-14#   58-20#  59-9#   60-10#
                61-17#  62-19#  63-18#  64-25#  65-29#
T1               8-8     48-57#
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T1.1     48-62#
T10       8-8      57-14#
T10.1    57-29#
T10.1$   57-30#    57-72
T10.2    57-49#
T10.2$   57-39     57-46#
T10.3$   57-59     57-65     57-68#
T10.4$   57-45     57-66#
T10.7$   57-26     57-75#
T10.8$   57-67     57-73     57-80#
T11       8-8      58-20#
T11.1    58-32#
T11.2$   58-33#    58-39     58-50
T11.5$   58-45#
T12       8-8      59-9#
T12.1    59-20#
T12.2    59-31#
T13       8-8      60-10#
T13.1    60-19#
T13.1$   60-32     60-36#
T13.2    60-28#
T14       8-8      61-17#
T14.1    61-30#
T14.1$   61-52#    61-144
T14.2    61-69#
T14.3    61-121#
T14.7$   61-44     61-146#
T14.8$   61-98     61-120    61-139    61-143    61-151#
T1410$   61-69#
T1411$   61-89     61-113    61-122#
T1412$   61-131    61-137    51-141#
T1420    13-100#   61-76     61-160    65-132    65-225
T15       8-8      62-19#
T15.1    62-37#
T15.2    62-42#
T15.3    62-56#
T16       8-8      63-18#
T16.1    63-38#
T16.2    63-42#
T16.3    63-63#
T16.4    63-67#
T17       8-8      64-25#
T17.1    64-52#
T18       8-8      65-29#
T18.1    65-70#
T18.2    65-125#
T18.3    65-177#
T1811$   65-145    65-169    65-178#
T1812$   65-187    65-193    65-197#
T18END   65-154    65-176    65-195    65-205    65-215#
T18OFL   65-86     65-210#
T2        8-8      49-14#
T2.1     49-18#
T2.11    49-18#    49-23
T2.2     49-25#
T2.21    49-25#    49-30
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T3        8-8      50-23#
T3.1     50-46#
T3.11    50-29     50-47#
T3.2     50-49#
T4        8-8      51-22#
T4.1     51-41#
T4.2     51-44#
T5        8-8      52-17#
T5.1     52-27#
T5.11    52-28#    52-36
T5.2     52-30#
T5.3     52-42#
T5.31    52-43#    52-51
T5.4     52-45#
T5.5     52-57#
T5.51    52-58#    52-66
T5.6     52-60#
T6        8-8      53-8#
T6.1     53-15#
T6.11    53-16#    53-24
T6.2     53-18#
T7        8-8      54-23#
T7.1     54-44#
T7.1$    54-45#    54-106
T7.10$   54-60#    54-91
T7.2     54-76#
T7.2$    54-53     54-68     54-77#
T7.20$   54-73#    54-101
T7.3$    54-85     54-96     54-103#
T7.44$   54-59     54-64#
T7.7$    54-37     54-108#
T7.8$    54-62     54-75     54-105    54-113#
T7A      13-79#    54-32     54-115
T8        8-8      55-1?#
T8.1     55-25#
T8.1$    55-38#    55-60     55-96
T8.10$   55-79     55-85     55-88#
T8.2     55-41#
T8.2$    55-51     55-58#
T8.3     55-69#
T8.3$    55-40     55-61#
T8.4$    55-66#    55-90
T8.5$    55-23     55-28#
T8.6$    55-68     55-91#
T8.7$    55-32     55-98#
T8.8$    55-87     55-93     55-103#
T8.9$    55-57     55-86#
T9        8-8      56-15#
T9.1     56-34#
T9.1$    56-31#    56-75
T9.2     56-52#
T9.2$    56-42     56-49#
T9.3$    56-62     56-68     56-71#
T9.4$    56-48     56-69#
T9.7$    56-27     56-78#
T9.8$    56-70     56-76     56-85#
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TD       36-10    36-19#
TEST1    48-59#   48-66
TEST10   57-22#
TEST13   60-13#   60-37
TEST14   61-29#   61-34
TEST15   62-23#   62-60
TEST16   63-30#   63-83
TEST17   64-53#   64-65    64-74    64-81
TEST18   65-55#   65-77
TEST3    50-27#   50-67    50-70
TEST4    51-26#   51-63    51-66
TEST5    52-25#
TEST6    53-13#
TEST7    54-33#
TEST8    55-20#
TEST9    56-23#
TICKMS   24-51*   24-55*   24-59#   24-113
TICKUS   24-52*   24-56*   24-60#
TIM.DN   13-36#   30-51*   30-74    30-120
TIM.PT   13-42#   30-45    30-91*   30-92*   30-143   30-146*  30-147*
TIM.UP   13-29#   17-39    30-44    30-50*   30-71    30-117   31-27    61-153   61-155   65-204   65-218   65-220
TIMER    33-116#  34-23    34-65*   34-128*  34-246*  35-155*  35-210*  36-22*   36-118*  36-143*  36-208   36-210*  36-243*  36-258*
         36-264*
TIMMSG   68-51    68-94#
TIMSTL   10-21#   24-157
TIMT10   13-85#   55-19    55-105
TIMT11   13-90#   56-22    56-87
TIMT12   13-95#   57-21    57-82
TIMTYP   10-20#   30-162   31-18
TRE      12-11#
TRK.DS   13-27#   17-31    17-33    26-32*   26-61*   26-101*  27-18*   29-19*   30-21*
TRK.RD   13-23#   17-5     17-33    25-21*   26-9     26-11*   26-16*   28-15*   29-16*   54-111*  55-101*  56-81*   57-78*   61-149*
         65-213*
TRKWC    13-45#   58-25    63-21    64-37
TRNSWT   33-90#   35-13*   35-185   35-187*  35-198   35-216*  35-222*  36-24    36-25*   36-236   36-253*
TST12    59-23    59-26#
TST12A   59-34    59-37#
TST13    60-23    60-27#
TST14A   61-20    61-37#
TST15    62-43#   62-51
TST18A   65-52    65-80#
TST18B   65-91#   65-208
TST18C   65-218#
TWOMS    24-152#  55-59    55-89    56-51    56-73    57-48    57-70
TYPTIM   31-17#   54-115   55-105   56-87    57-82    61-160   65-225
UAM      11-57#
UNIT     15-2#    42-30*   42-73*   42-34    42-39
UNS      12-93#
UNSMSG   16-85#   42-77
UPE      12-38#   25-30
VERIFY   26-79    26-120   29-8#
WCE      12-39#   25-42
WCEFLG   13-43#   27-9*    54-64*   54-71*   54-92*   54-99*   61-100*  61-116*  65-156*  65-172*
WCF      12-84#   25-66
WCKD     12-210#  63-45    63-70    64-58    65-73    65-200
WCKHD    12-211#
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WLE      12-90#   25-71
WOR      12-147#  25-150
WRITMG   68-38    68-87#
WRPAT    63-39#   63-52
WRPATN   63-64#   63-77
WRSAFM   68-44    68-88#
WRT.RP   34-101   34-105   25-21    35-31    35-35    35-42    35-46    35-55    35-59    35-66    35-71    35-83    35-91    35-102
         35-117   35-140   35-146   35-164   35-168   35-179   36-105   36-315#
WRTALL   10-27#   64-28    65-32
WRTDAT   12-212#  63-43    63-68    64-56    65-71    65-180
WRTENM   16-65#   64-31    65-35
WRTTD    12-214#
WRYUNS   12-146#  25-150
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X$FALS    7-278#  68-1?    68-40    68-59
X$OFFS    7-278#  68-16    68-40    68-59
X$TRUE    7-278#
XIT14    61-39    61-164#
XIT18    65-82    65-229#
XTIMES   13-10#   61-18    61-142   65-40    65-204
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BCOMPL    1-15#    7-278#  42-18
BERROR    1-19#    7-278#
BGNAU     1-23#    7-278#  46-9
BGNAUT    1-31#    7-278#  43-10
BGNCLN    1-39#    7-278#  44-8
BGNDU     1-47#    7-278#  45-8
BGNHRD    1-55#    7-278#  67-53
BGNHW     1-66#    7-278#   9-9
BGNINI    1-77#    7-278#  42-8
BGNMOD    1-85#    7-278#   7-304   11-51   40-41   48-38   67-43
BGNMSG    1-98#    7-278#  17-3     17-29   17-38   17-44
BGNPRO    1-106#   7-278#  41-8
BGNPTA    1-114#   7-278#  69-16
BGNRPT    1-144#   7-278#  40-47
BGNSEG    1-152#   7-278#  65-201
BGNSET    1-161#   7-278#  69-15
BGNSFT    1-182#   7-278#  68-12
BGNSRV    1-193#   7-278#  24-112   24-130   24-165   30-34   36-4
BGNSUB    1-201#   7-278#  48-62    49-18    49-25    50-46   50-49   51-41   51-44   52-27   52-30   52-42   52-45   52-57
         52-60    53-15    53-18    54-44    54-76    55-25   55-41   55-69   56-34   56-52   57-29   57-49   58-32   59-20
         59-31    60-19    60-28    61-30    61-69    61-121  62-37   62-42   62-56   63-38   63-42   63-63   63-67   64-52
         65-70    65-125   65-177
BGNSW     1-225#   7-278#  10-8
BGNTST    1-236#   7-278#  48-57    49-14    50-23    51-22   52-17   53-8    54-23   55-12   56-15   57-14   58-20   59-9
         60-10    61-17    62-19    63-18    64-25    65-29
BNCOMP    1-266#   7-278#  24-18    24-37    42-22    42-27   42-40
BNERRO    1-270#   7-278#
BREAK     1-274#   7-278#
BRESET    1-278#   7-278#  42-10
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CLOSE     1-292#   7-278#
CLRVEC    1-296#   7-278#  42-98    42-100   42-101   44-18   44-21   44-23
COMMEN    1-301#   7-278#
COMND     7-100#   48-59   50-26    51-25
DELAY     1-322#   7-278#
DESCRI    1-317#   7-278#  16-27
DEVTYP    1-341#   7-278#  16-17
DISPAT    1-346#   7-278#   8-8
DISPLA    1-360#   7-278#
DO        7-116#   29-24   42-138   48-63    48-64    49-19   49-26   50-47   50-63   51-42   51-54   52-28   52-31   52-43
         52-46    52-58    52-61    53-16    53-19
DOCLN     1-376#   7-278#  28-45    42-102   62-34
DODTA     7-129#   58-33   60-20    60-29    61-31    62-38   62-44   62-57   63-40   63-44   63-46   63-65   63-69   63-71
DODU      1-380#   7-278#
DORPT     1-385#   7-278#
DRV.IN    7-72#    54-113  55-103   56-85    57-80    61-151  65-215
ENDAU     1-389#   7-278#  46-34
ENDAUT    1-401#   7-278#  43-17
ENDCLN    1-413#   7-278#  44-26
ENDCOM    1-425#   7-278#
ENDDU     1-441#   7-278#  45-33
ENDHRD    1-453#   7-278#  67-62
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ENDINI    1-475#   7-278#  42-180
ENDMOD    1-487#   7-278#  10-40    39-1     46-35    66-2    68-123
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                31-46    31-46#   31-55    31-55#   31-62    31-62#   31-64    31-64#   31-66    31-66#   42-29    42-29#   42-71    42-71#
                42-73    42-73#   42-75    42-75#   42-77    42-77#   42-85    42-85#   42-114   42-114#  42-127   42-127#  42-132   42-132#
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                61-96    61-96#   61-97    61-97#   61-118   61-118#  61-119   61-119#  61-138   61-138#  64-31    64-31#   65-35    65-35#
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MSDECR           1-D29#   7-278#   9-21     9-21#    10-39    10-39#   10-40    10-40#   17-27    17-27#   17-36    17-36#   17-42    17-42#
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                46-35    46-35#   48-67    48-67#   48-68    48-68#   49-20    49-20#   49-27    49-27#   49-31    49-31#   50-48    50-48#
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                65-252   65-252#  66-2     66-2#    67-62    67-62#   68-71    68-71#   68-123   68-123#  69-16    69-16#
MSDEFA           1-E70#   7-278#   67-55    67-55#   67-57    67-57#   67-59    67-59#   67-61    67-61#   68-14    68-14#   68-18    68-18#
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                39-1#    40-76#   42-180#  43-17#   44-26#   45-33#   46-34#   46-35#   48-67#   48-68#   49-20#   49-27#   49-31#   50-48#
                50-64#   50-71#   51-43#   51-60#   51-67#   52-29#   52-32#   52-44#   52-47#   52-59#   52-62#   52-67#   53-17#   53-20#
                53-25#   54-57#   54-89#   54-120#  55-27#   55-55#   55-83#   55-110#  56-46#   56-66#   56-92#   57-43#   57-63#   57-87#
                58-44#   58-52#   59-25#   59-36#   59-45#   60-25#   60-34#   60-38#   61-32#   61-93#   61-135#  61-166#  62-39#   62-45#
                62-58#   62-63#   63-41#   63-47#   63-66#   63-72#   63-85#   64-60#   64-83#   65-75#   65-149#  65-191#  65-203#  65-252#
                66-2#    67-62#   68-71#   68-123#
MSERRI           1-A49#   7-278#   25-27    25-27#   25-32    25-32#   25-39    25-39#   25-44    25-44#   25-49    25-49#   25-58    25-58#
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                25-100   25-100#  25-105   25-105#  25-110   25-110#  25-115   25-115#  25-120   25-120#  25-125   25-125#  25-132   25-132#
                25-137   25-137#  25-144   25-144#  25-147   25-147#  25-152   25-152#  25-157   25-157#  25-162   25-162#  25-167   25-167#
                25-200   25-200#  28-19    28-19#   28-23    28-23#   28-27    28-27#   28-31    28-31#   28-35    28-35#   29-22    29-22#
                54-112   54-112#  55-102   55-102#  56-84    56-84#   57-79    57-79#   59-24    59-24#   59-35    59-35#   60-24    60-24#
                60-33    60-33#   61-150   61-150#  61-157   61-157#  61-159   61-159#  62-33    62-33#   65-214   65-214#  65-222   65-222#
                65-224   65-224#
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MSESCS           1-D10#   7-278#
MSEXCP           1-E01#   7-278#   67-55    67-55    67-55#   67-57    67-57    67-57#   67-59    67-59    67-59#   67-61    67-61    67-61#
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                68-26#   68-28    68-28    68-28#   68-30    68-30    68-30#   68-32    68-32    68-32#   68-34    68-34    68-34#
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10-8 10-8 10-8# 11-51# 16-17 16-17# 16-27 16-27# 17-3 17-3# 17-29 17-29# 17-38 17-38#

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	17-44	17-44#	24-112	24-112#	24-130	24-130#	24-165	24-165#	30-34	30-34#	36-4	36-4#	40-41#	40-47
	40-47#	41-8	41-8#	42-8	42-8#	43-10	43-10#	44-8	44-8#	45-8	45-8#	46-9	46-9#	48-38#
	67-43#	67-53	67-53#	68-12	68-12#	68-122	68-122#							
M$GNIN	1-D49#	7-278#	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323	7-323
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	8-8#	8-8#	8-8#	8-8#	9-9	9-9#	10-8	10-8#	16-17	16-17	16-17#	16-17#	16-27	16-27
	16-27#	16-27#	17-4	17-4	17-4	17-4	17-4	17-4	17-4#	17-4#	17-4#	17-4#	17-4#	17-5
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	17-6	17-6	17-6#	17-6#	17-6#	17-6#	17-6#	17-10	17-10	17-10	17-10	17-10	17-10	17-10
	17-10	17-10	17-10#	17-10#	17-10#	17-10#	17-10#	17-10#	17-10#	17-10#	17-12	17-12	17-12	17-12
	17-12	17-12#	17-12#	17-12#	17-12#	17-13	17-13	17-13	17-13	17-13	17-13	17-13	17-13	17-13
	17-13	17-13	17-13	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#	17-13#
	17-15	17-15	17-15	17-15	17-15	17-15#	17-15#	17-15#	17-15#	17-15#	17-16	17-16	17-16	17-16
	17-16	17-16	17-16	17-16	17-16	17-16	17-16	17-16#	17-16#	17-16#	17-16#	17-16#	17-16#	17-16#
	17-16#	17-16#	17-16#	17-16#	17-18	17-18	17-18	17-18	17-18	17-18#	17-18#	17-18#	17-18#	17-19
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	17-23#	17-23#	17-23#	17-24	17-24	17-24	17-24	17-24	17-24	17-24	17-24#	17-24#	17-24#	17-24#
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	17-33	17-33	17-33	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-33#	17-35
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	17-39	17-39	17-39#	17-39#	17-39#	17-39#	17-39#	17-41	17-41	17-41	17-41	17-41	17-41#	17-41#
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	24-126	24-126	24-126	24-126	24-126#	24-126#	24-126#	24-126#	24-126#	24-126#	24-133	24-133#	24-135	24-135
	24-135	24-135	24-135	24-135	24-135#	24-135#	24-135#	24-135#	24-135#	24-135#	24-155	24-155	24-155	24-155
	24-155	24-155	24-155#	24-155#	24-155#	24-155#	24-155#	24-155#	24-168	24-168#	24-170	24-170	24-170	24-170
	24-170	24-170	24-170#	24-170#	24-170#	24-170#	24-170#	24-170#	25-27	25-27	25-27	25-27	25-27#	25-27#
	25-27#	25-27#	25-27#	25-32	25-32	25-32	25-32	25-32#	25-32#	25-32#	25-32#	25-32#	25-39	25-39
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	25-63#	25-68	25-68	25-68	25-68	25-68#	25-68#	25-68#	25-68#	25-68#	25-73	25-73	25-73	25-73
	25-73#	25-73#	25-73#	25-73#	25-73#	25-84	25-84	25-84	25-84	25-84#	25-84#	25-84#	25-84#	25-84#
	25-89	25-89	25-89	25-89	25-89#	25-89#	25-89#	25-89#	25-89#	25-92	25-92	25-92	25-92	25-92#
	25-92#	25-92#	25-92#	25-92#	25-95	25-95	25-95	25-95	25-95#	25-95#	25-95#	25-95#	25-95#	25-100
	25-100	25-100	25-100	25-100#	25-100#	25-100#	25-100#	25-100#	25-105	25-105	25-105	25-105	25-105#	25-105#
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	25-132	25-132#	25-132#	25-132#	25-132#	25-132#	25-137	25-137	25-137	25-137	25-137#	25-137#	25-137#	25-137#
	25-137#	25-144	25-144	25-144	25-144	25-144#	25-144#	25-144#	25-144#	25-144#	25-147	25-147	25-147	25-147
	25-147#	25-147#	25-147#	25-147#	25-147#	25-152	25-152	25-152	25-152	25-152#	25-152#	25-152#	25-152#	25-152#

25-157	25-157	25-157	25-157	25-157#	25-157#	25-157#	25-157#	25-157#	25-162	25-162	25-162	25-162	25-162#
25-162#	25-162#	25-162#	25-162#	25-167	25-167	25-167	25-167	25-167#	25-167#	25-167#	25-167#	25-167#	25-200
25-200	25-200	25-200	25-200#	25-200#	25-200#	25-200#	25-200#	28-19	28-19	28-19	28-19	28-19#	28-19#
28-19#	28-19#	28-19#	28-23	28-23	28-23	28-23	28-23#	28-23#	28-23#	28-23#	28-23#	28-27	28-27
28-27	28-27	28-27#	28-27#	28-27#	28-27#	28-27#	28-31	28-31	28-31	28-31	28-31#	28-31#	28-31#
28-31#	28-31#	28-35	28-35	28-35	28-35	28-35#	28-35#	28-35#	28-35#	28-35#	28-45	28-45#	29-22
29-22	29-22	29-22	29-22#	29-22#	29-22#	29-22#	29-22#	30-36	30-36#	30-165	30-165	30-165	30-165
30-165	30-165#	30-165#	30-165#	30-165#	30-168	30-168	30-168	30-168	30-168	30-168	30-168#	30-168#	30-168#
30-168#	30-168#	30-171	30-171	30-171	30-171	30-171	30-171	30-171#	30-171#	30-171#	30-171#	30-171#	30-173
30-173	30-173	30-173	30-173	30-173#	30-173#	30-173#	30-173#	31-29	31-29	31-29	31-29	31-29	31-29#
31-29#	31-29#	31-29#	31-32	31-32	31-32	31-32	31-32	31-32#	31-32#	31-32#	31-32#	31-34	31-34
31-34	31-34	31-34	31-34	31-34#	31-34#	31-34#	31-34#	31-34#	31-39	31-39	31-39	31-39	31-39
31-39	31-39	31-39#	31-39#	31-39#	31-39#	31-39#	31-39#	31-40	31-40	31-40	31-40	31-40	31-40
31-40#	31-40#	31-40#	31-40#	31-40#	31-45	31-45	31-45	31-45	31-45	31-45	31-45	31-45#	31-45#
31-45#	31-45#	31-45#	31-45#	31-46	31-46	31-46	31-46	31-46	31-46#	31-46#	31-46#	31-46#	31-55
31-55	31-55	31-55	31-55	31-55	31-55#	31-55#	31-55#	31-55#	31-55#	31-62	31-62	31-62	31-62
31-62	31-62	31-62#	31-62#	31-62#	31-62#	31-62#	31-64	31-64	31-64	31-64	31-64	31-64	31-64#
31-64#	31-64#	31-64#	31-64#	31-66	31-66	31-66	31-66	31-66	31-66	31-66#	31-66#	31-66#	31-66#
31-66#	34-18	34-18	34-18#	34-1?	34-20	34-20	34-20#	34-20#	34-36	34-36	34-36	34-36	34-36
34-36	34-36#	34-36#	34-36#	34-36#	34-36#	34-36#	34-45	34-45	34-45#	34-45#	34-145	34-145	34-145#
34-145#	34-147	34-147	34-147#	34-147#	34-199	34-199	34-199#	34-199#	34-209	34-209	34-209#	34-209#	34-254
34-254	34-254#	34-254#	36-15	36-15#	40-61	40-61	40-61#	40-61#	40-76	40-76#	42-10	42-10#	42-16
42-16	42-16#	42-16#	42-18	42-18#	42-20	42-20	42-20#	42-20#	42-22	42-22#	42-25	42-25	42-25#
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42-39	42-39#	42-39#	42-39#	42-40	42-40#	42-71	42-71	42-71	42-71	42-71	42-71	42-71#	42-71#
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42-77	42-77	42-77	42-77#	42-77#	42-77#	42-77#	42-77#	42-85	42-85	42-85	42-85	42-85	42-85#
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42-101	42-101#	42-101#	42-102	42-102#	42-103	42-103	42-103#	42-103#	42-114	42-114	42-114	42-114	42-114
42-114	42-114#	42-114#	42-114#	42-114#	42-114#	42-127	42-127	42-127	42-127	42-127	42-127	42-127#	42-127#
42-127#	42-127#	42-127#	42-132	42-132	42-132	42-132	42-132	42-132#	42-132#	42-132#	42-132#	42-165	42-165
42-165#	42-165#	42-180	42-180#	43-17	43-17#	44-10	44-10	44-10#	44-10#	44-18	44-18	44-18#	44-18#
44-21	44-21	44-21#	44-21#	44-23	44-23	44-23#	44-23#	44-24	44-24	44-24#	44-24#	44-26	44-26#
45-18	45-18	45-18#	45-18#	45-33	45-33#	46-19	46-19	46-19#	46-19#	46-34	46-34#	48-62	48-62#
48-67	48-67#	48-68	48-68#	49-18	49-18#	49-20	49-20#	49-25	49-25#	49-27	49-27#	49-31	49-31#
50-46	50-46#	50-48	50-48#	50-49	50-49#	50-64	50-64#	50-71	50-71#	51-41	51-41#	51-43	51-43#
51-44	51-44#	51-60	51-60#	51-67	51-67#	52-27	52-27#	52-29	52-29#	52-30	52-30#	52-32	52-32#
52-42	52-42#	52-44	52-44#	52-45	52-45#	52-47	52-47#	52-57	52-57#	52-59	52-59#	52-60	52-60#
52-62	52-62#	52-67	52-67#	53-15	53-15#	53-17	53-17#	53-18	53-18#	53-20	53-20#	53-25	53-25#
54-26	54-26	54-26#	54-26#	54-37	54-37	54-37	54-37	54-37	54-37	54-37#	54-37#	54-37#	54-37#
54-37#	54-37#	54-39	54-39	54-39	54-39	54-39	54-39	54-39#	54-39#	54-39#	54-39#	54-39#	54-39#
54-44	54-44#	54-57	54-57#	54-60	54-60	54-60	54-60	54-60	54-60#	54-60#	54-60#	54-60#	54-61
54-61	54-61	54-61	54-61	54-61#	54-61#	54-61#	54-61#	54-73	54-73	54-73	54-73	54-73	54-73#
54-73#	54-73#	54-73#	54-74	54-74	54-74	54-74	54-74	54-74#	54-74#	54-74#	54-74#	54-76	54-76#
54-89	54-89#	54-110	54-110	54-110#	54-110#	54-112	54-112	54-112	54-112	54-112#	54-112#	54-112#	54-112#
54-112#	54-119	54-119	54-119	54-119	54-119	54-119	54-119#	54-119#	54-119#	54-119#	54-119#	54-119#	54-120
54-120#	55-15	55-15	55-15#	55-15#	55-18	55-18	55-18#	55-18#	55-25	55-25#	55-27	55-27#	55-32
55-32	55-32	55-32	55-32	55-32	55-32#	55-32#	55-32#	55-32#	55-32#	55-32#	55-34	55-34	55-34
55-34	55-34	55-34	55-34#	55-34#	55-34#	55-34#	55-34#	55-34#	55-41	55-41#	55-55	55-55#	55-69
55-69#	55-83	55-83#	55-86	55-86	55-86	55-86	55-86	55-86#	55-86#	55-86#	55-86#	55-100	55-100
55-100#	55-100#	55-102	55-102	55-102	55-102	55-102#	55-102#	55-102#	55-102#	55-102#	55-109	55-109	55-109
55-109	55-109	55-109	55-109#	55-109#	55-109#	55-109#	55-109#	55-109#	55-110	55-110#	56-18	56-18	56-18#
56-18#	56-21	56-21	56-21#	56-21#	56-27	56-27	56-27	56-27	56-27	56-27#	56-27#	56-27#	56-27#
56-27#	56-27#	56-27#	56-29	56-29	56-29	56-29	56-29	56-29	56-29#	56-29#	56-29#	56-29#	56-29#

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56-29#	56-34	56-34#	56-46	56-46#	56-52	56-52#	56-66	56-66#	56-69	56-69	56-69	56-69	56-69
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56-83#	56-83#	56-83#	56-83#	56-83#	56-83#	56-84	56-84	56-84	56-84	56-84#	56-84#	56-84#	56-84#
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56-92#	57-17	57-17	57-17#	57-17#	57-20	57-20	57-20#	57-20#	57-26	57-26	57-26	57-26	57-26
57-26	57-26#	57-26#	57-26#	57-26#	57-26#	57-26#	57-28	57-28	57-28	57-28	57-28	57-28	57-28#
57-28#	57-28#	57-28#	57-28#	57-28#	57-29	57-29#	57-43	57-43#	57-49	57-49#	57-63	57-63#	57-66
57-66	57-66	57-66	57-66	57-66#	57-66#	57-66#	57-66#	57-77	57-77	57-77#	57-77#	57-79	57-79
57-79	57-79	57-79#	57-79#	57-79#	57-79#	57-79#	57-86	57-86	57-86	57-86	57-86	57-86	57-86#
57-86#	57-86#	57-86#	57-86#	57-86#	57-87	57-87#	58-32	58-32#	58-44	58-44#	58-52	58-52#	59-20
59-20#	59-24	59-24	59-24	59-24	59-24#	59-24#	59-24#	59-24#	59-24#	59-24#	59-25	59-25#	59-31
59-35	59-35	59-35	59-35	59-35#	59-35#	59-35#	59-35#	59-35#	59-35#	59-36	59-36#	59-45	59-45#
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        59-45    59-45#   60-25    60-25#   60-34    60-34#   60-38    60-38#   61-32    61-32#   61-93    61-93#   61-135   61-135#
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        25-147#  25-152#  25-157#  25-162#  25-167#  25-200#  28-19#   28-23#   28-27#   28-31#   28-35#   28-45#   29-22#   30-34
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	63-42#	63-42#	63-47#	63-63	63-63	63-63	63-63#	63-63#	63-63#	63-66#	63-67	63-67	63-67	63-67#
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	65-70	65-70	65-70	65-70#	65-70#	65-70#	65-75#	65-78#	65-86#	65-88#	65-125	65-125	65-125	65-125#
	65-125#	65-125#	65-149#	65-152#	65-153#	65-174#	65-175#	65-177	65-177	65-177	65-177#	65-177#	65-177#	65-191#
	65-194#	65-199#	65-201	65-201	65-201	65-201#	65-201#	65-201#	65-201#	65-203#	65-207#	65-212#	65-214#	65-222#
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	55-110	55-110#	56-46	56-46#	56-66	56-66#	56-92	56-92#	57-43	57-43#	57-63	57-63#	57-87	57-87#
	58-44	58-44#	58-52	58-52#	59-25	59-25#	59-36	59-36#	59-45	59-45#	60-25	60-25#	60-34	60-34#
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	17-45	17-45#	17-47	17-47#	30-165	30-165#	30-168	30-168#	30-171	30-171#	30-173	30-173#	31-29	31-29#
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	42-127#	42-132	42-132#	42-165	42-165#	42-180	42-180#	43-17	43-17#	44-10	44-10#	44-18	44-18#	44-21
	44-21#	44-23	44-23#	44-24	44-24#	44-26	44-26#	45-18#	45-33	45-33#	46-19#	46-34	46-34#	48-62
	48-62#	48-67	48-67#	48-68	48-68#	49-18	49-18#	49-20	49-20#	49-25	49-25#	49-27	49-27#	49-31
	49-31#	50-46	50-46#	50-48	50-48#	50-49	50-49#	50-64	50-64#	50-71	50-71#	51-41	51-41#	51-43
	51-43#	51-44	51-44#	51-60	51-60#	51-67	51-67#	52-27	52-27#	52-29	52-29#	52-30	52-30#	52-32
	52-32#	52-42	52-42#	52-44	52-44#	52-45	52-45#	52-47	52-47#	52-57	52-57#	52-59	52-59#	52-60
	52-60#	52-62	52-62#	52-67	52-67#	53-15	53-15#	53-17	53-17#	53-18	53-18#	53-20	53-20#	53-25
	53-25#	54-26	54-26#	54-37	54-37#	54-39	54-39#	54-44	54-44#	54-57	54-57#	54-60	54-60#	54-61
	54-61#	54-73	54-73#	54-74	54-74#	54-76	54-76#	54-89	54-89#	54-110	54-110#	54-112	54-119	54-119#
	54-120	54-120#	55-15	55-15#	55-18	55-18#	55-25	55-25#	55-27	55-27#	55-32	55-32#	55-34	55-34#
	55-41	55-41#	55-55	55-55#	55-69	55-69#	55-83	55-83#	55-86	55-86#	55-100	55-100#	55-102	55-109
	55-109#	55-110	55-110#	56-18	56-18#	56-21	56-21#	56-27	56-27#	56-29	56-29#	56-34	56-34#	56-46
	56-46#	56-52	56-52#	56-66	56-66#	56-69	56-69#	56-80	56-80#	56-83	56-83#	56-84	56-91	56-91#
	56-92	56-92#	57-17	57-17#	57-20	57-20#	57-26	57-26#	57-28	57-28#	57-29	57-29#	57-43	57-43#
	57-49	57-49#	57-63	57-63#	57-66	57-66#	57-77	57-77#	57-79	57-86	57-86#	57-87	57-87#	58-32
	58-32#	58-44	58-44#	58-52	58-52#	59-20	59-20#	59-24	59-25	59-25#	59-31	59-31#	59-35	59-36
	59-36#	59-45	59-45#	60-19	60-19#	60-24	60-25	60-25#	60-28	60-28#	60-33	60-34	60-34#	60-35
	60-35#	60-38	60-38#	61-30	61-30#	61-32	61-32#	61-35	61-35#	61-44	61-44#	61-46	61-46#	61-69
	61-69#	61-93	61-93#	61-96	61-96#	61-97	61-97#	61-118	61-118#	61-119	61-119#	61-121	61-121#	61-135
	61-135#	61-138	61-138#	61-148	61-148#	61-150	61-157	61-159	61-165	61-165#	61-166	61-166#	62-33	62-34
	62-34#	62-37	62-37#	62-39	62-39#	62-42	62-42#	62-45	62-45#	62-56	62-56#	62-58	62-58#	62-63
	62-63#	63-38	63-38#	63-41	63-41#	63-42	63-42#	63-47	63-47#	63-63	63-63#	63-66	63-66#	63-67
	63-67#	63-72	63-72#	63-85	63-85#	64-31	64-31#	64-33	64-33#	64-52	64-52#	64-60	64-60#	64-83
	64-83#	65-35	65-35#	65-37	65-37#	65-70	65-70#	65-75	65-75#	65-78	65-78#	65-86	65-86#	65-88
	65-88#	65-125	65-125#	65-149	65-149#	65-152	65-152#	65-153	65-153#	65-174	65-174#	65-175	65-175#	65-177
	65-177#	65-191	65-191#	65-194	65-194#	65-199	65-199#	65-201	65-201#	65-203	65-203#	65-207	65-207#	65-212
	65-212#	65-214	65-222	65-224	65-230	65-230#	65-252	65-252#						
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	17-26#	17-27#	17-30#	17-31#	17-32#	17-33#	17-35#	17-36#	17-39#	17-41#	17-42#	17-45#	17-47#	17-48#
	24-16#	24-35#	24-84#	24-94#	24-126#	24-135#	24-155#	24-170#	25-27#	25-32#	25-39#	25-44#	25-49#	25-58#
	25-63#	25-68#	25-73#	25-84#	25-89#	25-92#	25-95#	25-100#	25-105#	25-110#	25-115#	25-120#	25-125#	25-132#
	25-137#	25-144#	25-147#	25-152#	25-157#	25-162#	25-167#	25-200#	28-19#	28-23#	28-27#	28-31#	28-35#	28-45#
	29-22#	30-165#	30-168#	30-171#	30-173#	31-29#	31-32#	31-34#	31-39#	31-40#	31-45#	31-46#	31-55#	31-62#
	31-64#	31-66#	34-18#	34-20#	34-36#	34-45#	34-145#	34-147#	34-199#	34-209#	34-254#	40-76#	42-10#	42-16#
	42-20#	42-25#	42-29#	42-39#	42-71#	42-73#	42-75#	42-77#	42-85#	42-89#	42-91#	42-98#	42-100#	42-101#
	42-102#	42-103#	42-114#	42-127#	42-132#	42-165#	42-180#	43-17#	44-10#	44-18#	44-21#	44-23#	44-24#	44-26#
	45-33#	46-34#	48-62#	48-67#	48-68#	49-18#	49-20#	49-25#	49-27#	49-31#	50-46#	50-48#	50-49#	50-64#
	50-71#	51-41#	51-43#	51-44#	51-60#	51-67#	52-27#	52-29#	52-30#	52-32#	52-42#	52-44#	52-45#	52-47#
	52-57#	52-59#	52-60#	52-62#	52-67#	53-15#	53-17#	53-18#	53-20#	53-25#	54-26#	54-37#	54-39#	54-44#
	54-57#	54-60#	54-61#	54-73#	54-74#	54-76#	54-89#	54-110#	54-112#	54-119#	54-120#	55-15#	55-18#	55-25#
	55-27#	55-32#	55-34#	55-41#	55-55#	55-69#	55-83#	55-86#	55-100#	55-102#	55-109#	55-110#	56-18#	56-21#
	56-27#	56-29#	56-34#	56-46#	56-52#	56-66#	56-69#	56-80#	56-83#	56-84#	56-91#	56-92#	57-17#	57-20#
	57-26#	57-28#	57-29#	57-43#	57-49#	57-63#	57-66#	57-77#	57-79#	57-86#	57-87#	58-32#	58-44#	58-52#
	59-20#	59-24#	59-25#	59-31#	59-35#	59-36#	59-45#	60-19#	60-24#	60-25#	60-28#	60-33#	60-34#	60-35#
	60-38#	61-30#	61-32#	61-35#	61-44#	61-46#	61-69#	61-93#	61-96#	61-97#	61-118#	61-119#	61-121#	61-135#
	61-138#	61-148#	61-150#	61-157#	61-159#	61-165#	61-166#	62-33#	62-34#	62-37#	62-39#	62-42#	62-45#	62-56#
	62-58#	62-63#	63-38#	63-41#	63-42#	63-47#	63-63#	63-66#	63-67#	63-72#	63-85#	64-31#	64-33#	64-52#
	64-60#	64-83#	65-35#	65-37#	65-70#	65-75#	65-78#	65-86#	65-88#	65-125#	65-149#	65-152#	65-153#	65-174#
	65-175#	65-177#	65-191#	65-194#	65-199#	65-201#	65-203#	65-207#	65-212#	65-214#	65-222#	65-224#	65-230#	65-252#
MSTSTL	1-C21#	7-278#	17-4	17-4#	17-5	17-5#	17-6	17-6#	17-10	17-10#	17-12	17-12#	17-13	17-13#
	17-15	17-15#	17-16	17-16#	17-18	17-18#	17-19	17-19#	17-23	17-23#	17-24	17-24#	17-26	17-26#
	17-27	17-27#	17-30	17-30#	17-31	17-31#	17-32	17-32#	17-33	17-33#	17-35	17-35#	17-36	17-36#
	17-39	17-39#	17-41	17-41#	17-42	17-42#	17-45	17-45#	17-47	17-47#	17-48	17-48#	24-16	24-16#
	24-35	24-35#	24-84	24-84#	24-94	24-94#	24-126	24-126#	24-135	24-135#	24-155	24-155#	24-170	24-170#

PARAMETER CODING MACRO V04.00 1-JAN-83 11:06:45 PAGE M-13 SEQ 0205
CROSS REFERENCE TABLE (CREF V04.00)

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	25-49#	25-58	25-58#	25-58#	25-63	25-63#	25-63#	25-68	25-68#	25-68#	25-73	25-73#	25-73#	25-84
	25-84#	25-84#	25-89	25-89#	25-89#	25-92	25-92#	25-92#	25-95	25-95#	25-95#	25-100	25-100#	25-100#
	25-105	25-105#	25-105#	25-110	25-110#	25-110#	25-115	25-115#	25-115#	25-120	25-120#	25-120#	25-125	25-125#
	25-125#	25-132	25-132#	25-132#	25-137	25-137#	25-137#	25-144	25-144#	25-144#	25-147	25-147#	25-147#	25-152
	25-152#	25-152#	25-157	25-157#	25-157#	25-162	25-162#	25-162#	25-167	25-167#	25-167#	25-200	25-200#	25-200#
	28-19	28-19#	28-19#	28-23	28-23#	28-23#	28-27	28-27#	28-27#	28-31	28-31#	28-31#	28-35	28-35#
	28-35#	28-45	28-45#	29-22	29-22#	29-22#	30-165	30-165#	30-168	30-168#	30-171	30-171#	30-173	30-173#
	31-29	31-29#	31-32	31-32#	31-34	31-34#	31-39	31-39#	31-40	31-40#	31-45	31-45#	31-46	31-46#
	31-55	31-55#	31-62	31-62#	31-64	31-64#	31-66	31-66#	34-18	34-18#	34-20	34-20#	34-36	34-36#
	34-45	34-45#	34-145	34-145#	34-147	34-147#	34-199	34-199#	34-209	34-209#	34-254	34-254#	40-76	40-76#
	42-10	42-10#	42-16	42-16#	42-20	42-20#	42-25	42-25#	42-29	42-29#	42-39	42-39#	42-71	42-71#
	42-73	42-73#	42-75	42-75#	42-77	42-77#	42-85	42-85#	42-89	42-89#	42-91	42-91#	42-98	42-98#
	42-100	42-100#	42-101	42-101#	42-102	42-102#	42-103	42-103#	42-114	42-114#	42-127	42-127#	42-132	42-132#
	42-165	42-165#	42-180	42-180#	43-17	43-17#	44-10	44-10#	44-18	44-18#	44-21	44-21#	44-23	44-23#
	44-24	44-24#	44-26	44-26#	45-33	45-33#	46-34	46-34#	48-62	48-62#	48-67	48-67#	48-68	48-68#
	49-18	49-18#	49-20	49-20#	49-25	49-25#	49-27	49-27#	49-31	49-31#	50-46	50-46#	50-48	50-48#
	50-49	50-49#	50-64	50-64#	50-71	50-71#	51-41	51-41#	51-43	51-43#	51-44	51-44#	51-60	51-60#
	51-67	51-67#	52-27	52-27#	52-29	52-29#	52-30	52-30#	52-32	52-32#	52-42	52-42#	52-44	52-44#
	52-45	52-45#	52-47	52-47#	52-57	52-57#	52-59	52-59#	52-60	52-60#	52-62	52-62#	52-67	52-67#
	53-15	53-15#	53-17	53-17#	53-18	53-18#	53-20	53-20#	53-25	53-25#	54-26	54-26#	54-37	54-37#
	54-39	54-39#	54-44	54-44#	54-57	54-57#	54-60	54-60#	54-	54-61#	54-73	54-73#	54-74	54-74#
	54-76	54-76#	54-89	54-89#	54-110	54-110#	54-112	54-112#	54-12#	54-119	54-119#	54-120	54-120#	55-15
	55-15#	55-18	55-18#	55-25	55-25#	55-27	55-27#	55-32	55-32#	55-34	55-34#	55-41	55-41#	55-55
	55-55#	55-69	55-69#	55-83	55-83#	55-86	55-86#	55-100	55-100#	55-102	55-102#	55-102#	55-109	55-109#
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	56-52	56-52#	56-66	56-66#	56-69	56-69#	56-80	56-80#	56-83	56-83#	56-84	56-84#	56-84#	56-91
	56-91#	56-92	56-92#	57-17	57-17#	57-20	57-20#	57-26	57-26#	57-28	57-28#	57-29	57-29#	57-43
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	57-87	57-87#	58-32	58-32#	58-44	58-44#	58-52	58-52#	59-20	59-20#	59-24	59-24#	59-24#	59-25
	59-25#	59-31	59-31#	59-35	59-35#	59-35#	59-36	59-36#	59-45	59-45#	60-19	60-19#	60-24	60-24#
	60-24#	60-25	60-25#	60-28	60-28#	60-33	60-33#	60-33#	60-34	60-34#	60-35	60-35#	60-38	60-38#
	61-30	61-30#	61-32	61-32#	61-35	61-35#	61-44	61-44#	61-46	61-46#	61-69	61-69#	61-93	61-93#
	61-96	61-96#	61-97	61-97#	61-118	61-118#	61-119	61-119#	61-121	61-121#	61-135	61-135#	61-138	61-138#
	61-148	61-148#	61-150	61-150#	61-150#	61-157	61-157#	61-157#	61-159	61-159#	61-159#	61-165	61-165#	61-166
	61-166#	62-33	62-33#	62-33#	62-34	62-34#	62-37	62-37#	62-39	62-39#	62-42	62-42#	62-45	62-45#
	62-56	62-56#	62-58	62-58#	62-63	62-63#	63-38	63-38#	63-41	63-41#	63-42	63-42#	63-47	63-47#
	63-63	63-63#	63-66	63-66#	63-67	63-67#	63-72	63-72#	63-85	63-85#	64-31	64-31#	64-33	64-33#
	64-52	64-52#	64-60	64-60#	64-83	64-83#	65-35	65-35#	65-37	65-37#	65-70	65-70#	65-75	65-75#
	65-78	65-78#	65-86	65-86#	65-88	65-88#	65-125	65-125#	65-149	65-149#	65-152	65-152#	65-153	65-153#
	65-174	65-174#	65-175	65-175#	65-177	65-177#	65-191	65-191#	65-194	65-194#	65-199	65-199#	65-201	65-201#
	65-203	65-203#	65-207	65-207#	65-212	65-212#	65-214	65-214#	65-214#	65-222	65-222#	65-222#	65-224	65-224#
	65-224#	65-230	65-230#	65-252	65-252#									
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	25-32	25-32	25-32	25-32#	25-39	25-39	25-39	25-39#	25-44	25-44	25-44	25-44#	25-49	25-49
	25-49	25-49#	25-58	25-58	25-58	25-58#	25-63	25-63	25-63	25-63#	25-68	25-68	25-68	25-68#
	25-73	25-73	25-73	25-73#	25-84	25-84	25-84	25-84#	25-89	25-89	25-89	25-89#	25-92	25-92
	25-92	25-92#	25-95	25-95	25-95	25-95#	25-100	25-100	25-100	25-100#	25-105	25-105	25-105	25-105#
	25-110	25-110	25-110	25-110#	25-115	25-115	25-115	25-115#	25-120	25-120	25-120	25-120#	25-125	25-125
	25-125	25-125#	25-132	25-132	25-132	25-132#	25-137	25-137	25-137	25-137#	25-144	25-144	25-144	25-144#
	25-147	25-147	25-147	25-147#	25-152	25-152	25-152	25-152#	25-157	25-157	25-157	25-157#	25-162	25-162
	25-162	25-162#	25-167	25-167	25-167	25-167#	25-200	25-200	25-200	25-200#	28-19	28-19	28-19	28-19#
	28-23	28-23	28-23	28-23#	28-27	28-27	28-27	28-27#	28-31	28-31	28-31	28-31#	28-35	28-35
	28-35	28-35#	29-22	29-22	29-22	29-22#	40-61	40-61#	42-91#	42-103#	42-165#	44-24#	45-18	45-18#
	46-19	46-19#	54-26#	54-112	54-112	54-112	54-112#	55-15#	55-18#	55-102	55-102	55-102	55-102#	56-18#