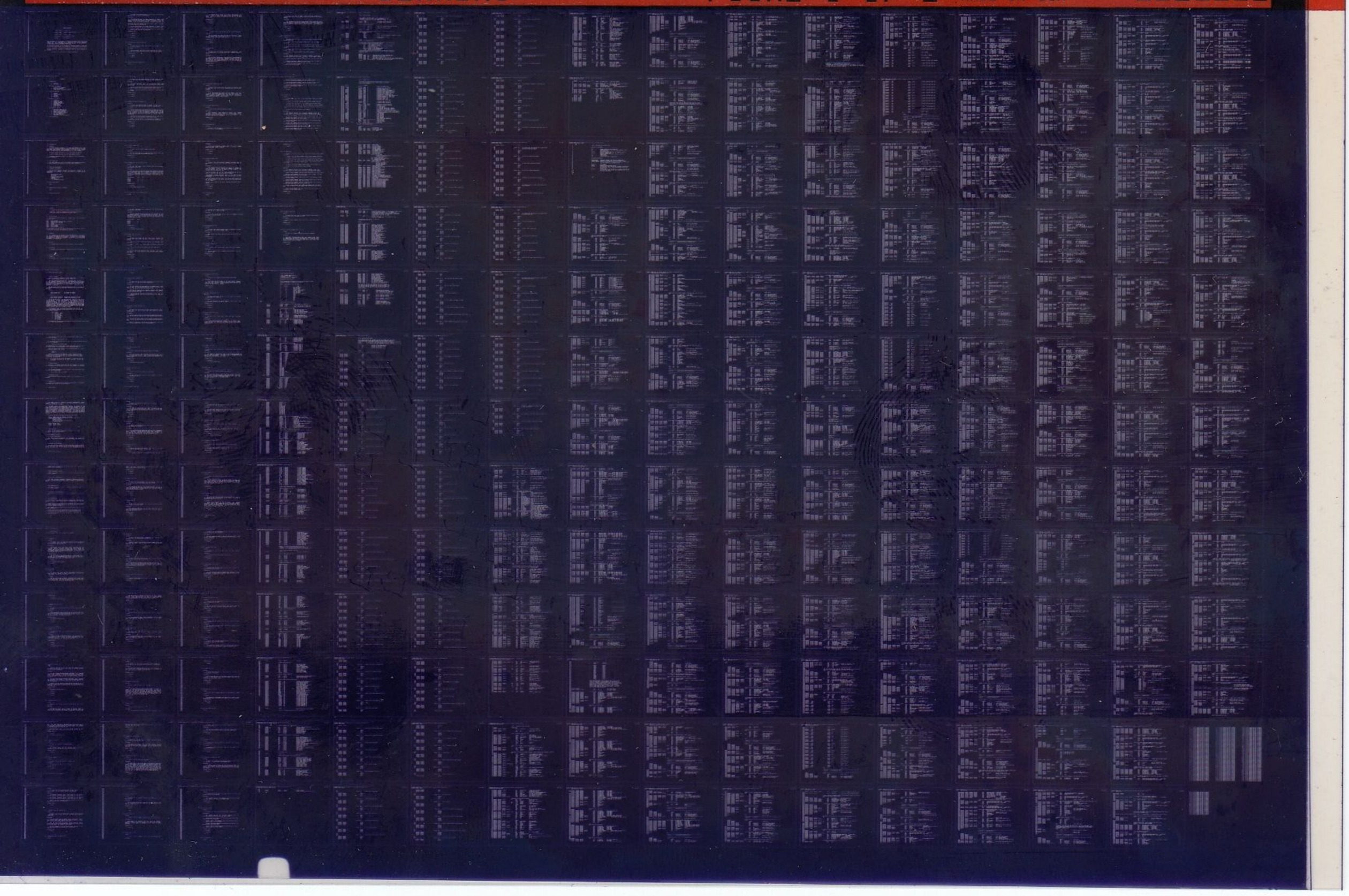
RM80

DSKLS TEST PT 1
CZRNBA0

AH-T107A-MC
FICHE 1 OF 2

JUL 1982

MADE IN USA



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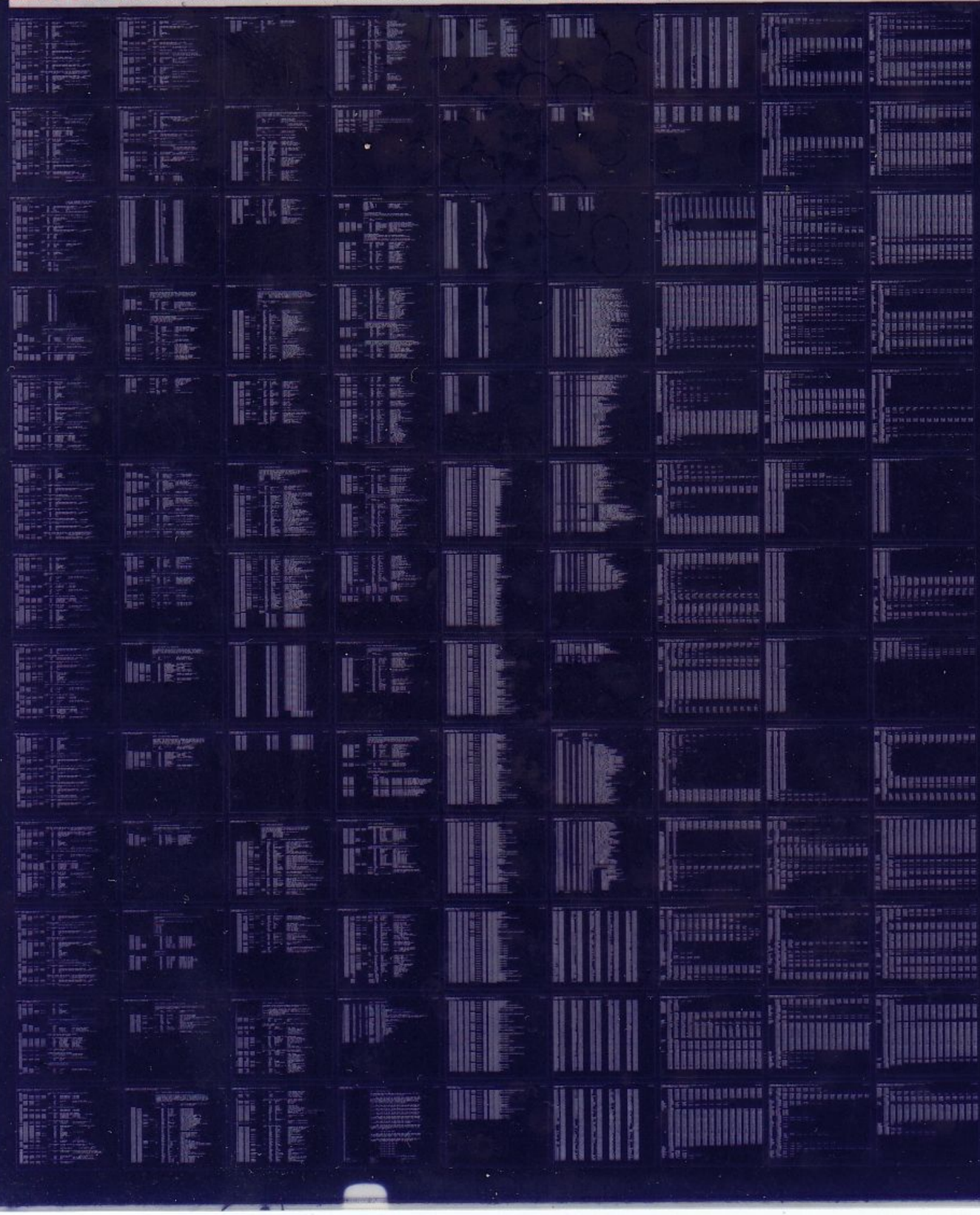
FICHE 2 OF 2



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IDENTIFICATION

PRODUCT CODE: AC-T106A-MC

PRODUCT NAME: CZRNBA0 RM80 DISKLESS TEST, PT 1

PRODUCT DATE: APRIL 1, 1982

MAINTAINER: CX DIAGNOSTIC GROUP

AUTHOR: MIKE LEAVITT

CONTENTS

1.0 INTRODUCTION

1.1 ABSTRACT

THE RM80 DISKLESS DIAGNOSTIC IS A STAND ALONE PROGRAM WHICH USES FUNCTIONAL AND DIAGNOSTIC MEANS TO VERIFY THE OPERABILITY OF THE RM80 DISK SUBSYSTEM EXCLUDING AND INDEPENDENTLY OF THE STORAGE MODULE DRIVE. IN PARTICULAR, THE PROGRAM SERVES THE FOLLOWING PURPOSES:

TO DETECT ERRORS AND FAULTS IN THE RH70 MASSBUS CONTROLLER;

TO DETECT ERRORS AND FAULTS IN THE RM80 MASSBUS ADAPTER;

TO RESOLVE HARDWARE FAILURES IN THE RM80 TO A FIELD REPLACEABLE MODULE OR MODULES.

1.2 UNIT UNDER TEST

THE UNIT UNDER TEST (UUT) IS THE RM80 DISK SUBSYSTEM, EXCLUDING THE STORAGE MODULE DISK DRIVE AND THE RH70 MASSBUS CONTROLLER.

2.0 OPERATING REQUIREMENTS

2.1 HARDWARE REQUIREMENTS

THE FOLLOWING MINIMUM HARDWARE CONFIGURATION, ASSUMED TO BE OPERATIONAL, IS REQUIRED TO LOAD AND EXECUTE THE RM80 DISKLESS DIAGNOSTIC:

PDP-11/70 PROCESSOR
20K MEMORY
KW11-L OR KW11-P CLOCK
PROGRAM LOADING DEVICE
TERMINAL
RH70 CONTROLLER
1 TO 8 RM80 DISK DRIVES

2.2 MEDIA REQUIREMENTS

NONE

2.3 PREREQUISITE DIAGNOSTIC PROGRAMS

NONE

3.0 OPERATING PROCEDURE

3.1 LOADING

THE PROGRAM MAY BE LOADED BY EITHER OF THE FOLLOWING MEDIA:

.PAPER TAPE, USING THE STANDARD PAPER TAPE LOADING PROCEDURE.
.XXDP MEDIA, USING THE APPROPRIATE LOADING DEVICE.

3.2 SWITCH OPTIONS

THE FOLLOWING SWITCH OPTIONS ARE INVOKED WHEN THE APPROPRIATE SWITCH IS ON.

SW15 HALT ON ERROR
SW14 LOOP ON TEST (CURRENTLY BEING EXECUTED)
SW13 INHIBIT ERROR TYPEOUTS
SW12 UNUSED
SW11 INHIBIT TEST ITERATIONS
SW10 BELL ON ERROR
SW09 LOOP ON ERROR
SW08 LOOP ON TEST IN SW07-00

THE LOW ORDER 8 SWITCHES ARE USED IN CONJUNCTION WITH SW08 TO SPECIFY A PARTICULAR TEST WHICH THE PROGRAM WILL LOOP ON.

3.3 STARTING

THE PROGRAM MAY BE STARTED AT LOCATION 200 OR 204. STARTING AT 200 WILL BE THE NORMAL STARTING ADDRESS. STARTING AT 204 WILL ENABLE THE RH/RM BASE ADDRESS TO BE CHANCED. IF RUNNING IN A STAND-ALONE ENVIRONMENT, THE PROGRAM USES CONSOLE DIALOGUE TO ALLOW THE OPERATOR TO CONTROL TEST CONDITIONS.

3.4 HALTING

THE PROGRAM CAN BE HALTED BY TYPING CONTROL C FROM THE CONSOLE.

3.5 RESTARTING

THE PROGRAM CAN BE RESTARTED AT ADDRESS 200 OR 204. (SEE SECTION 3.3)

4.0 OPERATOR INTERFACE

4.1 PROGRAM ID

THE PROGRAM TYPES ITS NAME AND MAINDEC NUMBER THE FIRST TIME IT

IS STARTED AFTER BEING LOADED.

4.2 CONSOLE DIALOGUE

WHEN THE PROGRAM IS RUNNING IN STAND ALONE MODE, IT ENTERS A CONSOLE DIALOGUE SEQNENCE AFTER TYPING THE PROGRAM I.D..

THE FIRST QUESTION TYPED OUT IS: 'TYPE HELP TEXT (L) N ?'. IF THE OPERATOR RESPONDS WITH A "Y", THE PROGRAM WILL TYPE A BRIEF HELP MESSAGE WHICH WILL LIST SWITCH OPTIONS, ETC. ANY OTHER RESPONSE TO THE QUESTION IS CONSIDERED A "N" AND NO HELP TEXT IS TYPED. THIS QUESTION IS ONLY ASKED ON THE INITIAL PROGRAM START AND NOT ON SUBSEQUENT START-UP'S.

ON THE PROGRAM INITIAL START AND WHEN RESTARTING AT LOCATION 204, THE OPERATOR MAY CHANGE THE RH/RM BASE ADDRESSES WITH THE FOLLOWING DIALOGUE.

EXAMPLE 1

```
RMCS1=176700 <CR>        ;NO CHANGE IN ADDRESS
RMVEC=000254 <CR>        ;NO CHANGE IN ADDRESS
```

EXAMPLE 2

```
RMCS1=176700 177200<CR> ;CHANGE BASE ADDRESS TO 177200
RMVEC=000254 260<CR>    ;CHANGE VECTOR ADDRESS TO 260
```

ON THE INITIAL START, THE NEXT QUESTION TYPED IS, 'TYPE "A" TO TEST ALL DRIVES, OR TYPE DRIVE NUMBER(S) AND TERMINATE INPUT WITH A CARRIAGE RETURN'. THEN, 'DRIVE(S):' IS TYPED AND WAITS FOR THE OPERATOR TO TYPE AN "A", TO TEST ALL POSSIBLE DRIVES OR TYPE ANY STRING OF DRIVE NUMBER(S) TO BE TESTED AND TERMINATE THE INPUT WITH A "CARRIAGE RETURN". NO COMMAS OR ANY OTHER SEPARATORS ARE NEEDED WHEN ENTERING THE DRIVE NUMBERS AS A STRING. THE PROGRAM ENTERS THE COMMA SEPARTOR AUTOMATICALLY AFTER TYPING EACH NUMBER. ON ALL SUBSEQUENT STARTS, ONLY THE 'DRIVE(S):' PROMPT IS TYPED.

THE DIAGNOSTIC THEN INITIALIZES AND REPORTS THE STATUS OF THE DRIVES WHICH WHERE PREVIOUSLY SPECIFIED FOR TESTING. THE FOLLOWING IS AN EXAMPLE PRINTOUT:

```
'UNIT STATUS:
  0    ONLINE   RM80
  1    LOAD DEVICE
  2    OFFLINE  RM80
  3    NOT PRESENT
  4    NOT PRESENT
  5    NOT AN RM80
  6    NOT PRESENT
  7    NOT PRESENT'
```

THE ABOVE UNIT STATUS SHOWS THAT DRIVE 0 & 2 WILL BE TESTED, WHILE DRIVES 1, & 3 - 7 WILL NOT BE TESTED.

THE DIAGNOSTIC THEN TYPES THE FOLLOWING MESSAGE, BASED ON THE STATUS OF THE DRIVE:

'DRIVE(S) TO BE TESTED, 0, 2'

IF NO DRIVES ARE AVAILABLE FOR TESTING, THE FOLLOWING MESSAGE WILL BE TYPED TO THE OPERATOR:

'DRIVE(S) TO BE TESTED, NONE'

THE PROGRAM WILL THEN, EITHER START TESTING THE DRIVES AVAILABLE FOR TESTING OR RETURN TO THE BEGINNING OF THE PROGRAM AND WAIT.

ONCE THE DRIVES START TESTING, THE FOLLOWING MESSAGE WILL OCCUR AS EACH DRIVE BEGINS TO BE TESTED:

'DRIVE 0
 DRIVE 2'

AFTER ALL THE DRIVES ARE COMPLETELY TESTED, THE END OF PASS MESSAGE WILL BE TYPED (SEE SECTION 4.3) AND THE PROGRAM WILL START TESTING ALL THE DRIVES AGAIN. THIS WILL CONTINUE UNTIL THE PROGRAM IS HALTED BY THE OPERATOR.

NOTE: THE LETTER LOCATED WITHIN THE BRACKETS () INDICATES THE TYPE OF RESPONSE REQUIRED BY THE USER, D=DECIMAL, O=OCTAL AND L=LETTER.

4.3 PROGRESS REPORTS

AN END OF PASS REPORT OCCURS EACH TIME THE PROGRAM IS EXECUTED FOR ALL DEVICES IN THE TEST QUE. THE END OF PASS REPORT IS AS FOLLOWS.

'END OF PASS 1'

THE FOLLOWING MESSAGE WILL ALSO OCCUR IF THERE WERE ERRORS SINCE THE LAST END OF PASS REPORT.

'TOTAL ERRORS SINCE LAST REPORT 0'

4.4 PERFORMANCE REPORT

NO PERFORMANCE REPORTS ARE GIVEN DURING THE EXECUTION OF THE PROGRAM.

4.5 PROGRAM HALTS

THERE ARE NO SCHEDULED HALTS DURING THE EXECUTION OF THE PROGRAM. PROCESSOR HALTS ARE DUE TO THE TRAP CATCHER.

4.6 ERROR REPORTS

THE RM80 DISKLESS DIAGNOSTIC PROVIDES COMPREHENSIVE ERROR REPORTS INTENDED TO (1) AID IN FAULT RESOLUTION AND (2) MINIMIZE REFERENCES TO PROGRAM LISTINGS.

THE FIRST LINE OF THE ERROR REPORT CONTAINS THE NUMBER OF THE UNIT (DRIVE) BEING TESTED, DRIVE TYPE, THE TEST NUMBER, THE ERROR NUMBER AND THE VALUE OF THE PROGRAM COUNTER WHERE THE ERROR WAS CALLED. THIS LINE IS FOLLOWED BY THE ERROR MESSAGE: SEVERAL LINES OF TEXT WHICH GIVE A COMPREHENSIVE DESCRIPTION OF THE ERROR, AND A LIST OF FAILING MODULES IN ORDER OF DECREASING PROBABILITY. THE ERROR MESSAGE IS NORMALLY FOLLOWED BY ONE OR MORE PAIRS OF LINES CONTAINING DATA HEADERS AND DATA PERTININENT TO THE ERROR, INCLUDING EXPECTED AND ACTUAL TEST RESULTS.

THE FOLLOWING PRINTOUT IS AN ERROR MESSAGE IN THIS FROGRAM:

```
DRV# 0 - RM80, TEST# 25, ERR# 66, PC=017566
ILLEGAL REGISTER ERROR "ILR" (RMER1, BIT 01) SHOULD BE SET
DURING REGISTER TRANSFER
       PROBABLE FAULT(S):
       (NOT INCLUDING CABLES OR CONNECTORS)
       IF MODULE, M7686,

EXPCTD  RECEVD  TEST
STATUS  STATUS  REGSTR
000002  000000  176750
```

4.7 EXECUTION TIME

PASS 1 OF THE PROGRAM TAKES ABOUT 20 SECONDS. PASS 2 AND SUBSEQUENT PASSES TAKE 60 SECONDS.

5.0 ENVIRONMENTAL SUPPORT

5.1 PROCESSOR COMPATIBILITY

THE RM80 DISKLESS DIAGNOSTIC IS EXECUTABLE ON A PDP-11/70 PROCESSOR, PROVIDING PREVIOUSLY MENTIONED HARDWARE REQUIREMENTS ARE MET.

5.2 DUAL PORT CONFIGURATIONS

THE RM80 DISKLESS DIAGNOSTIC IS NOT EXECUTABLE ON RM80 SUBSYSTEMS HAVING THE DUAL PORT OPTION UNLESS THE DUAL PORT SWITCH IS SET TO TO THE APPROPRIATE PORT (A OR B) AND NOT TO THE PROGRAMMABLE POSITION (A/B).

5.3 MEMORY PARITY HARDWARE

MEMORY PARITY HARDWARE WILL NOT BE USED DURING THE EXECUTION OF THE RM80 DISKLESS DIAGNGOSTIC.

5.4 MEMORY MANAGEMENT HARDWARE

MEMORY MANAGEMENT HARDWARE WILL NOT BE USED DURING THE RM80 DISKLESS DIAGNOSTIC.

5.5 ACT11, APT11 COMPATIBILITY

THE RM80 DISKLESS DIAGNOSTIC PROGRAM IS COMPATIBLE WITH ACT11 AND APT11 IN BOTH DUMP AND AUTOMATIC MODES. FURTHER, THE PROGRAM WILL EXECUTE A QUICK PASS DURING THE FIRST PASS IN SUPPORT OF QUICK VERIFY MODE.

5.6 XXDP COMPATIBILITY

THE RM80 DISKLESS DIAGNOSTIC PROGRAM IS COMPATIBLE WITH XXDP IN DUMP AND CHAIN MODES.

5.7 OPERATING SYSTEM COMPATIBILITY

THE PROGRAM IS NOT REQUIRED TO BE COMPATIBLE WITH ANY OPERATING SYSTEM.

6.0 TEST DESCRIPTION

THE PROGRAM IS DESIGNED IN A BOTTOM UP MANNER SUCH THAT EACH TEST GENERALLY USES A MORE COMPLEX SUBSET OF HARDWARE THAN THE PREVIOUS TEST.

MODULE CALLOUT IS PREDICATED ON THE ASSUMPTION THAT EARLIER TESTS HAVE BEEN COMPLETED WITHOUT ERROR AND THAT ERRORS ARE DUE TO SINGLE, NONTRANSIENT HARDWARE FAILURES.

THE "RM80 DISKLES DIAGNOSTIC" CAN BE EXECUTED USING AN RH70 MASSBUS CONTROLLER.

UNLESS SPECIFIED BY THE OPERATOR OR BY THE ENVIRONMENT TABLE THE TEST IS REPEATED FOR EACH POSSIBLE DEVICE STARTING WITH DEVICE 0.

THE MODULES WHICH MAY BE CALLED OUT DURING THE EXECUTION OF THE TEST ARE AS FOLLOWS:

IF
CS
DS

MASSBUS MODULE

THE RADIAL MODULE (RD) IS NOT TESTED BY THIS PROGRAM.

TEST 1 TRANSFER TEST

PURPOSE:

TO VERIFY THAT THE RM80 CAN COMPLETE A REGISTER TRANSFER ON THE MASSBUS, AND, IN PARTICULAR, TO VERIFY THAT "TRANSFER" IS NOT STUCK IN AN INACTIVE STATE.

PROCEDURE:

THE PROGRAM WRITES AND READS REMOTE REGISTERS FOR THE SELECTED DEVICE. REGISTER CONTENTS AND PARITY ERRORS ARE IGNORED, AND THE TEST FAILS IF A "NONEXISTENT DEVICE ERROR" OR BUS TIMEOUT OCCURRS FOR EVERY REGISTER ACCESS. IF THE TEST FAILS THE PROGRAM JUMPS TO THE END OF PASS HANDLER WHICH SELECTS THE NEXT DEVICE TO BE TESTED.

PROBABLE FAULT:

THE TEST FAILS IF THE SELECTED DEVICE IS NONEXISTENT OR IS SWITCHED TO THE PROGRAMMABLE POSITION OR TO THE ALTERNATE PORT. THE FOLLOWING FAULTS ARE APPLICABLE ONLY WHEN THE DEVICE IS PRESENT AND IS SWITCHED TO THE APPROPRIATE PORT.

1. IF MODULE

2. ASYNCHRONOUS MASSBUS MODULE

3. CS MODULE

TEST 2 CTOD TEST

PURPOSE:

TO VERIFY THAT DATA CAN BE TRANSFERRED TO AND FROM THE RM80 USING THE CONTROL BUS AND, IN PARTICULAR, TO VERIFY THAT "CONTROLLER TO DEVICE" HAS NOT FAILED.

PROCEDURE:

THE TEST WRITES ONES IN REMOTE REGISTERS THEN READS EACH REGISTER WHICH WILL WRITE ZEROS IN THE REGISTER IF "IF3 CTOD HOLD H" IS STUCK AT ONE. THE TEST THEN READS AS MANY REMOTE REGISTERS AS ARE NECESSARY TO OBTAIN ONE OR MORE ONE BITS.

```
400                                     PROBABLE FAULT:
401
402                                     1.  IF MODULE
403
404                                     2.  ASYNCHRONOUS MASSBUS MODULE
405
406
407
408
409
410                             TEST 3  MASSBUS INITIALIZE TEST
411
412                                     PURPOSE:
413
414                                         TO VERIFY THAT THE MASSBUS ADAPTER IS BEING  INITIALIZED  BY
415                                     THE MASS BUS.
416
417                                     PROCEDURE:
418
419                                         USING CONTROLLER CLEAR TO INITIALIZE THE SELECTED UNIT, THIS
420                                     TEST THEN READS MASSBUS ADAPTER REGISTERS TO VERIFY THAT AT LEAST
421                                     ONE BIT IS CLEARED.  MASSBUS ADAPTER REGISTERS ARE  PRESET  TO  A
422                                     NON ZERO VALUE PRIOR TO CONTROLLER CLEAR.
423
424                                     PROBABLE FAULT:
425
426                                     1.  ASYNCHRONOUS MASSBUS MODULE
427
428                                     2.  IF MODULE
429
430                                     3.  CS MODULE
431
432
433
434
435
436                             TEST 4  CLEAR STUCK ACTIVE TEST
437
438                                     PURPOSE:
439
440                                         TO VERIFY THAT 'MBA CLR L'' ON THE CS MODULE IS NOT STUCK  IN
441                                     AN ACTIVE STATE.
442
443                                     PROCEDURE:
444
445                                         CONTROLLER CLEAR IS USED TO INITIALIZE  THE  SELECTED  UNIT,
446                                     AFTER  WHICH  1'S  ARE  WRITTEN  IN  ERROR  REGISTERS 1 AND 2 AND
447                                     MAINTENANCE REGISTER 1.  IF ANY 1 BITS CAN BE READ BACK THE  TEST
448                                     IS OK, ELSE, 'MBA CLR L'' IS PROBABLY STUCK ACTIVE.
449
450                                     PROBABLE FAULT:
451
452                                     1.  CS MODULE
453
454                                     2.  IF MODULE
455
456                                     3.  ASYNCHRONOUS MASSBUS MODULE
```

TEST 5 TRISTATE TRANSFER TEST

PURPOSE:

TO VERIFY THAT THE PATH TO AND FROM THE MASSBUS ADAPTER TRI-STATE REGISTER BUS IS NOT STUCK AT ONE OR ZERO AND THAT EACH BIT POSITION IS INDEPENDENT.

PROCEDURE:

THIS TEST PRESETS MASSBUS ADAPTER REGISTERS TO A NONZERO VALUE, THEN, ASSUMING THE REGISTERS ARE PRESET, IT CLEARS THEM USING A MOVE INSTRUCTION. THE TEST THEN READS AS MANY REGISTERS AS IS NECESSARY TO OBTAIN ONE OR MORE ZEROS FROM EACH BIT POSITION.

THE TEST CLEARS MASSBUS ADAPTER REGISTERS, THEN, ASSUMING THE REGISTERS ARE CLEARED, IT LOADS THEM WITH ONES AND READS AS MANY REGISTERS AS IS NECESSARY TO OBTAIN ONE OR MORE ONE BITS IN EACH BIT POSITION.

FINALLY, THE TEST WRITES A SINGLE ONE BIT PATTERN IN BIT 0 OF SELECTED REMOTE REGISTERS AND VERIFIES THAT THE PATTERN CAN BE READ BACK. THE ONE BIT IS SHIFTED AND THE TEST REPEATED FOR ALL BIT POSITIONS.

PROBABLE FAULT:

1. ASYNCHRONOUS MASSBUS MODULE
2. IF MODULE
3. CS MODULE
4. DS MODULE

TEST 6 REGISTER SELECT TEST

PURPOSE:

TO VERIFY THAT THE REGISTER SELECT LINES ARE NOT IN A STUCK POSITION.

PROCEDURE:

EACH REGISTER SELECT LINE IS TESTED BY WRITING ZEROS IN THOSE DEVICE REGISTERS FOR WHICH THE LINE MUST BE ZERO, THEN WRITING ONES IN THOSE DEVICE REGISTERS FOR WHICH THE LINE MUST BE

ONE. THE ZERO REGISTER IS READ BACK AND IF THE SELECT LINE IS STUCK AT ZERO, THE ZERO REGISTER WILL CONTAIN ONES. THE PROCESS IS REPEATED TO DETECT A STUCK AT ONE FAULT, EXCEPT IN THIS CASE, THE ONES REGISTER IS WRITTEN FIRST.

REGISTER SELECT LINES 1, 2, 4 AND 8 ARE TESTED IN THIS MANNER; SELECT LINE 16 IS EXPLICITLY TESTED IN THE "ILR TEST".

PROBABLE FAULT:

1. IF MODULE

2. ASYNCHRONOUS MASSBUS MODULE

TEST 7 DRIVE TYPE TEST

PURPOSE:

TO TEST THE "DRIVE TYPE" REGISTER, RMDT.

PROCEDURE:

THE PROGRAM READS RMDT AND VERIFIES THAT THE RESULT CORRESPONDS TO A SINGLE PORT OR DUAL PORT RM80 DRIVE.

PROBABLE FAULT:

1. IF MODULE

TEST 10 DEVICE AVAILABLE TEST

PURPOSE:

TO VERIFY THAT DEVICE AVAILABLE STATUS IS SET.

PROCEDURE:

THE PROGRAM TESTS "DVA", BIT 11 OF RMCS1.

PROBABLE FAULT:

1. IF MODULE

TEST 11 HOLDING REGISTER TRANSFER TEST

PURPOSE:

TO VERIFY THAT THE HOLDING REGISTER IS NOT STUCK AT ONE, STUCK AT ZERO, AND THAT THERE IS NO BIT INTERFERENCE.

PROCEDURE:

THE PROGRAM TRANSFERS ONES, THEN ZEROS TO THE HOLDING REGISTER AND VERIFIES THAT NONE OF THE BITS ARE STUCK AT ONE.

THE PROGRAM TRANSFERS ZEROS, THEN ONES TO THE HOLDING REGISTER AND VERIFIES THAT NONE OF THE BITS ARE STUCK AT ZERO.

FINALLY, THE TEST TRANSFERS A SHIFTING ONE BIT PATTERN AND VERIFIES THAT EACH BIT IS INDEPENDENT.

PROBABLE FAULT:

1. IF MODULE

TEST 12 CONTROL STATUS #1 TRANSFER TEST

PURPOSE:

TO VERIFY THAT BITS 01 THROUGH 05 OF CONTROL STATUS REGISTER 1 ARE NOT STUCK AT ONE OR ZERO, AND THAT THERE IS NOT BIT INTERFERENCE.

PROCEDURE:

THIS TEST WRITES ONES IN CONTROL STATUS REGISTER 1, RMCS1, THEN WRITES ZEROS AND VERIFIES THAT THE BITS ARE NOT STUCK AT ONE. THE GO BIT IS NOT TESTED IN THIS TEST.

NEXT, THE TEST CLEARS THE CONTROL STATUS REGISTER, RMCS1, WRITES ONES IN BITS 01 THROUGH 05 AND VERIFIES THAT THE BITS ARE NOT STUCK AT ZERO. THE GO BIT IS NOT TESTED.

THE TEST TRANSFERS A SHIFTING ONE BIT DATA PATTERN TO AND FROM RMCS1 AND CHECKS FOR ADJACENT BIT INTERFERENCE.

PROBABLE FAULT:

1. IF MODULE

TEST 13 ERROR REGISTER #1 TRANSFER TEST

PURPOSE:

TO VERIFY THAT ERROR REGISTER 1 IS NOT STUCK AT ONE OR ZERO, AND THAT THERE IS NOT BIT INTERFERENCE.

PROCEDURE:

THIS TEST WRITES ONES IN ERROR REGISTER 1, RMER1, THEN WRITES ZEROS AND VERIFIES THAT THE REGISTER IS NOT STUCK AT ONE. "UNSAFE" IS NOT TESTED DURING THIS TEST. IN ORDER TO LIMIT THE PROBABLE FAULTS TO ONE OR TWO MODULES, THE TEST IS EXECUTED IN 3 PARTS WITH EACH PART TESTING THOSE BITS WHOSE PRESET FUNCTIONS ARE DERIVED FROM THE SAME MODULE.

THE TEST WRITES ZEROS IN ERROR REGISTER 1, RMER1, THEN WRITES ONES AND VERIFIES THAT THE REGISTER IS NOT STUCK AT ZERO.

FINALLY, THE TEST WRITES A SHIFTING ONE BIT PATTERN IN RMER1 AND CHECKS FOR ADJACENT BIT INTERFERENCE.

PROBABLE FAULT:

1. IF MODULE
2. CS MODULE
3. DS MODULE

TEST 14 CLEAR OFFSET STUCK ACTIVE TEST

PURPOSE:

TO VERIFY THAT THE SIGNAL WHICH CLEARS OFFSET MODE IS NOT STUCK IN ACTIVE STATE.

PROCEDURE:

THE TEST WRITES A ONE IN THE OFFSET DIRECTION BIT WHICH IS CLEARED BY THE SIGNAL AND VERIFIES THAT A ONE CAN BE READ BACK.

PROBABLE FAULT:

1. IF MODULE
2. DS MODULE

TEST 15 OFFSET REGISTER TRANSFER TEST

PURPOSE:

```
                        TO VERIFY THAT THE OFFSET REGISTER  IS  NOT  STUCK  AT  ONE,
STUCK AT ZERO, AND THAT THERE IS NO ADJACENT BIT INTERFERENCE.

PROCEDURE:

        THE OFFSET  REGISTER,  RMOF,  IS  WRITTEN  WITH  ONES,  THEN
WRITTEN  WITH  ZEROS AND READ TO VERIFY THAT NONE OF THE BITS ARE
STUCK AT ONE.

        THEN THE OFFSET REGISTER IS WRITTEN WITH ZEROS  AND  WRITTEN
WITH ONES TO VERIFY THAT THE REGISTER IS NOT STUCK AT ZERO.

        FINALLY, THE OFFSET REGISTER IS TESTED WITH A  SHIFTING  ONE
BIT PATTERN.

PROBABLE FAULT:

1.  IF MODULE

2.  DS MODULE



TEST 16 ERROR REGISTER #2 TRANSFER TEST

        PURPOSE:

        TO VERIFY THAT ERROR REGISTER  2, RMER2,  IS  NOT  STUCK  AT
ONE, STUCK AT ZERO, AND THAT THERE IS NOT BIT INTERFERENCE.

PROCEDURE:

        THE TEST WRITES ONES THEN WRITES ZEROS IN RMER2 AND VERIFIES
THAT  NONE OF THE BITS ARE STUCK AT ONE.  "SKI" AND "DVC" ARE NOT
TESTED.  IN ORDER TO LIMIT THE NUMBER OF PROBABLE FAULTS  TO  ONE
OR  TWO  MODULES,  THE TEST IS EXECUTED IN 3 PARTS WITH EACH PART
TESTING THOSE BITS WHOSE PRESET FUNCTIONS ARE  DERIVED  FROM  THE
SAME MODULE.

        THEN THE TEST WRITES ZEROS IN ERROR REGISTER 2,  AND  WRITES
ONES VERIFYING THAT THE REGISTER IS NOT STUCK AT ZERO.

        FINALLY, THE TEST WRITES A SHIFTING ONE BIT PATTERN  IN  THE
REGISTER AND VERIFIES THAT ALL BIT POSITIONS ARE INDEPENDENT.

PROBABLE FAULT:

1.  IF MODULE

2.  CS MODULE

3.  DS MODULE
```

TEST 17 SERIAL NUMBER TEST

PURPOSE:

TO VERIFY THAT THE SERIAL NUMBER CAN BE READ.

PROCEDURE:

THE TEST READS THE SERIAL NUMBER REGISTER SEVERAL TIMES AND VERIFIES THAT THE NUMBER IS THE SAME EACH TIME.

PROBABLE FAULT:

1. CS MODULE

TEST 20 CONTROL BUS PARITY DETECTION TEST

PURPOSE:

TO TEST THE RM80'S PARITY CHECKING LOGIC FOR THE MASSBUS ASYNCHRONOUS CONTROL BUS.

PROCEDURE:

THIS TEST WRITES A SHIFTING ONE BIT DATA PATTERN IN THE DISK ADDRESS REGISTER USING "PAT" TO CONTROL THE STATE OF THE PARITY BIT. "PAR" STATUS, BIT 03 OF RMER1, IS CHECKED AFTER EACH PATTERN IS TRANSFERRED..NOTE THE FOLLOWING TABLE SHOWS A SET OF TEST PATTERNS THAT COULD BE USED INSTEAD OF A SHIFTING ONE BIT PATTERN.

DATA PATTERN	PAT	PAR
000000	1	1
075266	0	0
163753	0	0
116535	1	1

PROBABLE FAULT:

1. IF MODULE

2. ASSYNCHRONOUS MASSBUS MODULE

TEST 21 CONTROL BUS PARITY GENERATION TEST

PURPOSE:

799
800 TO TEST THE RM80'S PARITY GENERATING LOGIC FOR THE MASSBUS
801 ASYNCHRONOUS CONTROL BUS.
802
803 PROCEDURE:
804
805 THE TEST TRANSFERS A SHIFTING ONE BIT DATA PATTERN TO THE
806 DISK ADDRESS REGISTER. AFTER EACH PATTERN IS READ BACK, "MASSBUS
807 CONTROL BUS PARITY ERROR" IS TESTED AND SHOULD BE ZERO..NOTE THE
808 FOLLOWING SET OF TEST PATTERNS COULD BE USED INSTEAD OF THE
809 SHIFTING ONE BIT PATTERN.
810
811 DATA PATTERN MCPE
812
813 000000 0
814 056747 0
815 135672 0
816 163135 0
817
818 PROBABLE FAULT:
819
820 1. IF MODULE
821
822 2. ASYNCHRONOUS MASSBUS MODULE
823
824
825
826
827
828 TEST 22 RMDA, RMDC FAULT TEST
829
830 PURPOSE:
831
832 TO VERIFY THAT THERE ARE NOT FAULTS WHICH INHIBIT THE
833 PROGRAM FROM WRITING RMDC AND RMDA. SPECIFICALLY, THESE FAULTS
834 INCLUDE:
835
836 ."GO H" STUCK HIGH, WHICH WOULD INHIBIT THE REGISTER LOAD
837 FUNCTION,
838
839 ."RIP L" STUCK LOW, WHICH WOULD CONSTANTLY CLEAR THE
840 REGISTER
841
842 ."EBL" STUCK, WHICH WOULD INHIBIT THE CLOCK FUNCTION.
843
844 PROCEDURE:
845
846 THE TEST WRITES AND READS BOTH RMDC, AND RMDA. WITH ZEROS,
847 THEN ONES. THE TEST PASSES IF EITHER REGISTER CAN BE WRITTEN
848 WITH ONES.
849
850 PROBABLE FAULT:
851
852 1. DS MODULE
853
854 2. IF MODULE
855

3. CS MODULE

TEST 23 DISK ADDRESS TRANSFER TEST

PURPOSE:

TO VERIFY THAT THE DISK ADDRESS REGISTER IS NOT STUCK AT ONE OR ZERO, AND THAT THERE IS NOT BIT INTERFERENCE.

PROCEDURE:

THIS TEST PRESETS THE DISK ADDRESS TO A NONZERO VALUE. THEN USES A MOVE TO CLEAR THE REGISTER.THE TEST THEN READS RMDA AND VERIFIES THAT NONE OF THE BITS ARE STUCK AT ONE.

THEN THE TEST PRECLEARS THE MASSBUS ADAPTER DISK ADDRESS REGISTER (RMDA), LOADS IT TO ALL ONES, AND VERIFIES THAT NONE OF THE BITS ARE STUCK AT ZERO.

A SHIFTING ONE BIT PATTERN IS TRANSFERRED TO AND FROM THE DISK ADDRESS REGISTER, RMDA, AND THE TEST VERIFIES THAT EACH BIT IS INDEPENDENT.

PROBABLE FAULT:

1. DS MODULE

2. IF MODULE

TEST 24 DESIRED CYLINDER TRANSFER TEST

PURPOSE:

TO VERIFY THAT THE DESIRED CYLINDER ADDRESS REGISTER, RMDC, IS NOT STUCK AT ONE OR ZERO, AND THAT THERE IS NOT BIT INTERFERENCE.

PROCEDURE:

THIS TEST WRITES ONES IN THE DESIRED CYLINDER REGISTER RMDC, THEN WRITES ZEROS AND VERIFIES THAT THE REGISTER IS NOT STUCK AT ONE.

THEN THE TEST WRITES ZEROS IN THE DESIRED CYLINDER REGISTER, RMDC, WRITES ONES AND VERIFIES THAT THE REGISTER IS NOT STUCK AT ZERO.

FINALLY, A SHIFTING 1 BIT PATTERN IS TRANSFERRED TO AND FROM RMDC AND THE PROGRAM CHECKS FOR BIT INTERFERENCE.

```
913
914                                   PROBABLE FAULT:
915
916                                   1.  DS MODULE
917
918                                   2.  IF MODULE
919
920
921
922
923
924                             TEST 25 ILLEGAL REGISTER TEST
925
926                                   PURPOSE:
927
928                                        TO TEST ILLEGAL REGISTER ERROR DETECTION IN THE RM80.
929
930                                   PROCEDURE:
931
932                                        THIS TEST READS ALL LEGAL REGISTERS AND VERIFIES THAT "ILR",
933                                   BIT  2 OF RMER1 DOES NOT SET.  THEN, TO THE EXTENT ALLOWED BY THE
934                                   MASSBUS CONTROLLER, IT READS ILLEGAL REGISTERS AND VERIFIES  THAT
935                                   "ILR" IS SET.
936
937                                   PROBABLE FAULT:
938
939                                   1.  IF MODULE
940
941                                   2.  ASSYNCHRONOUS MASSBUS MODULE
942
943
944
945
946
947                             TEST 26 RESET GO BY INIT TEST
948
949                                   PURPOSE:
950
951                                        TO VERIFY THAT GO CAN BE RESET BY INITIALIZE.
952
953                                   PROCEDURE:
954
955                                        THE TEST SETS GO THEN CLEARS GO  USING  MASSBUS  INITIALIZE,
956                                   I.E., CONTROLLER CLEAR.
957
958                                   PROBABLE FAULT:
959
960                                   1.  CS MODULE
961
962                                   2.  IF MODULE
963
964
965
966
967
968                             TEST 27 DIAGNOSTIC MODE TEST
969
```

```
                                PURPOSE:

                                     TO VERIFY THAT 'DIAGNOSTIC MODE', BIT 0  OF  RMMR1,  IS  NOT
                                STUCK AT ONE OR ZERO.

                                PROCEDURE:

                                     THE  RM80  IS  INITIALIZED  AND  'DMD'  IS CHECKED FOR ZERO.
                                'DMD' IS WRITTEN WITH ONE AND READ TO VERIFY THAT IT IS NOT STUCK
                                AT ZERO, THEN WRITTEN WITH ZERO AND READ TO VERIFY THAT IT IS NOT
                                STUCK AT ONE.

                                PROBABLE FAULT:

                                1.  CS MODULE

                                2.  IF MODULE




                           TEST 30 MOL TEST

                                PURPOSE:

                                     TO VERIFY THAT 'MEDIUM ON LINE' STATUS CAN BE SET AND  RESET
                                USING MAINTENANCE UNIT READY.

                                PROCEDURE:

                                     AFTER INITIALIZING THE SUBSYSTEM, THE TEST SETS  'DIAGNOSTIC
                                MODE:   AND READS THE DRIVE STATUS REGISTER, RMDS, EXPECTING MOL,
                                BIT 12 TO BE ZERO.  'MAINTENANCE UNIT READY', BIT 9 OF RMMR1,  IS
                                SET  AND  MOL  SHOULD BE ONE.  THE TEST THEN WRITES A ZERO IN MUR
                                AND READS RMDS, VERIFYING THAT 'MEDIUM ON LINE' IS ZERO.

                                PROBABLE FAULT:

                                1.  CS MODULE

                                2.  IF MODULE




                           TEST 31 WRITE LOCK TEST

                                PURPOSE:

                                     TO VERIFY THAT 'WRITE LOCK' STATUS,  WRL,  CAN  BE  SET  AND
                                RESET USING 'MAINTENANCE WRITE PROTECT', MWP.

                                PROCEDURE:

                                     WITH DIAGNOSTIC MODE SET, THE PROGRAM SETS MWP,  BIT  03  OF
```

RMMR1, AND READS RMDS TO VERIFY THAT WRL, BIT 11 IS SET. THEN MWP IS RESET AND WRL SHOULD BE ZERO.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 32 DRIVE FAULT TEST

PURPOSE:

TO VERIFY THAT "DEVICE CHECK", DVC, AND "UNSAFE", UNS, CAN BE SET AND RESET USING "MAINTENANCE DRIVE FAULT", MDF.

PROCEDURE:

WITH DIAGNOSTIC MODE SET, THE PROGRAM SETS MDF, BIT 06 OF RMMR1, AND READS RMER3 TO VERIFY THAT DVC, BIT 07 IS SET RMER1 IS ALSO READ AND UNS, BIT 14 SHOULD ALSO BE SET. THEN MDF IS RESET AND DVC AND UNS SHOULD BE RESET.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 33 SEEK ERROR TEST

PURPOSE:

TO VERIFY THAT "SEEK ERROR", SKI, CAN BE SET AND RESET USING "MAINTENANCE SEEK ERROR", MSER.

PROCEDURE:

WITH DIAGNOSTIC MODE SET, THE TEST SETS MSER, BIT 07 OF RMMR1 AND READS RMER3 TO VERIFY THAT SKI, BIT 14 IS SET. MSER IS RESET AND SKI SHOULD RESET.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 34 PIP TEST

PURPOSE:

TO VERIFY THAT "POSITIONING IN PROGRESS", PIP, CAN BE SET AND RESET USING "MAINTENANCE ON CYLINDER", MOC.

PROCEDURE:

DIAGNOSTIC MODE IS SET THEN MOC, BIT 08 OF RMMR1 IS SET AND PIP, BIT 13 OF RMDS, SHOULD BE ZERO. MOC IS THEN RESET AND PIP SHOULD BE ONE.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 35 EBL TEST

PURPOSE:

TO VERIFY THAT END OF BLOCK STATUS "EBL" CAN BE SET AND RESET USING DIAGNOSTIC END OF BLOCK "DEBL".

PROCEDURE:

THE PROGRAM SETS DIAGNOSTIC MODE AND VERIFIES THAT EBL IS RESET. THEN IT SETS DEBL AND VERIFIES THAT EBL IS SET. FINALLY, THE TEST TRANSFERS A SHIFTING ONE BIT TO RMMR1, AND CHECKS FOR DEBL BEING SET BY AN ADJACENT BIT.

PROBABLE FAULT:

1. CS MODULE

TEST 36 LAST SECTOR, LAST TRACK TEST

PURPOSE:

TO VERIFY THE DESIRED TRACK/SECTOR PLA ON THE DS MODULE USING RMMR1, BITS 01 AND 02.

PROCEDURE:

THE TEST WRITES ALL POSSIBLE PATTERNS IN THE DISK ADDRESS REGISTER, RMDA, AND VERIFIES "LS" AND "LST" STATUS FOR EACH PATTERN. THE PROCEDURE IS DONE ONCE FOR 18 BIT FORMAT, ONCE FOR 16 BIT FORMAT AND ONCE FOR 16 BIT FORMAT WITH "SSEI" SET.

PROBABLE FAULT:

1. DS MODULE

2. CS MODULE

TEST 37 RMDA COUNT TEST

PURPOSE:

TO VERIFY THAT THE DISK ADDRESS REGISTER (RMDA) INCREMENTS PROPERLY.

PROCEDURE:

THE TEST INCREMENTS RMDA USING DIAGNOSTIC END OF BLOCK "DEBL" AND VERIFIES THE RESULT IN 18 BIT FORMAT, 16 BIT FORMAT AND 16 BIT FORMAT WITH "SSEI" SET.

PROBABLE FAULT:

1. DS MODULE

TEST 40 RMDC COUNT TEST

PURPOSE:

TO VERIFY THAT THE DESIRED CYLINDER REGISTER, RMDC, INCREMENTS PROPERLY.

PROCEDURE:

THE PROGRAM INCREMENTS RMDC USING DIAGNOSTIC END OF BLOCK, "DEBL", AND VERIFIES THE RESULT IN 18 BIT FORMAT, 16 BIT FORMAT AND 16 BIT FORMAT WITH "SSEI" SET.

PROBABLE FAULT:

1. DS MODULE

```
1198                                TEST 41 LBT TEST
1199
1200                                     PURPOSE:
1201
1202                                          TO INSURE THAT  LAST BLOCK TRANSFERRED, "LBT", CLEARS WHEN
1203                                     RMDA IS WRITTEN, AND SETS WHEN THE LAST SECTOR IS TRANSFERRED.
1204
1205                                     PROCEDURE:
1206
1207                                          THE TEST USES DIAGNOSTIC EBL TO SET LBT,  AND  TRANSFERS  TO
1208                                     RMDA TO RESET LBT.  THE RESULTS ARE VERIFIED IN 18 BIT FORMAT, 16
1209                                     BIT FORMAT AND 16 BIT FORMAT WITH "SSEI" SET.
1210
1211
1212                                     PROBABLE FAULT:
1213
1214                                     1.  DS MODULE
1215
1216                                     2.  IF MODULE
1217
1218
1219
1220
1221
1222                                TEST 42 COMPOSITE ERROR TEST
1223
1224                                     PURPOSE:
1225
1226                                          TO TEST "COMPOSITE ERROR", BIT 14 OF RMDS.
1227
1228                                     PROCEDURE:
1229
1230                                          THE TEST USES INITIALIZE AND DIAGNOSTIC MODE  TO  FORCE  ALL
1231                                     ERRORS  TO  ZERO THEN VERIFIES THAT "ERR" IS ZERO.  EACH ERROR IS
1232                                     INDIVIDUALLY SET AND "ERR" SHOULD BE ONE FOR EVERY ERROR  TESTED.
1233                                     ADDRESSES  #2  AND #17 OF THE COMPOSITE ERROR PLA ARE NOT TESTED.
1234                                     "ABORT" AND "EXCEPTION" OUTPUTS OF THE PLA ARE NOT  TESTED.   THE
1235                                     TEST  FAILS  IF ERR IS NOT ZERO WITH ALL SET ARGUMENTS ZERO OR IF
1236                                     ERR IS NOT ONE WITH ANY SET ARGUMENT ONE.
1237
1238                                     PROBABLE FAULT:
1239
1240                                     1.  IF MODULE
1241
1242
1243
1244
1245
1246                                TEST 43 WRITE GO TEST
1247
1248                                     PURPOSE:
1249
1250                                          TO VERIFY THAT GO CAN BE SET.
1251
1252                                     PROCEDURE:
1253
1254                                          THE TEST ENABLES THE  DEBUG  CLOCK,  THEN  TRANSFERS  A  NOP
```

FUNCTION CODE AND GO BIT TO RMCS1, VERIFYING THAT GO SETS. ALL FUNCTION CODES ARE TESTED.

PROBABLE FAULT:

1. IF MODULE

2. CS MODULE

TEST 44 BRANCH MULTIPLEXOR TEST

PURPOSE:

TO VERIFY THAT THE OUTPUT OF THE COMMAND SEQUENCER BRANCH MULTIPLEXOR DOES NOT HAVE A FAULT.

PROCEDURE:

WITH DEBUG CLOCK ENABLED, THE TEST USES VARIOUS FUNCTION CODES AND REGISTER CONDITIONS TO ADDRESS THE TEST BIT MULTIPLEXOR SUCH THAT THE TEST BIT, BIT12 OF RMMR2, CAN BE CHECKED FOR A STUCK FAULT.

PROBABLE FAULT:

1. CS MODULE

TEST 45 SET/RESET GO TEST

PURPOSE:

TO VERIFY THAT GO CAN BE SET AND RESET.

PROCEDURE:

THE SUBSYSTEM IS INITIALIZED AND PUT IN DIAGNOSTIC MODE WITH "DEBUG CLOCK ENABLE", BIT 14 OF RMMR1 SET.CERTAIN FUNCTION CODES ARE WRITTEN IN RMCS1 AND THE PROGRAM READS RMCS1 TO VERIFY THAT GO IS SET. RMDS IS ALSO READ TO VERIFY THAT "DRY" IS RESET. THEN THE PROGRAM STEPS THE DEBUG CLOCK USING BIT 15 OF RMMR1 AND VERIFIES THAT "GO" RESETS AND "DRY" SETS. USING A FUNCTION CODE THAT RESETS GO AT A DIFFERENT PROM ADDRESS. THE TEST FAILS IF GO DOES NOT SET OR CANNOT BE RESET BY THE COMMAND SEQUENCER. THE TEST ALSO FAILS IF "DRIVE READY" IS NOT THE COMPLIMENT OF GO.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 46 END 1 RESET GO TEST

PURPOSE:

TO VERIFY THAT THE COMMAND SEQUENCER CAN RESET GO AT THE END1 LOCATION.

PROCEDURE:

THE TEST EXECUTES RELEASE, SEARCH AND ILLEGAL FUNCTION CODE 32 IN DIAGNOSTIC MODE AND VERIFIES THAT GO RESETS ON THE SPECIFIED CLOCK CYCLE.

PROBABLE FAULT:

1. CS MODULE

TEST 47 SET PULSE TEST

PURPOSE:

TO VERIFY THAT THE COMMAND SEQUENCER CAN GENERATE SET PULSE.

PROCEDURE:

WITH DEBUG CLOCK ENABLED, THE TEST STEPS THE COMMAND SEQUENCER THROUGH PARTS OF VARIOUS FUNCTION CODES AND CHECKS CONTINUE, BIT 06 OF RMMR1 TO DETERMINE IF SET PULSE IS BEING GENERATED.

PROBABLE FAULT:

1. CS MODULE

TEST 50 SET/RESET IVC TEST

PURPOSE:

TO TEST "INVALID COMMAND" STATUS FOR EACH FUNCTION CODE.

PROCEDURE:

THE PROGRAM RESETS VOLUME VALID USING 'MAINTENANCE UNIT READY', BIT09 OF RMMR1, THEN LOADS THE FUNCTION CODE AND GO IN RMCS1. EACH FUNCTION CODE IS TESTED AND "IVC", BIT 12 OF RMER2 IS CHECKED.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 51 SET LSC TEST

PURPOSE:

TO VERIFY THAT "LOSS OF SYSTEM CLOCK" CAN SET AND RESET.

PROCEDURE:

THE TEST ENABLES THE DEBUG CLOCK AND SETS THE GO BIT. AFTER WAITING ENOUGH TIME FOR THE ONE SHOT TO SET, THE TEST DISABLES THE DEBUG CLOCK AND VERIFIES THAT LSC SETS.

PROBABLE FAULT:

1. CS MODULE

2. IF MODULE

TEST 52 DECODE TEST

PURPOSE:

TO VERIFY THAT THE "DECODE" FLOP ON THE IF MODULE SETS WITH THE LEADING EDGE OF "SET PULSE" EXCEPT WHEN "COMPOSITE ERROR" IS ACTIVE.

PROCEDURE:

THE TEST USES "VOLUME VALID" AND "OCCUPPIED" TO DETERMINE IF THE DECODE FLOP IS SET OR RESET. INITIALLY, VV AND OCCUPPIED ARE RESET AND THE TEST EXECUTES THOSE COMMANDS WHICH SET VV OR OCC AND VERIFIES THAT ONE OR BOTH BITS SET. THE SAME COMMANDS ARE EXECUTED AGAIN WITH COMPOSITE ERROR SET, AND THE TEST VERIFIES THAT NEITHER BIT SETS.

PROBABLE FAULT:

1. IF MODULE

TEST 53 SET/RESET VOLUME VALID TEST

PURPOSE:

TO VERIFY THAT "VOLUME VALID" RESETS WITH THE LEADING EDGE OF UNIT READY, AND SETS WITH PACK ACKNOWLEDGE AND READ IN PRESET COMMANDS.

PROCEDURE:

USING "MAINTENANCE UNIT READY", BIT 9 OF RMMR1, THIS TEST FORCES A ZERO TO ONE TRANSITION OF UNIT READY AND VERIFIES THAT VOLUME VALID,BIT 6 OF RMDS IS ZERO. THEN THE TEST EXECUTES A PACK ACKNOWLEDGE COMMAND, VERIFYING THAT VV SETS. THE PROCEDURE IS REPEATED WITH A READ IN PRESET COMMAND.

PROBABLE FAULT:

1. IF MODULE

TEST 54 ILLEGAL FUNCTION TEST

PURPOSE:

TO TEST ILLEGAL FUNCTION ERROR IN THE RM80.

PROCEDURE:

WITH DIAGNOSTIC CLOCK ENABLED TO INHIBIT THE COMMAND SEQUENCER, THIS TEST VERIFIES THAT "ILF", BIT 0 OF RMER1, IS OFF FOR LEGAL FUNCTION CODES AND ON FOR ILLEGAL FUNCTIONCODES. THE STATUS OF THE "GO" BIT IS IGNORED.

PROBABLE FAULT:

1. IF MODULE

TEST 55 OCCUPIED TEST

PURPOSE:

TO VERIFY THAT "OCCUPIED" IS SET DURING DATA TRANSFERS AND IS RESET FOR ALL OTHER COMMANDS.

PROCEDURE:

FOR EACH DATA TRANSFER COMMAND, "OCC", BIT 15 OF RMMR1 SHOULD BE ONE, DEBUG CLOCK IS ENABLED TO PREVENT GO FROM RESETTING BEFORE STATUS IS SAMPLED.

PROBABLE FAULT:

1. IF MODULE

2. CS MODULE

TEST 56 READ IN PRESET TEST

PURPOSE:

TO VERIFY THAT "READ IN PRESET" COMMAND IS DECODED, AND IN PARTICULAR, TO VERIFY THAT "IF5 READ IN CMD L" IS NOT STUCK AT ONE.

PROCEDURE:

EACH VISIBLE STATUS OR REGISTER BIT WHICH IS CLEARED BY "READ IN PRESET" IS SET. THEN THE RIP COMMAND IS EXECUTED AND THE TEST VERIFIES THAT ONE OR MORE BITS ARE CLEARED. THE FOLLOWING ARE USED DURING THE TEST.

. ALL BITS OF RMOF ARE SET BY A MOVE INSTRUCTION AND THE TEST PASSES IF USED BITS ARE ZERO AFTER THE RIP COMMAND.

. THE DESIRED CYLINDER REGISTER, RMDC, IS SET WITH A MOVE INSTRUCTION AND THE TEST PASSES IF BITS 00-09 ARE ZERO AFTER THE RIP COMMAND.

. THE DISK ADDRESS REGISTER, RMDA, IS SET WITH A MOVE INSTRUCTION AND THE TEST PASSES IF BITS 00-07, AND BITS 08-15 ARE ZERO AFTER THE RIP COMMAND.

THE TEST FAILS IF NONE OF THE PRESET TERMS ARE ZERO AFTER THE RIP COMMAND.

PROBABLE FAULT:

1. IF MODULE

2. DS MODULE

TEST 57 RIP/RMOF TEST

PURPOSE:

```
1540
1541                                    TO VFRIFY THAT "READ IN PRESET" RESETS FMT16, ECI, HCI AND
1542                                SSEI BITS 09, 10, 11 AND 12 OF RMOF.
1543
1544                                PROCEDURE:
1545
1546                                    FMT16, ECI, HCI AND SSEI ARE SET, THEN A RIP COMMAND IS EXECUTED
1547                                AND EACH BIT SHOULD BE ZERO.
1548
1549                                PROBABLE FAULT:
1550
1551                                1.  IF MODULE
1552
1553                                2.  DS MODULE
1554
1555
1556
1557
1558
1559                            TEST 60 RMDA/RMDC/RIP TEST
1560
1561                                PURPOSE:
1562
1563                                    TO VERIFY THAT "READ IN PRESET" RESETS THE DESIRED  CYLINDER
1564                                ADDRESS, RMDC, AND THE DISK ADDRESS, RMDA.
1565
1566                                PROCEDURE:
1567
1568                                    RMDA AND RMDC ARE PRESET THEN TESTED FOR ZERO AFTER THE  RIP
1569                                COMMAND.
1570
1571                                PROBABLE FAULT:
1572
1573                                1.  DS MODULE
1574
1575
1576
1577
1578
1579                            TEST 61 OFFSET COMMAND TEST
1580
1581                                PURPOSE:
1582
1583                                    TO  VERIFY  THAT  "OFFSET MODE"  SETS  WITH  OFFSET COMMAND.
1584
1585                                PROCEDURE:
1586
1587                                    THE TEST EXECUTES OFFSET COMMAND AND VERIFIES THAT "OM", BIT
1588                                00 OF RMDS IS ONE.
1589
1590                                PROBABLE FAULT:
1591
1592                                1.  IF MODULE
1593
1594
1595
1596
```

```
1597
1598                        TEST 62 RETURN TO CENTER TEST
1599
1600                             PURPOSE:
1601
1602                                  TO VERIFY THAT "RETURN TO CENTER" RESETS OFFSET MODE.
1603
1604                             PROCEDURE:
1605
1606                                  OFFSET MODE, BIT 00 OF RMDS, IS SET WITH OFFSET COMMAND,
1607                             THEN THE TEST EXECUTES A RETURN TO CENTER COMMAND AND VERIFIES
1608                             THAT OFFSET MODE RESETS.  OFFSET DIRECTION IS ALSO SET AND
1609                             CHECKED FOR ZERO AFTER THE COMMAND.
1610
1611                             PROBABLE FAULT:
1612
1613                             1.  IF MODULE
1614
1615
1616
1617
1618
1619                        TEST 63 RMDC CLEAR OFFSET TEST
1620
1621                             PURPOSE:
1622
1623                                  TO VERIFY THAT CLEAR OFFSET IS ACTIVE WHEN THE DESIRED
1624                             CYLINDER ADDRESS IS WRITTEN.
1625
1626                             PROCEDURE:
1627
1628                                  THE TEST EXECUTES AN OFFSET COMMAND, WRITES RMDC, AND
1629                             VERIFIES THAT OM, BIT 00 OF RMDS IS ZERO.
1630
1631                             PROBABLE FAULT:
1632
1633                             1.  DS MODULE
1634
1635                             2.  IF MODULE
1636
1637
1638
1639
1640
1641                        TEST 64 EBL CLEAR OFFSET TEST
1642
1643                             PURPOSE:
1644
1645                                  TO VERIFY THAT OFFSET MODE CLEARS WHEN HEAD SWITCHING
1646                             OCCURS.
1647
1648                             PROCEDURE:
1649
1650                                  THE TEST EXECUTES AN OFFSET COMMAND TO SET OFFSET MODE.
1651                             AFTER SETTING THE FORMAT BIT AND LOADING THE LAST SECTOR/TRACK
1652                             ADDRESS IN RMDA, THE TEST FORCES AN EBL AND VERIFIES THAT OFFSET
1653                             MODE RESETS.
```

```
1654
1655                                    PROBABLE FAULT:
1656
1657                                    1.  DS MODULE
1658
1659
1660
1661
1662
1663                            TEST 65 RUN AND GO TEST
1664
1665                                    PURPOSE:
1666
1667                                        TO  VERIFY THAT  'RUN AND GO''  FLOP SETS DURING READ AND  WRITE
1668                                    COMMANDS.
1669
1670                                    PROCEDURE:
1671
1672                                        THE  RM80  IS  INITIALIZED   AND  A  DATA TRANSFER COMMAND WITH
1673                                    GO SET IS WRITTEN IN RMCS1.  'RUN AND GO'', BIT 14 OF RMMR1 SHOULD BE
1674                                    ONE FOR EACH DATA COMMAND.  THE  DEBUG  CLOCK  IS ENABLED SO THAT GO
1675                                    DOES NOT RESET BEFORE STATUS IS TESTED.
1676
1677                                    PROBABLE FAULT:
1678
1679                                    1.  CS MODULE
1680
1681                                    2.  SYNCHRONOUS MASSBUS MODULE
1682
1683
1684
1685
1686
1687                            TEST 66 SET IAE TEST
1688
1689                                    PURPOSE:
1690
1691                                        TO VERIFY THAT INVALID ADDRESS ERROR CAN SET.
1692
1693                                    PROCEDURE:
1694
1695                                        THE TEST LOADS INVALID SECTOR, TRACK AND CYLINDER  ADDRESSES
1696                                    AND  EXECUTES  A  SEARCH COMMAND, VERIFYING THAT ''IAE'' SETS.  THE
1697                                    PROCESS IS REPEATED WITH A DIFFERENT COMMAND IF THE IAE DOES  NOT
1698                                    SET, AND THE TEST FAILS IF IAE CANNOT BE SET.
1699
1700                                    PROBABLE FAULT:
1701
1702                                    1.  DS MODULE
1703
1704                                    2.  IF MODULE
1705
1706
1707
1708
1709
1710                            TEST 67 SEARCH, SEEK, READ, WRITE TEST
```

```
1711
1712                                    PURPOSE:
1713
1714                                        TO VERIFY THAT THE ''SCH SK R OR W' DECODE ON THE  IF  MODULE
1715                                    IS CORRECT FOR ALL FUNCTION CODES.
1716
1717                                    PROCEDURE:
1718
1719                                        THE TEST LOADS INVALID SECTOR, TRACK AND CYLINDER  ADDRESSES
1720                                    AND  EXECUTES  EACH  COMMAND  TO  WHERE  SET  PULSE IS ACTIVE AND
1721                                    VERIFIES THE DECODE BY CHECKING ''IAE''.
1722
1723                                    PROBABLE FAULT:
1724
1725                                    1.  IF MODULE
1726
1727
1728
1729
1730
1731                                TEST 70 INVALID TRACK/SECTOR TEST
1732
1733                                    PURPOSE:
1734
1735                                        TO VERIFY  THAT  INVALID  TRACK  AND  SECTOR  ADDRESSES  ARE
1736                                    DETECTED.
1737
1738                                    PROCEDURE:
1739
1740                                        THE TEST LOADS THE TEST  PATTERN  IN  RMDA  AND  EXECUTES  A
1741                                    SEARCH COMMAND, VERIFYING THAT ''IAE'' SETS.
1742
1743                                    PROBABLE FAULT:
1744
1745                                    1.  DS MODULE
1746
1747                                    2.  TRACK ADDRESS OPTION JUMPER
1748
1749
1750
1751
1752
1753                                TEST 71 INVALID CYLINDER TEST
1754
1755                                    PURPOSE:
1756
1757                                        TO VERIFY THAT INVALID CYLINDER ADDRESSES ARE DETECTED.
1758
1759                                    PROCEDURE:
1760
1761                                        THE TEST LOADS THE TEST  PATTERN  IN  RMDC  AND  EXECUTES  A
1762                                    SEARCH COMMAND, VERIFYING THAT ''IAE'' SETS.
1763
1764                                    PROBABLE FAULTS:
1765
1766                                    1.  DS MODULE
1767
```

2. CYLINDER ADDRESS OPTION JUMPER

TEST 72 SET AOE TEST

PURPOSE:

TO VERIFY THAT ADDRESS OVERFLOW ERROR IS DETECTED.

PROCEDURE:

THE TEST LOADS THE ADDRESS OF THE LAST SECTOR IN RMDA AND RMDC, THEN INITIATES A DATA COMMAND WITH DEBUG CLOCK ENABLED. END OF BLOCK IS FORCED TO INCREMENT THE SECTOR ADDRESS, AND THE TEST VERIFIES THAT "AOE" IS SET, IN 18 BIT FORMAT, 16 BIT FORMAT AND 16 BIT FORMAT WITH "SSEI" SET.

PROBABLE FAULT:

1. DS MODULE

TEST 73 SET RMR TEST

PURPOSE:

TO VERIFY THAT "REGISTER MODIFICATION REFUSED" SETS WHEN A REGISTER IS WRITTEN WHILE GO IS SET, EXCEPT WHEN THE ATTENTION OR MAINTENANCE REGISTER IS WRITTEN.

PROCEDURE:

"DEBUG CLOCK ENABLE" IS SET TO INHIBIT THE COMMAND SEQUENCER, THEN A NOP COMMAND AND GO BIT IS WRITTEN IN RMCS1. WITHOUT STEPPING THE DEBUG CLOCK, THE TEST WRITES RMMR AND RMAS, WHICH SHOULD NOT SET RMR STATUS. THEN RMDA IS WRITTEN AND RMR STATUS, BIT 02 OF RMER1, SHOULD BE ONE.

PROBABLE FAULT:

1. IF MODULE

TEST 74 PGM STATUS CHECK

PURPOSE:

TO VERIFY THAT THE PROGRAMMABLE STATUS BIT AND THE DRIVE REQUEST STATUS BIT ARE COMPATABLE.

PROCEDURE:

THE TEST REPORTS AN ERROR IF PGM IS ON AND DRQ IS OFF. PGM IS NOT PREDICTABLE IN THE CASE WHERE DRQ IS ON BECAUSE OF THE PORT SELECT SWITCH.

PROBABLE FAULT:

1. IF MODULE

TEST 75 DVA/DPR STATUS CHECK

PURPOSE:

TO VERIFY THAT DEVICE AVAILABLE STATUS AND DRIVE PRESENT STATUS ARE SET.

PROCEDURE:

DVA AND DPR ARE TESTED AND BOTH SHOULD BE ON.

PROBABLE FAULT:

1. IF MODULE

TEST 76 PORT REQUEST TEST, PART 1

PURPOSE:

TO VERIFY THAT THE PORT REQUEST FLOPS ON THE IF MODULE SET WHEN THE PROGRAM READS RMCS1.

PROCEDURE:

THE TEST EXECUTES A RELEASE COMMAND, THEN, ASSUMING THE PORT IS RELEASED, IT READS RMCS1, THEN READS RMMR2 AND VERIFIES THAT ONE OF THE PORT REQUEST FLOPS IS SET.

PROBABLE FAULT:

1. IF MODULE

2. CS MODULE

```
1882
1883
1884                    TEST 77 PORT REQUEST TEST, PART 2
1885
1886                         PURPOSE:
1887
1888                              TO VERIFY THAT THE PORT REQUEST FLOPS ON THE IF  MODULE  SET
1889                         WHEN THE PROGRAM WRITES RMAS.
1890
1891                         PROCEDURE:
1892
1893                              THE TEST EXECUTES A RELEASE COMMAND  THEN  WRITES  RMAS  AND
1894                         READS RMMR2, VERIFYING THAT ONE OF THE REQUEST FLOPS IS SET.
1895
1896                         PROBABLE FAULT:
1897
1898                         1.  IF MODULE
1899
1900                         2.  CS MODULE
1901
1902
1903
1904
1905
1906                    TEST 100 PORT REQUEST TEST, PART 3
1907
1908                         PURPOSE:
1909
1910                              TO VERIFY THAT PORT REQUEST SETS WHEN  ANY  REGISTER  EXCEPT
1911                         RMAS IS WRITTEN.
1912
1913                         PROCEDURE:
1914
1915                              THE TEST WRITES THE DISK ADDRESS REGISTER AND VERIFIES  THAT
1916                         THE PORT REQUEST FLOP IS ON.
1917
1918                         PROBABLE FAULT:
1919
1920                         1.  IF MODULE
1921
1922                         2.  CS MODULE
1923
1924
1925
1926
1927
1928                    TEST 101 RELEASE TEST
1929
1930                         PURPOSE:
1931
1932                              TO VERIFY THAT A RELEASE COMMAND CAN RESET THE REQUEST FLOPS
1933                         RQA AND RQB IN MAINTANCE REGISTER #2.
1934
1935                         PROCEDURE:
1936
1937                              THE PROGRAM SETS REQUEST FLOP BY WRITTING THE RMCS1 REGISTER
1938                         THEN, EXECUTES A RELEASE COMMAND TO RESET THE REQUEST FLOP.
```

```
1939
1940                                    PROBABLE FAULT:
1941
1942                                    1.  IF MODULE
1943
1944
1945
1946
1947
1948                            TEST 102 WRITE ATA TEST
1949
1950                                    PURPOSE:
1951
1952                                        TO VERIFY THAT ATTENTION CAN BE CLEARED BY WRITING THE
1953                                    ATTENTION SUMMARY REGISTER.
1954
1955                                    PROCEDURE:
1956
1957                                        THE PROGRAM RESETS AND SETS UNIT READY WHICH SHOULD CAUSE AN
1958                                    ATTENTION,  THEN WRITES THE ATTENTION SUMMARY REGISTER AND
1959                                    VERIFIES THAT ATTENTION IS RESET.
1960
1961                                    PROBABLE FAULT:
1962
1963                                    1.  IF MODULE
1964
1965                                    2.  CS MODULE
1966
1967
1968
1969
1970
1971                            TEST 103 RESET ATA BY GO TEST
1972
1973                                    PURPOSE:
1974
1975                                        TO VERIFY THAT ATA RESETS WHEN GO IS ON AND COMPOSITE  ERROR
1976                                    IS OFF.
1977
1978                                    PROCEDURE:
1979
1980                                        THE PROGRAM SETS MAINTENANCE UNIT READY WHICH  SHOULD  CAUSE
1981                                    AN ATTENTION.  THEN, WITH DEBUG CLOCK ENABLED, GO IS SET, AND ATA
1982                                    SHOULD BE ZERO.
1983
1984                                    PROBABLE FAULT:
1985
1986                                    1.  IF MODULE
1987
1988
1989
1990
1991
1992                            TEST 104 UNIT READY ATA TEST
1993
1994                                    PURPOSE:
1995
```

TO VERIFY THAT ONE-ZERO AND ZERO-ONE TRANSITIONS OF UNIT READY SET ATTENTION.

PROCEDURE:

THE TEST USES DIAGNOSTIC MODE TO FORCE BOTH TRANSITIONS OF UNIT READY AND VERIFIES THAT ATA SETS WITH EACH TRANSITION.

PROBABLE FAULT:

1. IF MODULE

TEST 105 ERROR ATA TEST

PURPOSE:

TO VERIFY THAT ATTENTION SETS WHEN COMPOSITE ERROR OCCURS WHILE GO IS OFF.

PROCEDURE:

THE PROGRAM CLEARS THE DEVICE AND SETS AN ERROR, THEN VERIFIES ATA IS ON.

PROBABLE FAULT:

1. IF MODULE

TEST 106 REGISTER TRANSFER ATA TEST

PURPOSE:

TO VERIFY THAT ATTENTION SETS WHEN ANY REGISTER, EXCEPT FOR RMAS AND RMCS, IS WRITTEN WHILE COMP ERROR IS SET.

PROCEDURE:

THE PROGRAM FORCES AN ERROR THEN RESETS ATTENTION FROM THE ERROR. THE PROGRAM THEN WRITES RMAS AND RMCS AND VERIFIES THAT NO ATTENTION OCCURS, AND WRITES RMDC AND VERIFIES THAT ATTENTION DOES OCCUR.

PROBABLE FAULT:

1. IF MODULE

```
2053
2054                          TEST 107 P SET ATA TEST
2055
2056                               PURPOSE:
2057
2058                                    TO VERIFY THAT ATA IS SET AT THE COMPLETETION OF AN OFFSET AND
2059                               RETURN TO CENTER LINE COMMAND.
2060
2061                               PROCEDURE:
2062
2063                                    THE  PROGRAM  EXECUTES  THE COMMANDS USING THE MAINTANCE DEBUG
2064                               CLOCK AND EXPECTS ATA TO BE SET ON COMPLETETION.
2065
2066                               PROBABLE FAULT:
2067
2068                               1.  IF MODULE
2069
2070
2071
2072
2073
2074                          TEST 110 SET WLE TEST
2075
2076                               PURPOSE:
2077
2078                                    TO VERIFY THAT "WLE" IS SET OR RESET WHEN IT SHOULD BE.
2079
2080                               PROCEDURE.
2081
2082                                    THE  PROGRAM  EXECUTES  THE  FOLLOWING  COMMANDS  USING  THE
2083                               MAINTANCE DEBUG CLOCK AND EXPECTS WLE SET OR RESET.
2084
2085                                    EXECUTE WRITE DATA COMMAND WITH MAINTANCE WRITE PROTECT SET,
2086                               SHOULD EXPECT WLE TO BE SET.
2087
2088                                    EXECUTE  WRITE  DATA COMMAND WITHOUT MAINTANCE WRITE PROTECT
2089                               SET, SHOULD EXPECT WLE TO BE RESET.
2090
2091                                    EXECUTE  READ DATA COMMAND WITH MAINTANCE WRITE PROTECT SET,
2092                               SHOULD EXPECT WLE TO BE RESET.
2093
2094                                    EXECUTE  READ IN PRESET COMMAND WITH MAINTANCE WRITE PROTECT
2095                               SET, SHOULD EXPECT WLE TO BE RESET.
2096
2097                               PROBABLE FAULT:
2098
2099                               1.  CS MODULE
2100
2101                               2.  IF MODULE
2102
2103
2104
2105
2106
2107                          TEST 111 EXCEPTION TEST
2108
2109                               PURPOSE:
```

2110
2111 TO VERIFY THAT "REX" OF RMMR1 IS RESET AFTER THE CONTROLLER IS
2112 INTIALIALIZED AND SET WHEN AN ERROR IS DETECTED DURING A DATA TRANSFER
2113 COMMAND.
2114
2115 PROCEDURE:
2116
2117 THE PROGRAM WILL INITIALIZE THE MASSBUS ("REX" SHOULD BE CLEAR)
2118 AND THEN EXECUTE THE WRITE DATA COMMAND USING THE MAINTANCE DEBUG CLOCK.
2119 WHILE THE COMMAND IS BEING EXECUTED (RUN AND GO SET), THE PROGRAM CAUSES
2120 A "RMR" ERROR, BY TRYING TO WRITE THE RMER1 REGISTER ("REX" SHOULD BE
2121 SET).
2122
2123 PROBABLE FAULT:
2124
2125 1. CS MODULE
2126
2127 2. IF MODULE
2128
2129
2130
2131
2132
2133 TEST 112 RECALIBRATE TEST
2134
2135 PURPOSE:
2136
2137 TO VERIFY THAT "OPI" SETS, IF UNIT READY DROPS DURING RECALIBRATE
2138 COMMAND EXECUTION.
2139
2140 TO VERIFY THAT THE RECALIBRATE COMMAND ABORTS DURING COMMAND
2141 EXECUTION.
2142
2143 TO VERIFY THAT "OPI" SETS, IF ON CYLINDER LATCH DOES NOT CLEAR.
2144
2145 TO VERIFY THAT "ATA" SETS, IF THE DRIVE COMPLETES THE RECALIBRATE
2146 COMMAND.
2147
2148 TO VERIFY THAT THE RECALIBRATE COMMAND ABORTS AFTER EXECUTION
2149 DUPING A WAIT LOOP.
2150
2151 TO VERIFY THE TAG BUS DURING A RECALIBRATE COMMAND.
2152
2153 PROCEDURE:
2154
2155 THE PROGRAM EXECUTES THE FOLLOWING COMMANDS USING THE
2156 MAINTANCE DEBUG CLOCK AND EXPECTS THE RESULTS FOLLOWING EACH COMMAND.
2157
2158 EXECUTE RECALIBRATE COMMAND, DROP UNIT READY AND VERIFY THAT "OPI"
2159 IS SET.
2160
2161 EXECUTE RECALIBRATE COMMAND, SET DRIVE FAULT ("MDF" IN RMMR1) TO
2162 CAUSE COMMAND ABORT AND VERIFY THAT "GO" IS RESET.
2163
2164 EXECUTE RECALIBRATE COMMAND, VERIFY THAT "OPI" IS SET WHEN ON
2165 CYLINDER LATCH IS NOT CLEARED.
2166

```
2167                                        EXECUTE RECALIBRATE COMMAND, DROP ON CYLINDER TO RESET LATCH,
2168                                    THEN SET ON CYLINDER AGAIN AND VERIFY THAT "ATA" IS SET.
2169
2170                                        EXECUTE RECALIBRATE COMMAND, DROP ON CYLINDER TO RESET LATCH,
2171                                    LEAVE ON CYLINDER RESET AND VERIFY THAT "GO" IS STILL SET.
2172
2173                                        EXECUTE RECALIBRATE COMMAND AND VERIFY THAT THE TAG BUS IS CORRECT
2174                                    ACCORDING A PRE-DETERMINED TABLE.
2175
2176                                    PROBABLE FAULT:
2177
2178                                    1.  CS MODULE
2179
2180
2181
2182
2183
2184                                TEST 113 SEEK TEST
2185
2186                                    PURPOSE:
2187
2188                                        TO VERIFY THAT "OPI" SETS, IF UNIT READY DROPS DURING SEEK COMMAND
2189                                    EXECUTION.
2190
2191                                        TO VERIFY THAT THE SEEK COMMAND ABORTS DURING COMMAND EXECUTION.
2192
2193                                        TO VERIFY THAT "OPI" SETS, IF ON CYLINDER LATCH DOES NOT CLEAR.
2194
2195                                        TO VERIFY THAT "ATA" SETS, IF THE DRIVE COMPLETES THE SEEK COMMAND.
2196
2197                                        TO VERIFY THAT THE SEEK COMMAND ABORTS AFTER EXECUTION DURING A WAIT
2198                                     LOOP.
2199
2200                                        TO VERIFY THE TAG BUS DURING A SEEK COMMAND.
2201
2202                                    PROCEDURE:
2203
2204                                        THE  PROGRAM  EXECUTES  THE  FOLLOWING  COMMANDS  USING  THE
2205                                    MAINTANCE DEBUG CLOCK AND EXPECTS THE RESULTS FOLLOWING EACH COMMAND.
2206
2207                                        EXECUTE SEEK COMMAND, DROP UNIT READY AND VERIFY THAT "OPI" IS SET.
2208
2209                                        EXECUTE SEEK COMMAND, SET DRIVE FAULT ("MDF" IN RMMR1) TO CAUSE
2210                                    COMMAND ABORT AND VERIFY THAT "GO" IS RESET.
2211
2212                                        EXECUTE SEEK COMMAND, VERIFY THAT "OPI" IS SET WHEN ON CYLINDER
2213                                    LATCH IS NOT CLEARED.
2214
2215                                        EXECUTE SEEK COMMAND, DROP ON CYLINDER TO RESET LATCH, THEN SET
2216                                    ON CYLINDER AGAIN AND VERIFY THAT "ATA" IS SET.
2217
2218                                        EXECUTE SEEK COMMAND, DROP ON CYLINDER TO RESET LATCH, LEAVE ON
2219                                    CYLINDER RESET AND VERIFY THAT "GO" IS STILL SET.
2220
2221                                        EXECUTE SEEK COMMAND AND VERIFY THAT THE TAG BUS IS CORRECT
2222                                    ACCORDING A PRE-DETERMINED TABLE.
2223
```

```
                                    PROBABLE FAULT:

                                    1.  CS MODULE




                                TEST 114 SEARCH TEST

                                        TO VERIFY THAT "OPI" SETS, IF UNIT READY DROPS DURING SEARCH COMMAND
                                    EXECUTION.

                                        TO VERIFY THAT THE SEARCH COMMAND ABORTS DURING COMMAND EXECUTION.

                                        TO VERIFY THAT "OPI" SETS, IF ON CYLINDER LATCH DOES NOT CLEAR.

                                        TO VERIFY THAT "ATA" SETS, IF THE DRIVE COMPLETES THE SEARCH COMMAND.

                                        TO VERIFY THAT THE SEARCH COMMAND ABORTS AFTER EXECUTION DURING A
                                     WAIT LOOP.

                                        TO VERIFY THAT SEARCH COMMAND ABORTS DURING SECTOR COMPARE LOOP

                                        TO VERIFY THE TAG BUS DURING A SEARCH COMMAND.

                                    PROCEDURE:

                                        THE  PROGRAM  EXECUTES  THE  FOLLOWING  COMMANDS  USING  THE
                                    MAINTANCE DEBUG CLOCK AND EXPECTS THE RESULTS FOLLOWING EACH COMMAND.

                                        EXECUTE SEARCH COMMAND, DROP UNIT READY AND VERIFY THAT "OPI" IS SET.

                                        EXECUTE SEARCH COMMAND, SET DRIVE FAULT ("MDF" IN RMMR1) TO CAUSE
                                    COMMAND ABORT AND VERIFY THAT "GO" IS RESET.

                                        EXECUTE SEARCH COMMAND, VERIFY THAT "OPI" IS SET WHEN ON CYLINDER
                                    LATCH IS NOT CLEARED.

                                        EXECUTE SEARCH COMMAND, DROP ON CYLINDER TO RESET LATCH, THEN SET
                                    ON CYLINDER AGAIN AND VERIFY THAT "ATA" IS SET.

                                        EXECUTE SEARCH COMMAND, DROP ON CYLINDER TO RESET LATCH, LEAVE ON
                                    CYLINDER RESET AND VERIFY THAT "GO" IS STILL SET.

                                        EXECUTE SEARCH COMMAND, WHILE IN SECTOR COMPARE LOOP, SET DRIVE
                                    FAULT ("MDF" IN RMMR1) TO CAUSE COMMAND ABORT AND VERIFY THAT "ATA" IS
                                    SET.

                                        EXECUTE SEARCH COMMAND AND VERIFY THAT THE TAG BUS IS CORRECT
                                    ACCORDING A PRE-DETERMINED TABLE.

                                    PROBABLE FAULT:

                                    1.  CS MODULE
```

```
2281
2282
2283
2284                          TEST 115 SEARCH TIMEOUT TEST
2285
2286                               PURPOSE:
2287
2288                                    TO VERIFY THAT ''OPI'' SETS, IF ''MSEN'' (SEARCH TIMEOUT ENABLE) IS
2289                               DROPPED DURING SEARCH COMMAND EXECUTION.
2290
2291                               PROCEDURE:
2292
2293                                    EXECUTE SEARCH COMMAND, VERIFY THAT ''OPI'' IS SET WHEN ''MSEN'' IS
2294                               CLEARED.
2295
2296                               PROBABLE FAULT:
2297
2298                               1.  CS MODULE
2299
2300
2301
2302
2303
2304                          TEST 116 - 120 DATA COMMAND TESTS (1, 2, 3)
2305
2306                               PURPOSE:
2307
2308                                    TO VERIFY THE COMMAND SEQUENCER DURING DATA COMMANDS.
2309
2310                               PROCEDURE:
2311
2312                                    THIS TEST, LIKE RECALIBRATE, SEEK, AND  SEARCH  TESTS,  USES
2313                               THE  MAINTENANCE  REGISTER TO SIMULATE DRIVE CONDITIONS AND FORCE
2314                               THE COMMAND SEQUENCER THROUGH EACH BRANCH PATH.  ADDITIONAL ITEMS
2315                               WHICH ARE TESTED INCLUDE OFFSET PLUS AND MINUS ON THE TAG BUS AND
2316                               ''ENABLE SEARCH'', BIT 11 OF RMMR1.
2317
2318                               PROBABLE FAULT:
2319
2320                               1.  CS MODULE
2321
2322
2323
2324
2325
2326                          \
```

```
                        ;*LAST REVISION 07-AUG-81
695
696                     .TITLE  CZRNBA0 RM80 DSKLS PT1
                        ;*COPYRIGHT (C) 1982
                        ;*DIGITAL EQUIPMENT CORPORATION
                        ;*COLORADO SPGS., CO. 80919
                        ;*
                        ;*PROGRAM BY MIKE LEAVITT
                        ;*
                        ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                        ;*PACKAGE (MAINDEC-11-DZQAC-C5), 18-MAR-81
                        ;*
697                     .SBTTL  OPERATIONAL SWITCH SETTINGS
                        ;*
                        ;*      SWITCH                  USE
                        ;*      ------          --------------------
                        ;*        15            HALT ON ERROR
                        ;*        14            LOOP ON TEST
                        ;*        13            INHIBIT ERROR TYPEOUTS
                        ;*        11            INHIBIT ITERATIONS
                        ;*        10            BELL ON ERROR
                        ;*         9            LOOP ON ERROR
                        ;*         8            LOOP ON TEST IN SWR<7:0>
698                     ;*         7            TN128
                        ;*         6            TN64
                        ;*         5            TN32
                        ;*         4            TN16
                        ;*         3            TN8
                        ;*         2            TN4
                        ;*         1            TN2
                        ;*         0            TN1
699
700                     .SBTTL  BASIC DEFINITIONS

                        ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
001100                  STACK   = 1100
104000                  ERROR   = EMT           ;;BASIC DEFINITION OF ERROR CALL
000004                  SCOPE   = IOT           ;;BASIC DEFINITION OF SCOPE CALL

                        ;*MISCELLANEOUS DEFINITIONS
000011                  HT      = 11            ;;CODE FOR HORIZONTAL TAB
000012                  LF      = 12            ;;CODE FOR LINE FEED
000015                  CR      = 15            ;;CODE FOR CARRIAGE RETURN
000200                  CRLF    = 200           ;;CODE FOR CARRIAGE RETURN-LINE FEED
177776                  PS      = 177776        ;;PROCESSOR STATUS WORD
177776                  PSW=PS
177774                  STKLMT  = 177774        ;;STACK LIMIT REGISTER
177772                  PIRQ    = 177772        ;;PROGRAM INTERRUPT REQUEST REGISTER
177570                  DSWR    = 177570        ;;HARDWARE SWITCH REGISTER
177570                  DDISP   = 177570        ;;HARDWARE DISPLAY REGISTER

                        ;*GENERAL PURPOSE REGISTER DEFINITIONS
000000                  R0      = %0            ;;GENERAL REGISTER
000001                  R1      = %1            ;;GENERAL REGISTER
000002                  R2      = %2            ;;GENERAL REGISTER
000003                  R3      = %3            ;;GENERAL REGISTER
000004                  R4      = %4            ;;GENERAL REGISTER
```

```
BASIC DEFINITIONS

                        R5      = %5            ;;GENERAL REGISTER
                        R6      = %6            ;;GENERAL REGISTER
                        R7      = %7            ;;GENERAL REGISTER
                        SP      = %6            ;;STACK POINTER
                        PC      = %7            ;;PROGRAM COUNTER

                        ;*PRIORITY LEVEL DEFINITIONS
                        PR0     = 0             ;;PRIORITY LEVEL 0
                        PR1     = 40            ;;PRIORITY LEVEL 1
                        PR2     = 100           ;;PRIORITY LEVEL 2
                        PR3     = 140           ;;PRIORITY LEVEL 3
                        PR4     = 200           ;;PRIORITY LEVEL 4
                        PR5     = 240           ;;PRIORITY LEVEL 5
                        PR6     = 300           ;;PRIORITY LEVEL 6
                        PR7     = 340           ;;PRIORITY LEVEL 7

                        ;*''SWITCH REGISTER'' SWITCH DEFINITIONS
                        SW15    = 100000
                        SW14    = 40000
                        SW13    = 20000
                        SW12    = 10000
                        SW11    = 4000
                        SW10    = 2000
                        SW09    = 1000
                        SW08    = 400
                        SW07    = 200
                        SW06    = 100
                        SW05    = 40
                        SW04    = 20
                        SW03    = 10
                        SW02    = 4
                        SW01    = 2
                        SW00    = 1
                        SW9=SW09
                        SW8=SW08
                        SW7=SW07
                        SW6=SW06
                        SW5=SW05
                        SW4=SW04
                        SW3=SW03
                        SW2=SW02
                        SW1=SW01
                        SW0=SW00

                        ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
                        BIT15   = 100000
                        BIT14   = 40000
                        BIT13   = 20000
                        BIT12   = 10000
                        BIT11   = 4000
                        BIT10   = 2000
                        BIT09   = 1000
                        BIT08   = 400
                        BIT07   = 200
                        BIT06   = 100
                        BIT05   = 40
                        BIT04   = 20
```

BASIC DEFINITIONS

```
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

                        ;*BASIC "CPU" TRAP VECTOR ADDRESSES
000004                  ERRVEC  = 4             ;;TIME OUT AND OTHER ERRORS
000010                  RESVEC  = 10            ;;RESERVED AND ILLEGAL INSTRUCTIONS
000014                  TBITVEC = 14            ;;"T" BIT
000014                  TRTVEC  = 14            ;;TRACE TRAP
000014                  BPTVEC  = 14            ;;BREAKPOINT TRAP (BPT)
000020                  IOTVEC  = 20            ;;INPUT/OUTPUT TRAP (IOT) **SCOPE**
000024                  PWRVEC  = 24            ;;POWER FAIL
000030                  EMTVEC  = 30            ;;EMULATOR TRAP (EMT) **ERROR**
000034                  TRAPVEC = 34            ;;"TRAP" TRAP
000060                  TKVEC   = 60            ;;TTY KEYBOARD VECTOR
000064                  TPVEC   = 64            ;;TTY PRINTER VECTOR
000240                  PIRQVEC = 240           ;;PROGRAM INTERRUPT REQUEST VECTOR
```

```
                        .SBTTL  RM80 REGISTER BIT DEFINITIONS

                        ;*RMCS. CONTROL STATUS REGISTER

004000                  DVA     = BIT11                 ;DEVICE AVAILABLE-READ ONLY
000040                  F4      = BIT05                 ;FUNCTION CODE
000020                  F3      = BIT04                 ;FUNCTION CODE
000010                  F2      = BIT03                 ;FUNCTION CODE
000004                  F1      = BIT02                 ;FUNCTION CODE
000002                  F0      = BIT01                 ;FUNCTION CODE
000001                  GO      = BIT00                 ;GO BIT
000077                  FNCMSK  = 000077                ;FUNCTION CODE MASK

                        ;FUNCTION CODES (BITS 01-05 OF RMCS1)
000000                  NOP     = 000000                ;NOP COMMAND
000002                  ILF02   = 000002                ;ILLEGAL COMMAND
000004                  SEEK    = 000004                ;SEEK COMMAND
000006                  RECAL   = 000006                ;RECALIBRATE COMMAND
000010                  DRVCLR  = 000010                ;DRIVE CLEAR COMMAND
000012                  RLEASE  = 000012                ;RELEASE COMMAND
000014                  OFFSET  = 000014                ;OFFSET COMMAND
000016                  RTC     = 000016                ;RETURN TO CENTERLINE COMMAND
000020                  RIP     = 000020                ;READ IN PRESET COMMAND
000022                  PAKACK  = 000022                ;PACK ACKNOWLEDGE COMMAND
000022                  PACACK  = PAKACK
000024                  ILF24   = 000024                ;ILLEGAL COMMAND
000026                  ILF26   = 000026                ;ILLEGAL COMMAND
000030                  SEARCH  = 000030                ;SEARCH COMMAND
```

RM80 REGISTER BIT DEFINITIONS

```
    732         000030                  ILF30   = 000030                ;ILLEGAL COMMAND
                000032                  ILF32   = 000032                ;ILLEGAL COMMAND
                000034                  ILF34   = 000034                ;ILLEGAL COMMAND
                000036                  ILF36   = 000036                ;ILLEGAL COMMAND
                000040                  ILF40   = 000040                ;ILLEGAL COMMAND
                000042                  ILF42   = 000042                ;ILLEGAL COMMAND
                C00044                  ILF44   = 000044                ;ILLEGAL COMMAND
                000046                  ILF46   = 000046                ;ILLEGAL COMMAND
    733         000050                  WCD     = 000050                ;WRITE CHECK DATA COMMAND
    734         000052                  WCH     = 000052                ;WRITE CHECK HEADER AND DATA
    735         000054                  ILF54   = 000054                ;ILLEGAL COMMAND
    736         000056                  ILF56   = 000056                ;ILLEGAL COMMAND
    737         000060                  WD      = 000060                ;WRITE DATA COMMAND
    738         000062                  WH      = 000062                ;WRITE HEADER AND DATA COMMAND
    739         000064                  ILF64   = 000064                ;ILLEGAL COMMAND
    740         000066                  ILF66   = 000066                ;ILLEGAL COMMAND
    741         000070                  RD      = 000070                ;READ DATA COMMAND
    742         000072                  RH      = 000072                ;READ HEADER AND DATA COMMAND
    743         000074                  ILF74   = 000074                ;ILLEGAL COMMAND
    744         000076                  ILF76   = 000076                ;ILLEGAL COMMAND
    745
    746                                 ;*RMDA  DISK ADDRESS REGISTER
    747
    748                                 ;TRACK ADDRESS DEFINITIONS
    749         004000                  TA8     = BIT11                 ;TRACK ADDRESS 8.
    750         002000                  TA4     = BIT10                 ;TRACK ADDRESS 4
    751         001000                  TA2     = BIT09                 ;TRACK ADDRESS 2
    752         000400                  TA1     = BIT08                 ;TRACK ADDRESS 1
    753
    754                                 ;SECTOR ADDRESS DEFINITIONS
    755         000020                  SA16    = BIT04                 ;SECTOR ADDRESS 16.
    756         000010                  SA8     = BIT03                 ;SECTOR ADDRESS 8.
    757         000004                  SA4     = BIT02                 ;SECTOR ADDRESS 4
    758         000002                  SA2     = BIT01                 ;SECTOR ADDRESS 2
    759         000001                  SA1     = BIT00                 ;SECTOR ADDRESS 1
    760
    761                                 ;TRACK & SECTOR MASKS
    762         177400                  TADMSK  = 177400                ;TRACK ADDRESS MASK
    763         000377                  SADMSK  = 000377                ;SECTOR ADDRESS MASK
    764
    765                                 ;*RMDS  DRIVE STATUS REGISTER
    766
    767         100000                  ATA     = BIT15                 ;ATTENTION ACTIVE
    768         040000                  ERR     = BIT14                 ;COMPOSITE ERROR
    769         020000                  PIP     = BIT13                 ;POSITIONING IN PROGRESS
    770         010000                  MOL     = BIT12                 ;MEDIUM ON LINE
    771         004000                  WRL     = BIT11                 ;WRITE LOCK
    772         002000                  LBT     = BIT10                 ;LAST BLOCK TRANSFERRED
    773         001000                  PGM     = BIT09                 ;PROGRAMMABLE
    774         000400                  DPR     = BIT08                 ;DRIVE PRESENT
    775         000200                  DRY     = BIT07                 ;DRIVE READY
    776         000100                  VV      = BIT06                 ;VOLUME VALID
    777         000001                  OM      = BIT00                 ;OFFSET MODE ACTIVE
    778
    779                                 ;*RMER1 ERROR REGISTER #1
    780
    781         100000                  DCK     = BIT15                 ;DATA CHECK ERROR
```

RM80 REGISTER BIT DEFINITIONS

```
782     040000          UNS     = BIT14                 ;DRIVE UNSAFE
783     020000          OPI     = BIT13                 ;OPERATION INCOMPLETE
784     010000          DTE     = BIT12                 ;DRIVE TIMING ERROR
785     004000          WLE     = BIT11                 ;WRITE LOCK ERROR
786     002000          IAE     = BIT10                 ;INVALID ADDRESS ERROR
787     001000          AOE     = BIT09                 ;ADDRESS OVERFLOW ERROR
788     000400          HCRC    = BIT08                 ;HEADER CRC ERROR
789     000200          HCE     = BIT07                 ;HEADER COMPARE ERROR
790     000100          ECH     = BIT06                 ;ECC "HARD" ERROR
791     000040          WCF     = BIT05                 ;WRITE CLOCK FAILURE
792     000020          FER     = BIT04                 ;FORMAT ERROR
793     000010          PAR     = BIT03                 ;PARITY ERROR
794     000004          RMR     = BIT02                 ;REGISTER MODIFICATION REFUSED
795     000002          ILR     = BIT01                 ;ILLEGAL REGISTER
796     000001          ILF     = BIT00                 ;ILLEGAL FUNCTION
797
798     115760          NDTMSK  = DCK!DTE!WLE!AOE!HCRC!HCE!ECH!WCF!FER
799                     ;"NDTMSK" IS USED TO MASK ERROR REGISTER 1 DURING NON - DATA
800                     ;COMMANDS, I.E., HOUSEKEEPING AND POSITIONING COMMANDS
801
802                     ;*RMAS  ATTENTION SUMMARY REGISTER
803
804     000377          ATNMSK  = 377                   ;MASK FOR ATTENTION BITS
805
806                     ;*RMLA  LOOK AHEAD REGISTER
807
808     002000          SC4     = BIT10                 ;SECTOR COUNT = 16
809     001000          SC3     = BIT09                 ;SECTOR COUNT = 8
810     000400          SC2     = BIT08                 ;SECTOR COUNT = 4
811     000200          SC1     = BIT07                 ;SECTOR COUNT = 2
812     000100          SC0     = BIT06                 ;SECTOR COUNT = 1
813
814     003700          SCTMSK  = 003700                ;SECTOR COUNT MASK
815
816                     ;*RMMR1 MAINTENANCE REGISTER #1
817
818                     ;WRITE ONLY BITS
819     100000          DBCK    = BIT15                 ;DEBUG CLOCK
820     040000          DBEN    = BIT14                 ;DEBUG CLOCK ENABLE
821     020000          DEBL    = BIT13                 ;DIAGNOSTIC END OF BLOCK
822     010000          MSEN    = BIT12                 ;SEARCH TIMEOUT ENABLE
823     004000          MCLK    = BIT11                 ;MAINTENANCE CLOCK
824     002000          MRD     = BIT10                 ;READ DATA
825     001000          MUR     = BIT09                 ;UNIT READY
826     000400          MOC     = BIT08                 ;ON CYLINDER
827     000200          MSER    = BIT07                 ;SEEK ERROR
828     000100          MDF     = BIT06                 ;DRIVE FAULT
829     000040          MS      = BIT05                 ;SECTOR PULSE
830     000010          MWP     = BIT03                 ;WRITE PROTECT
831     000004          MI      = BIT02                 ;INDEX PULSE
832     000002          MSC     = BIT01                 ;SECTOR COMPARE
833     000001          DMD     = BIT00                 ;DIAGNOSTIC MODE
834
835                     ;READ ONLY BITS
836     100000          OCC     = BIT15                 ;OCCUPIED
837     040000          RG      = BIT14                 ;RUN AND GO
838     020000          EBL     = BIT13                 ;END OF BLOCK
```

RM80 REGISTER BIT DEFINITIONS

```
                        REX     = BIT12                 ;EXCEPTION
                        ESRC    = BIT11                 ;ENABLE SEARCH
                        PLFS    = BIT10                 ;LOOKING FOR SYNC
                        ECRC    = BIT09                 ;ENABLE CRC OUT
                        PDA     = BIT08                 ;DATA AREA
                        PHA     = BIT07                 ;HEADER AREA
                        CONT    = BIT06                 ;CONTINUE
                        WC      = BIT05                 ;WORD CLOCK
                        EECC    = BIT04                 ;ENABLE ECC OUT
                        MWD     = BIT03                 ;WRITE DATA BIT
                        LS      = BIT02                 ;LAST SECTOR
                        LST     = BIT01                 ;LAST SECTOR AND TRACK
                        DMD     = BIT00                 ;DIAGNOSTIC MODE
051401                  MR1AAA  = DMD!MUR!DBEN!MOC!MSEN

                        ;*RMDT  DRIVE TYPE REGISTER

100000                  NSA     = BIT15                 ;NOT SECTOR ADDRESSED = 0
040000                  TAP     = BIT14                 ;TAPE DRIVE = 0
020000                  MOH     = BIT13                 ;MOVING HEAD = 1
004000                  DRQ     = BIT11                 ;DRIVE REQUEST REQUIRED

020026                  SNGPRT  = 020026                ;SINGLE PORT DRIVE TYPE
024026                  DULPRT  = 024026                ;DUAL PORT DRIVE TYPE

                        ;*RMOF  OFFSET REGISTER

010000                  FMT16   = BIT12                 ;16 BIT WORD FORMAT
004000                  ECI     = BIT11                 ;ECC INHIBIT
002000                  HCI     = BIT10                 ;HEADER COMPARE INHIBIT
001000                  SSEI    = BIT09                 ;SKIP SECTOR ERROR INHIBIT
000200                  OFD     = BIT07                 ;OFFSET FORWARD
160577                  XNUOF   = 160577                ;UNSED BITS OF RMOF

                        ;*RMDC  DESIRED CYLINDER ADDRESS REGISTER

001777                  CYLMSK  = 001777                ;MASK FOR CYLINDER ADDRESS
176000                  XNUDC   = 176000                ;UNSED BITS OF RMDC

                        ;*RMMR2 MAINTENANCE REGISTER #2

                        ;READ ONLY BITS
100000                  RQA     = BIT15                 ;PORT A REQUEST
040000                  RQB     = BIT14                 ;PORT B REQUEST
020000                  TAG     = BIT13                 ;TAG CONTROL
010000                  TST     = BIT12                 ;COMMAND SEQUENCE TEST BIT
004000                  CC      = BIT11                 ;CONTROL OR CYLINDER TAG
002000                  CH      = BIT10                 ;CONTROL OR HEAD TAG
001000                  BB09    = BIT09                 ;TAG BUS
000400                  BB08    = BIT08                 ;TAG BUS
000200                  BB07    = BIT07                 ;TAG BUS
000100                  BB06    = BIT06                 ;TAG BUS
000040                  BB05    = BIT05                 ;TAG BUS
000020                  BB04    = BIT04                 ;TAG BUS
000010                  BB03    = BIT03                 ;TAG BUS
000004                  BB02    = BIT02                 ;TAG BUS
000002                  BB01    = BIT01                 ;TAG BUS
```

```
RM80 REGISTER BIT DEFINITIONS

                000001          BB00    = BIT00                 ;TAG BUS
    890
    891                         ;*RMER2 ERROR REGISTER 2
    892
    893         100000          BSE     = BIT15                 ;BAD SECTOR ERROR
    894         040000          SKI     = BIT14                 ;SEEK INCOMPLETE
    895         020000          OPE     = BIT13                 ;OPERATOR PLUG ERROR
    896         010000          IVC     = BIT12                 ;INVALID COMMAND ERROR
    897         004000          LSC     = BIT11                 ;LOSS OF SYSTEM CLOCK
    898         002000          LBC     = BIT10                 ;LOSS OF BIT CLOCK
    899         000200          DVC     = BIT07                 ;DEVICE CHECK
    900         000040          SSE     = BIT05                 ;SKIP SECTOR ERROR
    901         000010          DPE     = BIT03                 ;DATA PARITY ERROR
    902         001527          XNUER2  = 001527                ;UNSED BITS OF RMER2
    903
    904                         .SBTTL  PROGRAM MNEMONICS
    905
    906         100000          MSE     = BIT15                 ;MANUFACTURING DETECTED SECTOR ERROR
    907         040000          USE     = BIT14                 ;USER DETECTED SECTOR ERROR
    908         020000          SSF     = BIT13                 ;SKIP SECTOR FAILURE
    909
    910                         .SBTTL  RM80 REGISTER INDEX VALUES
    911
    912         000000          RMCS1   = 00                    ;CONTROL STATUS REGISTER #1
    913         000006          RMDA    = 06                    ;DISK ADDRESS REGISTER
    914         000012          RMDS    = 12                    ;DRIVE STATUS REGISTER
    915         000014          RMER1   = 14                    ;ERROR REGISTER #1
    916         000016          RMAS    = 16                    ;ATTENTION SUMMARY REGISTER
    917         000020          RMLA    = 20                    ;LOOK AHEAD REGISTER
    918         000024          RMMR1   = 24                    ;MAINTENANCE REGISTER
    919         000026          RMDT    = 26                    ;DRIVE TYPE REGISTER
    920         000030          RMSN    = 30                    ;SERIAL NUMBER REGISTER
    921         000032          RMOF    = 32                    ;OFFSET REGISTER
    922         000034          RMDC    = 34                    ;DESIRED CYLINDER REGISTER
    923         000036          RMHR    = 36                    ;HOLDING REGISTER
    924         000040          RMMR2   = 40                    ;MAINTENANCE REGISTER #2
    925         000042          RMER2   = 42                    ;ERROR REGISTER #2
    926         000044          RMEC1   = 44                    ;ECC POSITION REGISTER
    927         000046          RMEC2   = 46                    ;ECC PATTERN REGISTER
    930         000050          ILRG50  = 50                    ;ILLEGAL REGISTER 50
                000052          ILRG52  = 52                    ;ILLEGAL REGISTER 52
                000054          ILRG54  = 54                    ;ILLEGAL REGISTER 54
                000056          ILRG56  = 56                    ;ILLEGAL REGISTER 56
                000060          ILRG60  = 60                    ;ILLEGAL REGISTER 60
                000062          ILRG62  = 62                    ;ILLEGAL REGISTER 62
                000064          ILRG64  = 64                    ;ILLEGAL REGISTER 64
                000066          ILRG66  = 66                    ;ILLEGAL REGISTER 66
                000070          ILRG70  = 70                    ;ILLEGAL REGISTER 70
                000072          ILRG72  = 72                    ;ILLEGAL REGISTER 72
                000074          ILRG74  = 74                    ;ILLEGAL REGISTER 74
                000076          ILRG76  = 76                    ;ILLEGAL REGISTER 76
    931
    932
    933         000077          IDXMSK  = 77                    ;MASK FOR REGISTER INDEX NUMBER
    934
    935                         .SBTTL  RH CONTROLLER REGISTER BIT DEFINITIONS
    936
```

RH CONTROLLER REGISTER BIT DEFINITIONS

```
                                ;*RMCS1 CONTROL STATUS REGISTER #1

100000                          SC      = BIT15         ;SPECIAL CONDITION-READ ONLY
040000                          TRE     = BIT14         ;TRANSFER ERROR
020000                          MCPE    = BIT13         ;MASSBUS CONTROL BUS PARITY ERROR-READ ONLY
002000                          PSEL    = BIT10         ;PORT B SELECT
001000                          A17     = BIT09         ;ADDRESS EXTENSION
000400                          A16     = BIT08         ;ADDRESS EXTENSION
000200                          RDY     = BIT07         ;READY-READ ONLY
000100                          IE      = BIT06         ;INTERRUPT ENABLE

                                ;*RMCS2 RH CONTROL STATUS REGISTER #2

100000                          DLT     = BIT15         ;DATA LATE-READ ONLY
040000                          WCE     = BIT14         ;WRITE CHECK ERROR-READ ONLY
020000                          UPE     = BIT13         ;UNIBUS PARITY ERROR
010000                          NED     = BIT12         ;NONEXISTANT DRIVE-READ ONLY
004000                          NEM     = BIT11         ;NONEXISTANT MEMORY-READ ONLY
002000                          PGE     = BIT10         ;PROGRAM ERROR-READ ONLY
001000                          MXF     = BIT09         ;MISSED TRANSFER
000400                          MDPE    = BIT08         ;MASSBUS DATA BUS PARITY ERROR-READ ONLY
000200                          OR      = BIT07         ;OUTPUT READY-READ ONLY
000100                          IR      = BIT06         ;INPUT READY-READ ONLY
000040                          CLR     = BIT05         ;CONTROLLER CLEAR
000020                          PAT     = BIT04         ;PARITY TEST
000010                          BAI     = BIT03         ;UNIBUS ADDRESS INCREMENT INHIBIT
000004                          U2      = BIT02         ;UNIT SELECT
000002                          U1      = BIT01         ;UNIT SELECT
000001                          U0      = BIT00         ;UNIT SELECT

                                ;UNIT SELECT MASK

000007                          UNTMSK  = 7             ;UNIT SELECT MASK

                                ;*RMCS3 RH70 CONTROL STATUS REGISTER #3

100000                          APE     = BIT15         ;ADDRESS PARITY ERROR
040000                          DPEHI   = BIT14         ;DATA PARITY ERROR HIGH WORD
020000                          DPELO   = BIT13         ;DATA PARITY ERROR LOW WORD
010000                          WCEHI   = BIT12         ;WRITE CHECK ERROR HIGH WORD
004000                          WCELO   = BIT11         ;WRITE CHECK ERROR LOW WORD
002000                          DBL     = BIT10         ;DOUBLE WORD TRANSFER
000100                          IE      = BIT06         ;INTERRUPT ENABLE
000010                          IPCK3   = BIT03         ;INVERT PARITY CHECK
000004                          IPCK2   = BIT02         ;INVERT PARITY CHECK
000002                          IPCK1   = BIT01         ;INVERT PARITY CHECK
000001                          IPCK0   = BIT00         ;INVERT PARITY CHECK

                                .SBTTL  RH CONTROLLER REGISTER INDEX VALUES

000000                          RMCS1   = 00            ;CONTROL, STATUS REGISTER #1
000002                          RMWC    = 02            ;WORD COUNT REGISTER
000004                          RMBA    = 04            ;BUS ADDRESS REGISTER
000010                          RMCS2   = 10            ;CONTROL, STATUS REGISTER #2
000022                          RMDB    = 22            ;DATA BUFFER
000050                          RMBAE   = 50            ;BUS ADDRESS EXTENSION
000052                          RMCS3   = 52            ;CONTROL, STATUS REGISTER #3
```

RH CONTROLLER REGISTER INDEX VALUES

```
994
995          176700                  ABASE   = 176700                ;UNIBUS ADDRESS
996          120254                  AVECT1  = 120254                ;UNIBUS VECTOR ADDRESS AND PRIORITY
997
```

TRAP CATCHER

```
                                .SBTTL  TRAP CATCHER

                000000                  .=0
                                ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ".+2,HALT"
                                ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
                                ;*LOCATION 0 CONTAIN 0 TO CATCH IMPROPERLY LOADED VECTORS
                000174          .=174
  000174        000000  DISPREG: .WORD  0              ;;SOFTWARE DISPLAY REGISTER
  000176        000000  SWREG:   .WORD  0              ;;SOFTWARE SWITCH REGISTER

                                .SBTTL  STARTING ADDRESS(ES)

  000200  000137  004652        JMP     @#START         ;;JUMP TO STARTING ADDRESS OF PROGRAM
2
3 000204  000137  004642        JMP     @#START1        ;CHANGE RH/RM BUS ADDRESS
4
5                               .SBTTL  ACT11 HOOKS

                                ;;**************************************************************
                                ;HOOKS REQUIRED BY ACT11
                                        $SVPC=.                 ;SAVE PC
                000210          .=46
                000046          $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .$EOP
  000046        054302          .=52
                000052          .WORD   0               ;;2)SET LOC.52 TO ZERO
  000052        000000          .=$SVPC                 ;; RESTORE PC
                000210
11
12              001100  .=1100
13                              .SBTTL  APT PARAMETER BLOCK

                                ;;**************************************************************
                                ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
                                ;;**************************************************************
                001100          .$X=.   ;;SAVE CURRENT LOCATION
                000024          .=24    ;;SET POWER FAIL TO POINT TO START OF PROGRAM
  000024        000200          200     ;;FOR APT START UP
                000044          .=44    ;;POINT TO APT INDIRECT ADDRESS PNTR.
  000044        001100          $APTHDR ;;POINT TO APT HEADER BLOCK
                001100          .=.$X   ;;RESET LOCATION COUNTER
                                ;;**************************************************************
                                ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
                                ;INTERFACE SPEC.

  001100                        $APTHD:
  001100  000000                $HIBTS: .WORD   0       ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
  001102  001222                $MBADR: .WORD   $MAIL   ;;ADDRESS OF APT MAILBOX (BITS 0-15)
  001104  000024                $TSTM:  .WORD   20.     ;;RUN TIM OF LONGEST TEST
  001106  000024                $PASTM: .WORD   20.     ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
  001110  000024                $UNITM: .WORD   20.     ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDED UNIT
  001112  000042                        .WORD   $ETEND-$MAIL/2  ;;LENGTH MAILBOX-ETABLE(WORDS)
14              001114  TAGADR=.
```

```
      0                                 .SBTTL  COMMON TAGS

                                        ;;*****************************************************************
                                        ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
                                        ;*USED IN THE PROGRAM.

            001114                              .=TAGADR
      001114                            $CMTAG:                         ;;START OF COMMON TAGS
      001114  000000                            .WORD   0
      001116     000                    $TSTNM: .BYTE   0               ;;CONTAINS THE TEST NUMBER
      001117     000                    $ERFLG: .BYTE   0               ;;CONTAINS ERROR FLAG
      001120  000000                    $ICNT:  .WORD   0               ;;CONTAINS SUBTEST ITERATION COUNT
      001122  000000                    $LPADR: .WORD   0               ;;CONTAINS SCOPE LOOP ADDRESS
      001124  000000                    $LPERR: .WORD   0               ;;CONTAINS SCOPE RETURN FOR ERRORS
      001126  000000                    $ERTTL: .WORD   0               ;;CONTAINS TOTAL ERRORS DETECTED
      001130     000                    $ITEMB: .BYTE   0               ;;CONTAINS ITEM CONTROL BYTE
      001131     001                    $ERMAX: .BYTE   1               ;;CONTAINS MAX. ERRORS PER TEST
      001132  000000                    $ERRPC: .WORD   0               ;;CONTAINS PC OF LAST ERROR INSTRUCTION
      001134  000000                    $GDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'GOOD' DATA
      001136  000000                    $BDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'BAD' DATA
      001140  000000                    $GDDAT: .WORD   0               ;;CONTAINS 'GOOD' DATA
      001142  000000                    $BDDAT: .WORD   0               ;;CONTAINS 'BAD' DATA
      001144  000000                            .WORD   0               ;;RESERVED--NOT TO BE USED
      001146  000000                            .WORD   0
      001150     000                    $AUTOB: .BYTE   0               ;;AUTOMATIC MODE INDICATOR
      001151     000                    $INTAG: .BYTE   0               ;;INTERRUPT MODE INDICATOR
      001152  000000                            .WORD   0
      001154  177570                    SWR:    .WORD   DSWR            ;;ADDRESS OF SWITCH REGISTER
      001156  177570                    DISPLAY: .WORD  DDISP           ;;ADDRESS OF DISPLAY REGISTER
      001160  177560                    $TKS:   177560                  ;;TTY KBD STATUS
      001162  177562                    $TKB:   177562                  ;;TTY KBD BUFFER
      001164  177564                    $TPS:   177564                  ;;TTY PRINTER STATUS REG. ADDRESS
      001166  177566                    $TPB:   177566                  ;;TTY PRINTER BUFFER REG. ADDRESS
      001170     000                    $NULL:  .BYTE   0               ;;CONTAINS NULL CHARACTER FOR FILLS
      001171     002                    $FILLS: .BYTE   2               ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
      001172     012                    $FILLC: .BYTE   12              ;;INSERT FILL CHARS. AFTER A "LINE FEED"
      001173     000                    $TPFLG: .BYTE   0               ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
      001174  000000                    $TMP0:  .WORD   0               ;;USER DEFINED
      001176  000000                    $TMP1:  .WORD   0               ;;USER DEFINED
      001200  000000                    $TMP2:  .WORD   0               ;;USER DEFINED
      001202  000000                    $TMP3:  .WORD   0               ;;USER DEFINED
      001204  000000                    $TMP4:  .WORD   0               ;;USER DEFINED
      001206  000000                    $TIMES: 0                       ;;MAX. NUMBER OF ITERATIONS
      001210  000000                    $ESCAPE:0                       ;;ESCAPE ON ERROR ADDRESS
      001212     207     377     377     $BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
      001216     077                     $QUES:  .ASCII  /?/             ;;QUESTION MARK
      001217     015                     $CRLF:  .ASCII  <15>            ;;CARRIAGE RETURN
      001220     012     000             $LF:    .ASCIZ  <12>            ;;LINE FEED
                                        ;;*****************************************************************
                                        .SBTTL  APT MAILBOX-ETABLE

                                        ;;*****************************************************************
                                        .EVEN
      001222                            $MAIL:                          ;;APT MAILBOX
      001222  000000                    $MSGTY: .WORD   AMSGTY           ;;MESSAGE TYPE CODE
      001224  000000                    $FATAL: .WORD   AFATAL           ;;FATAL ERROR NUMBER
      001226  000000                    $TESTN: .WORD   ATESTN           ;;TEST NUMBER
```

APT MAILBOX-ETABLE

```
001230  000000                  $PASS:   .WORD    APASS    ;;PASS COUNT
001232  000000                  $DEVCT:  .WORD    ADEVCT   ;;DEVICE COUNT
001234  000000                  $UNIT:   .WORD    AUNIT    ;;I/O UNIT NUMBER
001236  000000                  $MSGAD:  .WORD    AMSGAD   ;;MESSAGE ADDRESS
001240  000000                  $MSGLG:  .WORD    AMSGLG   ;;MESSAGE LENGTH
001242                          $ETABLE:                   ;;APT ENVIRONMENT TABLE
001242     000                  $ENV:    .BYTE    AENV     ;;ENVIRONMENT BYTE
001243     000                  $ENVM:   .BYTE    AENVM    ;;ENVIRONMENT MODE BITS
001244  000000                  $SWREG:  .WORD    ASWREG   ;;APT SWITCH REGISTER
001246  000000                  $USWR:   .WORD    AUSWR    ;;USER SWITCHES
001250  000000                  $CPUOP:  .WORD    ACPUOP   ;;CPU TYPE,OPTIONS
                                ;*                         BITS 15-11=CPU TYPE
                                ;*                                 11/04=01,11/05=02,11/20=03,11/40=04,11/45=05
                                ;*                                 11/70=06,PDQ=07,Q=10
                                ;                          BIT 10=REAL TIME CLOCK
                                ;*                         BIT  9=FLOATING POINT PROCESSOR
                                ;*                         BIT  8=MEMORY MANAGEMENT
001252     000                  $MAMS1:  .BYTE    AMAMS1   ;;HIGH ADDRESS,M.S. BYTE
001253     000                  $MTYP1:  .BYTE    AMTYP1   ;;MEM. TYPE,BLK#1
                                ;*                         MEM.TYPE BYTE   --  (HIGH BYTE)
                                ;*                                 900 NSEC CORE=001
                                ;*                                 300 NSEC BIPOLAR=002
                                ;*                                 500 NSEC MOS=003
001254  000000                  $MADR1:  .WORD    AMADR1   ;;HIGH ADDRESS,BLK#1
                                ;*                           MEM.LAST ADDR.=3 BYTES,THIS WORD AND LOW OF "TYPE" ABOVE
001256     000                  $MAMS2:  .BYTE    AMAMS2   ;;HIGH ADDRESS,M.S. BYTE
001257     000                  $MTYP2:  .BYTE    AMTYP2   ;;MEM.TYPE,BLK#2
001260  000000                  $MADR2:  .WORD    AMADR2   ;;MEM.LAST ADDRESS,BLK#2
001262     000                  $MAMS3:  .BYTE    AMAMS3   ;;HIGH ADDRESS,M.S.BYTE
001263     000                  $MTYP3:  .BYTE    AMTYP3   ;;MEM.TYPE,BLK#3
001264  000000                  $MADR3:  .WORD    AMADR3   ;;MEM.LAST ADDRESS,BLK#3
001266     000                  $MAMS4:  .BYTE    AMAMS4   ;;HIGH ADDRESS,M.S.BYTE
001267     000                  $MTYP4:  .BYTE    AMTYP4   ;;MEM.TYPE,BLK#4
001270  000000                  $MADR4:  .WORD    AMADR4   ;;MEM.LAST ADDRESS,BLK#4
001272  120254                  $VECT1:  .WORD    AVECT1   ;;INTERRUPT VECTOR#1,BUS PRIORITY#1
001274  000000                  $VECT2:  .WORD    AVECT2   ;;INTERRUPT VECTOR#2BUS PRIORITY#2
001276  176700                  $BASE:   .WORD    ABASE    ;;BASE ADDRESS OF EQUIPMENT UNDER TEST
001300  000000                  $DEVM:   .WORD    ADEVM    ;;DEVICE MAP
001302  000000                  $CDW1:   .WORD    ACDW1    ;;CONTROLLER DESCRIPTION WORD#1
001304  000000                  $CDW2:   .WORD    ACDW2    ;;CONTROLLER DESCRIPTION WORD#2
001306  000000                  $DDW0:   .WORD    ADDW0    ;;DEVICE DESCRIPTOR WORD#0
001310  000000                  $DDW1:   .WORD    ADDW1    ;;DEVICE DESCRIPTOR WORD#1
001312  000000                  $DDW2:   .WORD    ADDW2    ;;DEVICE DESCRIPTOR WORD#2
001314  000000                  $DDW3:   .WORD    ADDW3    ;;DEVICE DESCRIPTOR WORD#3
001316  000000                  $DDW4:   .WORD    ADDW4    ;;DEVICE DESCRIPTOR WORD#4
001320  000000                  $DDW5:   .WORD    ADDW5    ;;DEVICE DESCRIPTOR WORD#5
001322  000000                  $DDW6:   .WORD    ADDW6    ;;DEVICE DESCRIPTOR WORD#6
001324  000000                  $DDW7:   .WORD    ADDW7    ;;DEVICE DESCRIPTOR WORD#7
001326                          $ETEND:
                                .MEXIT
```

USER DEFINED TAGS

```
                                .SBTTL  USER DEFINED TAGS

001326  000000                  AUTSIZ: .WORD   0       ;ALLOW AUTO DRIVE SIZING = 0, USE MANUALLY INPUT DRIVES = 1
001330  000000                  CHGADR: .WORD   0       ;CHANGE RH/RM BUS ADDRESS = -1, NO CHANGE = 0
001332  000000                  XXDP:   .WORD   0       ;THE LOW BYTE CONTAINS THE DRIVE NUMBER FROM WHICH
                                                        ;THE PROGRAM WAS LOADED. THE HIGH BYTE CONTAINS THE
                                                        ;'XXDP' DEVICE CODE FOR THE RM80.
001334      000                 LSTRK:  .BYTE   0       ;LO BYTE = 0
001335      015                         .BYTE   13.     ;HI BYTE, CONTAINS LAST TRACK ADDRESS OF UNIT
                                                        ;UNDER TEST. RM80 = 13.

                                ;THE REGISTER INPUT BUFFER IS USED FOR
                                ;STORING DRIVE STATUS

001336                          GETBUF:

                                ;REGISTER INPUT BUFFER
001336  000000                  RMCS1I: .WORD   0       ;CONTROL, STATUS REGISTER #1
001340  000000                  RMWCI:  .WORD   0       ;WORD COUNT REGISTER
001342  000000                  RMBAI:  .WORD   0       ;BUS ADDRESS REGISTER
001344  000000                  RMDAI:  .WORD   0       ;DISK ADDRESS REGISTER
001346  000000                  RMCS2I: .WORD   0       ;CONTROL, STATUS REGISTER #2
001350  000000                  RMDSI:  .WORD   0       ;DRIVE STATUS REGISTER
001352  000000                  RMER1I: .WORD   0       ;ERROR REGISTER #1
001354  000000                  RMASI:  .WORD   0       ;ATTENTION SUMMARY REGISTER
001356  000000                  RMLAI:  .WORD   0       ;LOOK AHEAD REGISTER
001360  000000                  RMDBI:  .WORD   0       ;DATA BUFFER
001362  000000                  RMMR1I: .WORD   0       ;MAINTENANCE REGISTER #1
001364  000000                  RMDTI:  .WORD   0       ;DRIVE TYPE REGISTER
001366  000000                  RMSNI:  .WORD   0       ;SERIAL NUMBER REGISTER
001370  000000                  RMOFI:  .WORD   0       ;OFFSET REGISTER
001372  000000                  RMDCI:  .WORD   0       ;DESIRED CYLINDER REGISTER
001374  000000                  RMHRI:  .WORD   0       ;HOLDING REGISTER
001376  000000                  RMMR2I: .WORD   0       ;MAINTENANCE REGISTER #2
001400  000000                  RMER2I: .WORD   0       ;ERROR REGISTER #2
001402  000000                  RMEC1I: .WORD   0       ;ECC POSITION REGISTER
001404  000000                  RMEC2I: .WORD   0       ;ECC PATTERN REGISTER
001406  000000                  RMBAEI: .WORD   0       ;BUS ADDRESS EXTENSION REGISTER
001410  000000                  RMCS3I: .WORD   0       ;CONTROL, STATUS REGISTER #3

                                ;THE REGISTER OUTPUT BUFFER IS USED FOR
                                ;ASSEMBLING DATA GOING TO REGISTER

001412                          PUTBUF:

                                ;REGISTER OUTPUT BUFFER
001412  000000                  RMCS1O: .WORD   0       ;CONTROL, STATUS REGISTER #1
001414  000000                  RMWCO:  .WORD   0       ;WORD COUNT REGISTER
001416  000000                  RMBAO:  .WORD   0       ;BUS ADDRESS REGISTER
001420  000000                  RMDAO:  .WORD   0       ;DISK ADDRESS REGISTER
001422  000000                  RMCS2O: .WORD   0       ;CONTROL, STATUS REGISTER #2
001424  000000                  RMDSO:  .WORD   0       ;DRIVE STATUS REGISTER
001426  000000                  RMER1O: .WORD   0       ;ERROR REGISTER #1
001430  000000                  RMASO:  .WORD   0       ;ATTENTION SUMMARY REGISTER
001432  000000                  RMLAO:  .WORD   0       ;LOOK AHEAD REGISTER
001434  000000                  RMDBO:  .WORD   0       ;DATA BUFFER
001436  000000                  RMMR1O: .WORD   0       ;MAINTENANCE REGISTER #1
```

USER DEFINED TAGS

```
001440  000000          RMDTO:  .WORD   0       ;DRIVE TYPE REGISTER
001442  000000          RMSNO:  .WORD   0       ;SERIAL NUMBER REGISTER
001444  000000          RMOFO:  .WORD   0       ;OFFSET REGISTER
001446  000000          RMDCO:  .WORD   0       ;DESIRED CYLINDER REGISTER
001450  000000          RMHRO:  .WORD   0       ;HOLDING REGISTER
001452  000000          RMMR20: .WORD   0       ;MAINTENANCE REGISTER #2
001454  000000          RMER20: .WORD   0       ;ERROR REGISTER #2
001456  000000          RMEC10: .WORD   0       ;ECC POSITION REGISTER
001460  000000          RMEC20: .WORD   0       ;ECC PATTERN REGISTER
001462  000000          RMBAE0: .WORD   0       ;BUS ADDRESS EXTENSION REGISTER
001464  000000          RMCS30: .WORD   0       ;CONTROL, STATUS REGISTER #3

                        ;EACH WORD OF THE TEST QUE CONTAINS THE DEVICE NUMBER IN
                        ;THE LOW BYTE AND THE ATTENTION BIT IN THE HIGH BYTE. THE
                        ;FIRST WORD CONTAINS THE ADDRESS OF THE DEVICE UNDER TEST
                        ;IN THE TABLE. A ZERO WORD IS A BLANK AND REPRESENTS THE
                        ;END OF THE QUE.

001466  000000          TSTQUE: .WORD   0               ;CONTAINS DEVICE POINTER
001470                          .BLKW   8.              ;TEST QUE FOR DEVICES UNDER TEST
001510  000000                  .WORD   0               ;TABLE TERMINATOR GOES HERE WHEN
                                                        ;ALL 8. DEVICES ARE UNDER TEST.

001512  172540          $LPCSR: .WORD   172540          ;KW11-P CONTROL + STATUS REGISTER
001514  172542          $LPCSB: .WORD   172542          ;KW11-P COUNT SET BUFFER
001516  000104          $LPVEC: .WORD   104             ;KW11-P INTERRUPT VECTOR
001520  000106                  .WORD   106
001522  177546          $LLCSR: .WORD   177546          ;KW11-L CONTROL + STATUS REGISTER
001524  000100          $LLVEC: .WORD   100             ;KW11-L INTERRUPT VECTOR
001526  000102                  .WORD   102
001530  000000          $PSW:   .WORD                   ;STORAGE FOR PRIORITY
001532  000000          TIME:   .WORD                   ;STORAGE FOR ELAPSED TIME
001534  000000          WATCH:  .WORD                   ;STORAGE FOR REMAINING TIME
001536  000000          CLOCK:  .WORD                   ;ADDRESS OF START CLOCK SUB
001540  000000          STOPCL: .WORD                   ;ADDRESS OF STOP CLOCK SUB

                        ;PUT TAGS HERE
```

ERROR POINTER TABLE

```
                                .SBTTL  ERROR POINTER TABLE

                                ;*THIS TABLE CONTAINS THE INFORMATION FOR EACH ERROR THAT CAN OCCUR.
                                ;*THE INFORMATION IS OBTAINED BY USING THE INDEX NUMBER FOUND IN
                                ;*LOCATION $ITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
                                ;*NOTE1:        IF $ITEMB IS 0 THE ONLY PERTINENT DATA IS ($ERRPC).
                                ;*NOTE2:        EACH ITEM IN THE TABLE CONTAINS 4 POINTERS EXPLAINED AS FOLLOWS:

                                ;*      EM              ;;POINTS TO THE ERROR MESSAGE
                                ;*      DH              ;;POINTS TO THE DATA HEADER
                                ;*      DT              ;;POINTS TO THE DATA
                                ;*      DF              ;;POINTS TO THE DATA FORMAT


  001542                        $ERRTB:
  1
  2                             ;ERROR  1       CANNOT CLEAR NED STATUS
  3
  001542  064376                        EMT1
  001544  072262                        EHT1
  001546  072362                        EDT1
  001550  072410                        EFT1

  4
  5                             ;ERROR  2       CANNOT READ OR WRITE ANY DEVICE REG WITHOUT NED
  6
  001552  064404                        EMT2
  001554  072266                        EHT2
  001556  072364                        EDT2
  001560  072412                        EFT2

  7
  8                             ;ERROR  3       CANNOT WRITE/READ ONES TO ANY DEVICE REGISTER
  9
  001562  064432                        EMT3
  001564  000000                        0
  001566  000000                        0
  001570  000000                        0

 10
 11                             ;ERROR  4       CANNOT CLEAR ANY DEVICE REGISTER BITS W/MASSBUS INIT
 12
  001572  064452                        EMT4
  001574  000000                        0
  001576  000000                        0
  001600  000000                        0

 13
 14                             ;ERROR  5       CANNOT WRITE/READ ZEROS TO ALL BIT POSITIONS
 15
  001602  064474                        EMT5
  001604  072272                        EHT5
  001606  072366                        EDT5
  001610  072414                        EFT5

 16
 17                             ;ERROR  6       CANNOT WRITE/READ ONES TO ALL BIT POSITIONS
```

ERROR POINTER TABLE

```
     18
     001612  064520                          EMT6
     001614  072272                          EHT5
     001616  072366                          EDT5
     001620  072414                          EFT5

     19
     20                             ;ERROR  7       CANNOT WRITE/READ SHIFTING ONE BIT TO ALL BIT POSITIONS
     21                             ;               OF DEVICE REGISTERS
     22
     001622  064542                          EMT7
     001624  072276                          EHT7
     001626  072366                          EDT5
     001630  072414                          EFT5

     23
     24                             ;ERROR  10      REGISTER SELECT 1 APPEARS S-A-0
     25
     001632  064564                          EMT10
     001634  000000                          0
     001636  000000                          0
     001640  000000                          0

     26
     27                             ;ERROR  11      REGISTER SELECT 1 APPEARS S-A-1
     28
     001642  064602                          EMT11
     001644  000000                          0
     001646  000000                          0
     001650  000000                          0

     29
     30                             ;ERROR  12      REGISTER SELECT 2 APPEARS S-A-0
     31
     001652  064620                          EMT12
     001654  000000                          0
     001656  000000                          0
     001660  000000                          0

     32
     33                             ;ERROR  13      REGISTER SELECT 2 APPEARS S-A-1
     34
     001662  064636                          EMT13
     001664  000000                          0
     001666  000000                          0
     001670  000000                          0

     35
     36                             ;ERROR  14      REGISTER SELECT 4 APPEARS S-A-0
     37
     001672  064654                          EMT14
     001674  000000                          0
     001676  000000                          0
     001700  000000                          0

     38
     39                             ;ERROR  15      REGISTER SELECT 4 APPEARS S-A-1
```

ERROR POINTER TABLE

```
40
   001702  064672                          EMT15
   001704  000000                          0
   001706  000000                          0
   001710  000000                          0

41
42                              ;ERROR  16      REGISTER SELECT 8 APPEARS S-A-0
43
   001712  064710                          EMT16
   001714  000000                          0
   001716  000000                          0
   001720  000000                          0

44
45                              ;ERROR  17      REGISTER SELECT 8 APPEARS S-A-1
46
   001722  064726                          EMT17
   001724  000000                          0
   001726  000000                          0
   001730  000000                          0

47
48                              ;ERROR  20      CANT WRITE ZEROS RMDA
49
   001732  064744                          EMT20
   001734  072262                          EHT1
   001736  072362                          EDT1
   001740  072410                          EFT1

50
51                              ;ERROR  21      CANT WRITE ONES RMDA
52
   001742  064764                          EMT21
   001744  072262                          EHT1
   001746  072362                          EDT1
   001750  072410                          EFT1

53
54                              ;ERROR  22      BIT INTERFERENCE IN WRITING/READING RMDA
55
   001752  065004                          EMT22
   001754  072262                          EHT1
   001756  072362                          EDT1
   001760  072410                          EFT1

56
57                              ;ERROR  23      CANT WRITE ZEROS RMCS1
58
   001762  065020                          EMT23
   001764  072262                          EHT1
   001766  072362                          EDT1
   001770  072410                          EFT1

59
60                              ;ERROR  24      CANT WRITE ONES RMCS1
61
```

ERROR POINTER TABLE

```
        001772  065040                          EMT24
        001774  072262                          EHT1
        001776  072362                          EDT1
        002000  072410                          EFT1

    62
    63                              ;ERROR  25      BIT INTERFERENCE IN WRITING/READING RMCS1
    64
        002002  065060                          EMT25
        002004  072262                          EHT1
        002006  072362                          EDT1
        002010  072410                          EFT1

    65
    66                              ;ERROR  26      MBA CLR L IS STUCK ACTIVE
    67
        002012  065074                          EMT26
        002014  000000                          0
        002016  000000                          0
        002020  000000                          0

    68
    69                              ;ERROR  27      CANNOT CLEAR RMER1-PAR,RMR,ILF,ILR
    70
        002022  065126                          EMT27
        002024  072262                          EHT1
        002026  072362                          EDT1
        002030  072410                          EFT1

    71
    72                              ;ERROR  30      CANNOT CLEAR RMER1-DCK,IAE,AOE,HCRC,HCE,ECH,WCF,FER
    73
        002032  065140                          EMT30
        002034  072262                          EHT1
        002036  072362                          EDT1
        002040  072410                          EFT1

    74
    75                              ;ERROR  31      CANNOT CLEAR RMER1-OPI,DTE
    76
        002042  065154                          EMT31
        002044  072262                          EHT1
        002046  072362                          EDT1
        002050  072410                          EFT1

    77
    78                              ;ERROR  32      CANNOT WRITE 0 IN RMER1-PAR,RMR,ILF,ILR
    79
        002052  065170                          EMT32
        002054  072262                          EHT1
        002056  072362                          EDT1
        002060  072410                          EFT1

    80
    81                              ;ERROR  33      CANNOT WRITE 0 IN RMER1-DCK,IAE,AOE,HCRC,HCE,ECH,WCF,FER
    82
        002062  065204                          EMT33
```

ERROR POINTER TABLE

```
        002064  072262                          EHT1
        002066  072362                          EDT1
        002070  072410                          EFT1

     83
     84                             ;ERROR  34       CANNOT WRITE 0 IN RMER1-OPI,DTE
     85
        002072  065222                          EMT34
        002074  072262                          EHT1
        002076  072362                          EDT1
        002100  072410                          EFT1

     86
     87                             ;ERROR  35       CANNOT WRITE 1 IN RMER1
     88
        002102  065240                          EMT35
        002104  072262                          EHT1
        002106  072362                          EDT1
        002110  072410                          EFT1

     89
     90                             ;ERROR  36       CANNOT WRITE SHIFTING 1 IN RMER1
     91
        002112  065254                          EMT36
        002114  072262                          EHT1
        002116  072362                          EDT1
        002120  072410                          EFT1

     92
     93                             ;ERROR  37       CANNOT WRITE ZEROS IN RMDC
     94
        002122  065270                          EMT37
        002124  072262                          EHT1
        002126  072362                          EDT1
        002130  072410                          EFT1

     95
     96                             ;ERROR  40       CANNOT WRITE ONES IN RMDC
     97
        002132  065304                          EMT40
        002134  072262                          EHT1
        002136  072362                          EDT1
        002140  072410                          EFT1

     98
     99                             ;ERROR  41       BIT INTERFERENCE IN WRITING/READING RMDC
    100
        002142  065324                          EMT41
        002144  072262                          EHT1
        002146  072362                          EDT1
        002150  072410                          EFT1

    101
    102                             ;ERROR  42       CANNOT WRITE 1'S IN RMDC OR RMDA
    103
        002152  065340                          EMT42
        002154  000000                          0
```

ERROR POINTER TABLE

```
002156  000000                          0
002160  000000                          0

104
105                             ;ERROR  43      CANNOT CLEAR RMCS1-FUNCTION CODE
106
002162  065364                          EMT43
002164  072262                          EHT1
002166  072362                          EDT1
002170  072410                          EFT1

107
108                             ;ERROR  44      UNUSED BITS OF RMER2 NOT ZERO
109
002172  065376                          EMT44
002174  072262                          EHT1
002176  072362                          EDT1
002200  072410                          EFT1

110
111                             ;ERROR  45      CANNOT CLEAR RMER2-OPE,IVC,LSC
112
002202  065412                          EMT45
002204  072262                          EHT1
002206  072362                          EDT1
002210  072410                          EFT1

113
114                             ;ERROR  46      CANNOT CLEAR RMER2-LBC,DPE
115
002212  065426                          EMT46
002214  072262                          EHT1
002216  072362                          EDT1
002220  072410                          EFT1

116
117                             ;ERROR  47      CANNOT WRITE ZEROS RMER2-OPE,IVC,LSC
118
002222  065442                          EMT47
002224  072262                          EHT1
002226  072362                          EDT1
002230  072410                          EFT1

119
120                             ;ERROR  50      CANNOT WRITE ZEROS RMER2-LBC,DPE
121
002232  065464                          EMT50
002234  072262                          EHT1
002236  072362                          EDT1
002240  072410                          EFT1

122
123                             ;ERROR  51      CANNOT WRITE ONES RMER2
124
002242  065506                          EMT51
002244  072262                          EHT1
002246  072362                          EDT1
```

ERROR POINTER TABLE

```
        002250  072410                          EFT1

    125
    126                             ;ERROR  52      CANNOT WRITE SHIFTING ONES RMER2
    127
        002252  065526                          EMT52
        002254  072262                          EHT1
        002256  072362                          EDT1
        002260  072410                          EFT1

    128
    129                             ;ERROR  53      UNUSED BITS OF RMOF ARE NOT ZERO
    130
        002262  065542                          EMT53
        002264  072262                          EHT1
        002266  072362                          EDT1
        002270  072410                          EFT1

    131
    132                             ;ERROR  54      CANNOT WRITE ZEROS RMOF
    133
        002272  065556                          EMT54
        002274  072262                          EHT1
        002276  072362                          EDT1
        002300  072410                          EFT1

    134
    135                             ;ERROR  55      CANNOT WRITE ONES RMOF
    136
        002302  065576                          EMT55
        002304  072262                          EHT1
        002306  072362                          EDT1
        002310  072410                          EFT1

    137
    138                             ;ERROR  56      CANNOT WRITE SHIFTING ONES RMOF
    139
        002312  065616                          EMT56
        002314  072262                          EHT1
        002316  072362                          EDT1
        002320  072410                          EFT1

    140
    141                             ;ERROR  57      DEVICE IS NOT AN RM80
    142
        002322  065632                          EMT57
        002324  072302                          EHT57
        002326  072370                          EDT57
        002330  072416                          EFT57

    143
    144                             ;ERROR  60      DEVICE AVAILABLE IS NOT SET
    145
        002332  065646                          EMT60
        002334  072262                          EHT1
        002336  072362                          EDT1
        002340  072410                          EFT1
```

ERROR POINTER TABLE

```
146
147                                     ;ERROR  61      CANNOT WRITE ZEROS RMHR
148
    002342  065662                              EMT61
    002344  072262                              EHT1
    002346  072362                              EDT1
    002350  072410                              EFT1

149
150                                     ;ERROR  62      CANNOT WRITE ONES RMHR
151
    002352  065702                              EMT62
    002354  072262                              EHT1
    002356  072362                              EDT1
    002360  072410                              EFT1

152
153                                     ;ERROR  63      CANNOT WRITE SHIFTING ONES RMHR
154
    002362  065722                              EMT63
    002364  072262                              EHT1
    002366  072362                              EDT1
    002370  072410                              EFT1

155
156                                     ;ERROR  64      CANNOT CLEAR ILR STATUS
157
    002372  065736                              EMT64
    002374  072262                              EHT1
    002376  072362                              EDT1
    002400  072410                              EFT1

158
159                                     ;ERROR  65      ILR ERROR SHOULD NOT BE SET
160
    002402  065750                              EMT65
    002404  072306                              EHT65
    002406  072372                              EDT65
    002410  072420                              EFT65

161
162                                     ;ERROR  66      ILR ERROR SHOULD BE SET
163
    002412  065764                              EMT66
    002414  072306                              EHT65
    002416  072372                              EDT65
    002420  072420                              EFT65

164
165                                     ;ERROR  67      CANNOT CLEAR PAR STATUS-DPE IS RESET
166
    002422  066000                              EMT67
    002424  072262                              EHT1
    002426  072362                              EDT1
    002430  072410                              EFT1
```

ERROR POINTER TABLE

```
167
168                                 ;ERROR  70      CANNOT CLEAR PAR AND DPE STATUS
169
     002432  066016                         EMT70
     002434  072262                         EHT1
     002436  072362                         EDT1
     002440  072410                         EFT1

170
171                                 ;ERROR  71      'PAR'' ERROR SHOULD NOT BE SET-'PAT'' IS OFF
172
     002442  066036                         EMT71
     002444  072312                         EHT71
     002446  072374                         EDT71
     002450  072422                         EFT71

173
174                                 ;ERROR  72      'PAR'' ERROR SHOULD BE SET-'PAT'' IS ON
175
     002452  066062                         EMT72
     002454  072312                         EHT71
     002456  072374                         EDT71
     002460  072422                         EFT71

176
177                                 ;ERROR  73      'MCPE'' ERROR SHOULD NOT BE SET
178
     002462  066106                         EMT73
     002464  072312                         EHT71
     002466  072374                         EDT71
     002470  072422                         EFT71

179
180                                 ;ERROR  74      UNEXPECTED BUS TIMEOUT
181
     002472  066126                         EMT74
     002474  072316                         EHT74
     002476  072376                         EDT74
     002500  072424                         EFT74

182
183                                 ;ERROR  75      CANT CLEAR 'DMD''
184
     002502  066136                         EMT75
     002504  072262                         EHT1
     002506  072362                         EDT1
     002510  072410                         EFT1

185
186                                 ;ERROR  76      CANT WRITE ZERO 'DMD''
187
     002512  066150                         EMT76
     002514  072262                         EHT1
     002516  072362                         EDT1
     002520  072410                         EFT1

188
```

ERROR POINTER TA3LE

```
189                                     ;ERROR  77      CANT WRITE ONE 'DMD''
190
     002522  066164                               EMT77
     002524  072262                               EHT1
     002526  072362                               EDT1
     002530  072410                               EFT1

191
192                                     ;ERROR  100     DMD SET BY WRONG BIT
193
     002532  066200                               EMT100
     002534  072312                               EHT71
     002536  072372                               EDT65
     002540  072420                               EFT65

194
195                                     ;ERROR  101     CANT CLEAR 'MOL'' IN DIAGNOSTIC MODE
196
     002542  066220                               EMT101
     002544  072262                               EHT1
     002546  072362                               EDT1
     002550  072410                               EFT1

197
198                                     ;ERROR  102     CANT SET 'MOL'' IN DIAGNOSTIC MODE
199
     002552  066240                               EMT102
     002554  072262                               EHT1
     002556  072362                               EDT1
     002560  072410                               EFT1

200
201                                     ;ERROR  103     'MUR'' SET BY WRONG BIT
202
     002562  066260                               EMT103
     002564  072312                               EHT71
     002566  072372                               EDT65
     002570  072420                               EFT65

203
204                                     ;ERROR  104     CANT RESET 'WRL'' IN DIAGNOSTIC MODE
205
     002572  066304                               EMT104
     002574  072262                               EHT1
     002576  072362                               EDT1
     002600  072410                               EFT1

206
207                                     ;ERROR  105     CANT SET 'WRL'' IN DIAGNOSTIC MODE
208
     002602  066324                               EMT105
     002604  072262                               EHT1
     002606  072362                               EDT1
     002610  072410                               EFT1

209
210                                     ;ERROR  106     'MWP'' SET BY WRONG BIT
```

ERROR POINTER TABLE

```
211
     002612  066344                          EMT106
     002614  072312                          EHT71
     002616  072372                          EDT65
     002620  072420                          EFT65

212
213                                 ;ERROR  107     CANT RESET 'DVC' USING 'MDVC'
214
     002622  066370                          EMT107
     002624  072262                          EHT1
     002626  072362                          EDT1
     002630  072410                          EFT1

215
216                                 ;ERROR  110     'DVC' IS RESET BUT 'UNS' IS SET
217
     002632  066410                          EMT110
     002634  072262                          EHT1
     002636  072362                          EDT1
     002640  072410                          EFT1

218
219                                 ;ERROR  111     'DVC' IS SET BUT 'UNS' IS NOT SET
220
     002642  066432                          EMT111
     002644  072262                          EHT1
     002646  072362                          EDT1
     002650  072410                          EFT1

221
222                                 ;ERROR  112     CANT SET 'DVC' USING MDVC'
223
     002652  066452                          EMT112
     002654  072262                          EHT1
     002656  072362                          EDT1
     002660  072410                          EFT1

224
225                                 ;ERROR  113     'DVC' IS RESET BUT 'UNS' IS SET
226
     002662  066472                          EMT113
     002664  072262                          EHT1
     002666  072362                          EDT1
     002670  072410                          EFT1

227
228                                 ;ERROR  114     'DVC' IS SET BUT 'UNS' IS NOT SET
229
     002672  066516                          EMT114
     002674  072262                          EHT1
     002676  072362                          EDT1
     002700  072410                          EFT1

230
231                                 ;ERROR  115     'MDF' IS SET BY WRONG BIT
232
```

ERROR POINTER TABLE

```
        002702  066540                          EMT115
        002704  072322                          EHT115
        002706  072400                          EDT115
        002710  072426                          EFT115

    233
    234                             ;ERROR  116     CANT RESET ''SKI'' USING 'MSER''
    235
        002712  066564                          EMT116
        002714  072262                          EHT1
        002716  072362                          EDT1
        002720  072410                          EFT1

    236
    237                             ;ERROR  117     CANT SET ''SKI'' USING 'MSER''
    238
        002722  066604                          EMT117
        002724  072262                          EHT1
        002726  072362                          EDT1
        002730  072410                          EFT1

    239
    240                             ;ERROR  120     ''SKI'' SET BY WRONG BIT
    241
        002732  066624                          EMT120
        002734  072322                          EHT115
        002736  072400                          EDT115
        002740  072426                          EFT115

    242
    243                             ;ERROR  121     CANT RESET ''PIP'' USING 'MOC''
    244
        002742  066650                          EMT121
        002744  072262                          EHT1
        002746  072362                          EDT1
        002750  072410                          EFT1

    245
    246                             ;ERROR  122     CANT SET ''PIP'' USING 'MOC''
    247
        002752  066670                          EMT122
        002754  072262                          EHT1
        002756  072362                          EDT1
        002760  072410                          EFT1

    248
    249                             ;ERROR  123     ''MOC'' SET BY WRONG BIT
    250
        002762  066710                          EMT123
        002764  072322                          EHT115
        002766  072400                          EDT115
        002770  072426                          EFT115

    251
    252                             ;ERROR  124     CANT CLEAR ''EBL''
    253
        002772  066734                          EMT124
```

ERROR POINTER TABLE

```
        002774  072262                          EHT1
        002776  072362                          EDT1
        003000  072410                          EFT1

    254
    255                             ;ERROR  125     'EBL' NOT ZERO IN DIAGNOSTIC MODE
    256
        003002  066752                          EMT125
        003004  072262                          EHT1
        003006  072362                          EDT1
        003010  072410                          EFT1

    257
    258                             ;ERROR  126     CANT SET 'EBL' USING 'DEBL'
    259
        003012  066772                          EMT126
        003014  072262                          EHT1
        003016  072362                          EDT1
        003020  072410                          EFT1

    260
    261                             ;ERROR  127     'DEBL' SET BY WRONG BIT
    262
        003022  067010                          EMT127
        003024  072322                          EHT115
        003026  072400                          EDT115
        003030  072426                          EFT115

    263
    264                             ;ERROR  130     'LS' NOT CORRECT ACCORDING TO RMDA
    265
        003032  067034                          EMT130
        003034  072326                          EHT130
        003036  072402                          EDT130
        003040  072430                          EFT130

    266
    267                             ;ERROR  131     'LST' NOT CORRECT ACCORDING TO RMDA
    268
        003042  067052                          EMT131
        003044  072326                          EHT130
        003046  072402                          EDT130
        003050  072430                          EFT130

    269
    270                             ;ERROR  132     CANNOT INCREMENT SECTOR ADDRESS USING 'DEBL'
    271
        003052  067070                          EMT132
        003054  072332                          EHT132
        003056  072404                          EDT132
        003060  072432                          EFT132

    272
    273                             ;ERROR  133     CANNOT INCREMENT TRACK ADDRESS USING 'DEBL'
    274
        003062  067110                          EMT133
        003064  072332                          EHT132
```

ERROR POINTER TABLE

```
        003066  072404                          EDT132
        003070  072432                          EFT132

    275
    276                             ;ERROR  134     UNUSED BITS OF RMDC NOT ZERO
    277
        003072  067130                          EMT134
        003074  072262                          EHT1
        003076  072362                          EDT1
        003100  072410                          EFT1

    278
    279                             ;ERROR  135     "VV" NOT RESET BY UNIT READY
    280
        003102  067144                          EMT135
        003104  072262                          EHT1
        003106  072362                          EDT1
        003110  072410                          EFT1

    281
    282                             ;ERROR  136     SERIAL NUMBER IS INCONSISTENT
    283
        003112  067162                          EMT136
        003114  072262                          EHT1
        003116  072362                          EDT1
        003120  072410                          EFT1

    284
    285                             ;ERROR  137     CANT CLEAR "GO" BIT
    286
        003122  067174                          EMT137
        003124  072262                          EHT1
        003126  072362                          EDT1
        003130  072410                          EFT1

    287
    288                             ;ERROR  140     CANT INCREMENT CYLINDER USING "DEBL"
    289
        003132  067212                          EMT140
        003134  072332                          EHT132
        003136  072404                          EDT132
        003140  072432                          EFT132

    290
    291                             ;ERROR  141     CANT RESET "LBT" BY WRITING RMDA
    292
        003142  067232                          EMT141
        003144  072336                          EHT142
        003146  072404                          EDT132
        003150  072432                          EFT132

    293
    294                             ;ERROR  142     CANT SET "LBT" USING "DEBL"
    295
        003152  067246                          EMT142
        003154  072336                          EHT142
        003156  072404                          EDT132
```

ERROR POINTER TABLE

```
        003160  072432                          EFT132

    296
    297                             ;ERROR  143     CANT READ ZERO FROM COMP ERROR
    298
        003162  067264                          EMT143
        003164  072262                          EHT1
        003166  072362                          EDT1
        003170  072410                          EFT1

    299
    300                             ;ERROR  144     CANT SET COMP ERROR WITH RMER1 OR RMER2
    301
        003172  067300                          EMT144
        003174  072262                          EHT1
        003176  072362                          EDT1
        003200  072410                          EFT1

    302
    303                             ;ERROR  145     COMP ERROR DID NOT SET
    304
        003202  067322                          EMT145
        003204  072342                          EHT145
        003206  072402                          EDT130
        003210  072430                          EFT130

    305
    306                             ;ERROR  146     CANT SET "GO" BIT
    307
        003212  067344                          EMT146
        003214  072262                          EHT1
        003216  072362                          EDT1
        003220  072410                          EFT1

    308
    309                             ;ERROR  147     CANT READ A ONE FROM "TST"
    310
        003222  067362                          EMT147
        003224  072262                          EHT1
        003226  072362                          EDT1
        003230  072410                          EFT1

    311
    312                             ;ERROR  150     "TST" IS INCORRECT FOR THE FUNCTION CODE
    313
        003232  067374                          EMT150
        003234  072346                          EHT150
        003236  072400                          EDT115
        003240  072426                          EFT115

    314
    315                             ;ERROR  151     CANT SET THE "GO" BIT
    316
        003242  067416                          EMT151
        003244  072262                          EHT1
        003246  072362                          EDT1
        003250  072410                          EFT1
```

ERROR POINTER TABLE

```
317
318                                 ;ERROR  152     "DRY" NOT THE COMPLEMENT OF "GO"
319
003252  067430                              EMT152
003254  072262                              EHT1
003256  072362                              EDT1
003260  072410                              EFT1

320
321                                 ;ERROR  153     "GO" RESET EARLY
322
003262  067444                              EMT153
003264  072262                              EHT1
003266  072362                              EDT1
003270  072410                              EFT1

323
324                                 ;ERROR  154     "GO" DIDNT RESET ON TIME
325
003272  067464                              EMT154
003274  072262                              EHT1
003276  072362                              EDT1
003300  072410                              EFT1

326
327                                 ;ERROR  155     CANT CLEAR CONTINUE
328
003302  067504                              EMT155
003304  072262                              EHT1
003306  072362                              EDT1
003310  072410                              EFT1

329
330                                 ;ERROR  156     CONTINUE IS INCORRECT FOR THE FUNCTION CODE
331
003312  067522                              EMT156
003314  072346                              EHT150
003316  072400                              EDT115
003320  072426                              EFT115

332
333                                 ;ERROR  157     CANT CLEAR IVC
334
003322  067544                              EMT157
003324  072262                              EHT1
003326  072362                              EDT1
003330  072410                              EFT1

335
336                                 ;ERROR  160     IVC IS INCORRECT FOR THE FUNCTION CODE
337
003332  067562                              EMT160
003334  072346                              EHT150
003336  072400                              EDT115
003340  072426                              EFT115
```

ERROR POINTER TABLE

```
338
339                             ;ERROR  161     CANT CLEAR LSC
340
003342  067612                          EMT161
003344  072262                          EHT1
003346  072362                          EDT1
003350  072410                          EFT1

341
342                             ;ERROR  162     CANT SET LSC
343
003352  067630                          EMT162
003354  072262                          EHT1
003356  072362                          EDT1
003360  072410                          EFT1

344
345                             ;ERROR  163     COMMAND DECODE WAS ENABLED WITH COMP ERROR SET
346
003362  067646                          EMT163
003364  072262                          EHT1
003366  072362                          EDT1
003370  072410                          EFT1

347
348                             ;ERROR  164     COMMAND DECODE WAS ENABLED WITH COMP ERROR SET
349
003372  067670                          EMT164
003374  072262                          EHT1
003376  072362                          EDT1
003400  072410                          EFT1

350
351                             ;ERROR  165     DECODE DOES NOT SET
352
003402  067712                          EMT165
003404  000000                          0
003406  000000                          0
003410  000000                          0

353
354                             ;ERROR  166     CANT CLEAR OCCUPIED
355
003412  067736                          EMT166
003414  072262                          EHT1
003416  072362                          EDT1
003420  072410                          EFT1

356
357                             ;ERROR  167     ILF SET WITHOUT GO BIT
358
003422  067756                          EMT167
003424  072262                          EHT1
003426  072362                          EDT1
003430  072410                          EFT1

359
```

ERROR POINTER TABLE

```
360                                     ;ERROR  170     CANT SET VOLUME VALID
361
    003432  070000                              EMT170
    003434  072346                              EHT150
    003436  072400                              EDT115
    003440  072426                              EFT115

362
363                                     ;ERROR  171     ILF IS INCORRECT
364
    003442  070012                              EMT171
    003444  072346                              EHT150
    003446  072400                              EDT115
    003450  072426                              EFT115

365
366                                     ;ERROR  172     CANT SET OFFSET DIRECTION BIT
367
    003452  070026                              EMT172
    003454  072262                              EHT1
    003456  072362                              EDT1
    003460  072410                              EFT1

368
369                                     ;ERROR  173     OCCUPIED IS INCORRECT FOR FUNCTION CODE
370
    003462  070044                              EMT173
    003464  072346                              EHT150
    003466  072400                              EDT115
    003470  072426                              EFT115

371
372                                     ;ERROR  174     READ IN PRESET DIDNT CLEAR RMDA, RMDC OR RMOF
373
    003472  070066                              EMT174
    003474  000000                              0
    003476  000000                              0
    003500  000000                              0

374
375                                     ;ERROR  175     READ IN PRESET DIDNT CLEAR RMOF
376
    003502  070116                              EMT175
    003504  072262                              EHT1
    003506  072362                              EDT1
    003510  072410                              EFT1

377
378                                     ;ERROR  176     READ IN PRESET DIDNT CLEAR RMDA
379
    003512  070136                              EMT176
    003514  072262                              EHT1
    003516  072362                              EDT1
    003520  072410                              EFT1

380
381                                     ;ERROR  177     --RESERVED FOR POWER MONITOR BIT FAILURE--
```

ERROR POINTER TABLE

```
382
    003522  000000                          0
    003524  000000                          0
    003526  000000                          0
    003530  000000                          0

383
384                                 ;ERROR  200     CANT SET OFFSET MODE BY OFFSET COMMAND
385
    003532  070156                          EMT200
    003534  072262                          EHT1
    003536  072362                          EDT1
    003540  072410                          EFT1

386
387                                 ;ERROR  201     CANT RESET OFFSET MODE BY RTC COMMAND
388
    003542  070174                          EMT201
    003544  072262                          EHT1
    003546  072362                          EDT1
    003550  072410                          EFT1

389
390                                 ;ERROR  202     CANT RESET OFD BY RTC COMMAND
391
    003552  070212                          EMT202
    003554  072262                          EHT1
    003556  072362                          EDT1
    003560  072410                          EFT1

392
393                                 ;ERROR  203     CANT RESET OM BY RMDC
394
    003562  070230                          EMT203
    003564  072262                          EHT1
    003566  072362                          EDT1
    003570  072410                          EFT1

395
396                                 ;ERROR  204     CANT RESET OM BY EBL
397
    003572  070252                          EMT204
    003574  072262                          EHT1
    003576  072362                          EDT1
    003600  072410                          EFT1

398
399                                 ;ERROR  205     RUN AND GO NOT CORRECT FOR FUNCTION CODE
400
    003602  070272                          EMT205
    003604  072346                          EHT150
    003606  072400                          EDT115
    003610  072426                          EFT115

401
402                                 ;ERROR  206     CANT SET IAE ERROR
403
```

ERROR POINTER TABLE

```
        003612  070312                          EMT206
        003614  000000                          0
        003616  000000                          0
        003620  000000                          0

    404
    405                             ;ERROR  207     IAE IS INCORRECT FOR FUNCTION CODE
    406
        003622  070342                          EMT207
        003624  072346                          EHT150
        003626  072400                          EDT115
        003630  072426                          EFT115

    407
    408                             ;ERROR  210     IAE IS INCORRECT FOR RMDA
    409
        003632  070356                          EMT210
        003634  072322                          EHT115
        003636  072400                          EDT115
        003640  072426                          EFT115

    410
    411                             ;ERROR  211     IAE IS INCORRECT FOR RMDC
    412
        003642  070374                          EMT211
        003644  072322                          EHT115
        003646  072400                          EDT115
        003650  072426                          EFT115

    413
    414                             ;ERROR  212     CANT SET AOE
    415
        003652  070412                          EMT212
        003654  072336                          EHT142
        003656  072404                          EDT132
        003660  072432                          EFT132

    416
    417                             ;ERROR  213     RMR SET WHEN WRITING RMAS OR RMCS
    418
        003662  070424                          EMT213
        003664  072352                          EHT213
        003666  072400                          EDT115
        003670  072426                          EFT115

    419
    420                             ;ERROR  214     CANT SET RMR
    421
        003672  070454                          EMT214
        003674  072352                          EHT213
        003676  072400                          EDT115
        003700  072426                          EFT115

    422
    423                             ;ERROR  215     DRQ IS 0 AND PGM IS 1
    424
        003702  070466                          EMT215
```

ERROR POINTER TABLE

```
        003704  072262                          EHT1
        003706  072362                          EDT1
        003710  072410                          EFT1

    425
    426                             ;ERROR  216     DVA IS NOT SET
    427
        003712  070506                          EMT216
        003714  072262                          EHT1
        003716  072362                          EDT1
        003720  072410                          EFT1

    428
    429                             ;ERROR  217     DPR IS NOT SET
    430
        003722  070522                          EMT217
        003724  072262                          EHT1
        003726  072362                          EDT1
        003730  072410                          EFT1

    431
    432                             ;ERROR  220     CANT SET PORT REQUEST BY READING RMCS1
    433
        003732  070536                          EMT220
        003734  072356                          EHT220
        003736  072406                          EDT220
        003740  072434                          EFT220

    434
    435                             ;ERROR  221     CANT SET PORT REQUEST BY WRITING RMAS
    436
        003742  070554                          EMT221
        003744  072356                          EHT220
        003746  072406                          EDT220
        003750  072434                          EFT220

    437
    438                             ;ERROR  222     CANT SET PORT REQUEST BY WRITING RMDA
    439
        003752  070572                          EMT222
        003754  072356                          EHT220
        003756  072406                          EDT220
        003760  072434                          EFT220

    440
    441                             ;ERROR  223     CANT RESET PORT REQUEST BY RELEASE COMMAND
    442
        003762  070610                          EMT223
        003764  072356                          EHT220
        003766  072406                          EDT220
        003770  072434                          EFT220

    443
    444                             ;ERROR  224     CANT CLEAR ATA BY RMAS
    445
        003772  070626                          EMT224
        003774  072262                          EHT1
```

ERROR POINTER TABLE

```
        C 3776  072362                          EDT1
        004000  072410                          EFT1

    446
    447                             ;ERROR  225     ATA IS RESET BUT RMAS NOT ZERO
    448
        004002  070646                          EMT225
        004004  072262                          EHT1
        004006  072362                          EDT1
        004010  072410                          EFT1

    449
    450                             ;ERROR  226     CANT RESET ATA BY GO
    451
        004012  070670                          EMT226
        004014  072262                          EHT1
        004016  072362                          EDT1
        004020  072410                          EFT1

    452
    453                             ;ERROR  227     ATA NOT SET BY UNIT READY
    454
        004022  070706                          EMT227
        004024  072262                          EHT1
        004026  072362                          EDT1
        004030  072410                          EFT1

    455
    456                             ;ERROR  230     ATA NOT SET BY UNIT READY
    457
        004032  070724                          EMT230
        004034  072262                          EHT1
        004036  072362                          EDT1
        004040  072410                          EFT1

    458
    459                             ;ERROR  231     ATA NOT SET BY COMP ERROR
    460
        004042  070742                          EMT231
        004044  072262                          EHT1
        004046  072362                          EDT1
        004050  072410                          EFT1

    461
    462                             ;ERROR  232     ATA SET/DID NOT SET WHEN REGISTER WRITTEN
    463                             ;               WHILE COMP ERROR WAS SET
    464
        004052  070756                          EMT232
        004054  072352                          EHT213
        004056  072400                          EMT115
        004060  072426                          EHT115

    465
    466                             ;ERROR  233     ATA NOT SET BY COMMAND SEQUENCER
    467
        004062  071000                          EMT233
        004064  072346                          EHT150
```

ERROR POINTER TABLE

```
        004066  072400                          EDT115
        004070  072426                          EFT115

    468
    469                             ;ERROR  234     WLE INCORRECT ACCORDING TO FUNCTION CODE
    470
        004072  071022                          EMT234
        004074  072346                          EHT150
        004076  072400                          EDT115
        004100  072426                          EFT115

    471
    472                             ;ERROR  235     CANT CLEAR EXCEPTION
    473
        004102  071050                          EMT235
        004104  072262                          EHT1
        004106  072362                          EDT1
        004110  072410                          EFT1

    474
    475                             ;ERROR  236     CANT SET EXCEPTION
    476
        004112  071070                          EMT236
        004114  072322                          EHT115
        004116  072400                          EDT115
        004120  072426                          EFT115

    477
    478                             ;ERROR  237     CANT CLEAR IVC
    479
        004122  071122                          EMT237
        004124  072262                          EHT1
        004126  072362                          EDT1
        004130  072410                          EFT1

    480
    481                             ;ERROR  240     CANT SET IVC
    482
        004132  071122                          EMT237
        004134  072346                          EHT150
        004136  072400                          EDT115
        004140  072426                          EFT115

    483
    484                             ;ERROR  241     OPI NOT SET DURING RECALIBRATE
    485
        004142  071166                          EMT241
        004144  072262                          EHT1
        004146  072362                          EDT1
        004150  072410                          EFT1

    486
    487                             ;ERROR  242     RECALIBRATE DID NOT ABORT WHEN DRIVE FAULT SET
    488
        004152  071212                          EMT242
        004154  072262                          EHT1
        004156  072362                          EDT1
```

ERROR POINTER TABLE

```
        004160  072410                          EFT1

    489
    490                             ;ERROR  243     OPI SHOULD HAVE SET BECAUSE ON CYLINDER NEVER
    491                             ;               DROPPED DURING RECALIBRATE
    492
        004162  071236                          EMT243
        004164  072262                          EHT1
        004166  072362                          EDT1
        004170  072410                          EFT1

    493
    494                             ;ERROR  244     ATA NOT SET DURING RECALIBRATE
    495
        004172  071262                          EMT244
        004174  072262                          EHT1
        004176  072362                          EDT1
        004200  072410                          EFT1

    496
    497                             ;ERROR  245     GO RESET EARLY DURING RECALIBRATE
    498
        004202  071300                          EMT245
        004204  072262                          EHT1
        004206  072362                          EDT1
        004210  072410                          EFT1

    499
    500                             ;ERROR  246     GO NOT RESET DURING RECALIBRATE
    501
        004212  071316                          EMT246
        004214  072262                          EHT1
        004216  072362                          EDT1
        004220  072410                          EFT1

    502
    503                             ;ERROR  247     INCORRECT TAG BUS DURING RECALIBRATE
    504
        004222  071342                          EMT247
        004224  072262                          EHT1
        004226  072362                          EDT1
        004230  072410                          EFT1

    505
    506                             ;ERROR  250     OPI SHOULD HAVE SET DURING SEEK BECAUSE UNIT
    507                             ;               READY DROPPED
    508
        004232  071360                          EMT250
        004234  072262                          EHT1
        004236  072362                          EDT1
        004240  072410                          EFT1

    509
    510                             ;ERROR  251     SEEK DID NOT ABORT WHEN DRIVE FAULT SET
    511
        004242  071404                          EMT251
        004244  072262                          EHT1
```

ERROR POINTER TABLE

```
        004246  072362                          EDT1
        004250  072410                          EFT1

    512
    513                             ;ERROR  252     OPI SHOULD HAVE SET BECAUSE ON CYLINDER NEVER
    514                             ;               DROPPED DURING SEEK
    515
        004252  071430                          EMT252
        004254  072262                          EHT1
        004256  072362                          EDT1
        004260  072410                          EFT1

    516
    517                             ;ERROR  253     ATA NOT SET DURING SEEK
    518
        004262  071454                          EMT253
        004264  072262                          EHT1
        004266  072362                          EDT1
        004270  072410                          EFT1

    519
    520                             ;ERROR  254     GO RESET EARLY DURING SEEK
    521
        004272  071472                          EMT254
        004274  072262                          EHT1
        004276  072362                          EDT1
        004300  072410                          EFT1

    522
    523                             ;ERROR  255     GO DID NOT RESET DURING SEEK
    524
        004302  071510                          EMT255
        004304  072262                          EHT1
        004306  072362                          EDT1
        004310  072410                          EFT1

    525
    526                             ;ERROR  256     INCORRECT TAG BUS DURING SEEK
    527
        004312  071534                          EMT256
        004314  072262                          EHT1
        004316  072362                          EDT1
        004320  072410                          EFT1

    528
    529                             ;ERROR  257     OPI NOT SET DURING SEARCH
    530
        004322  071552                          EMT257
        004324  072262                          EHT1
        004326  072362                          EDT1
        004330  072410                          EFT1

    531
    532                             ;ERROR  260     SEARCH DID NOT ABORT WHEN DRIVE FAULT SET
    533
        004332  071576                          EMT260
        004334  072262                          EHT1
```

ERROR POINTER TABLE

```
        004336  072362                          EDT1
        004340  072410                          EFT1

    534
    535                                 ;ERROR  261     OPI SHOULD HAVE SET BECAUSE ON CYLINDER NEVER
    536                                 ;               DROPPED DURING SEARCH
    537
        004342  071622                          EMT261
        004344  072262                          EHT1
        004346  072362                          EDT1
        004350  072410                          EFT1

    538
    539                                 ;ERROR  262     ATA NOT SET DURING SEARCH
    540
        004352  071646                          EMT262
        004354  072262                          EHT1
        004356  072362                          EDT1
        004360  072410                          EFT1

    541
    542                                 ;ERROR  263     GO RESET EARLY DURING SEARCH
    543
        004362  071664                          EMT263
        004364  072262                          EHT1
        004366  072362                          EDT1
        004370  072410                          EFT1

    544
    545                                 ;ERROR  264     GO DID NOT RESET DURING SEARCH
    546
        004372  071702                          EMT264
        004374  072262                          EHT1
        004376  072362                          EDT1
        004400  072410                          EFT1

    547
    548                                 ;ERROR  265     SEARCH ENABLE DIDNT SET DURING SEARCH
    549
        004402  071726                          EMT265
        004404  072262                          EHT1
        004406  072362                          EDT1
        004410  072410                          EFT1

    550
    551                                 ;ERROR  266     INCORRECT TAG BUS DURING SEARCH
    552
        004412  071744                          EMT266
        004414  072262                          EHT1
        004416  072362                          EDT1
        004420  072410                          EFT1

    553
    554                                 ;ERROR  267     OPI NOT SET BY SEARCH TIMEOUT
    555
        004422  071762                          EMT267
        004424  072262                          EHT1
```

ERROR POINTER TABLE

```
        004426  072362                          EDT1
        004430  072410                          EFT1

    556
    557                             ;ERROR  270     OPI NOT SET DURING DATA COMMAND
    558
        004432  071776                          EMT270
        004434  072262                          EHT1
        004436  072362                          EDT1
        004440  072410                          EFT1

    559
    560                             ;ERROR  271     DATA COMMAND DID NOT ABORT WHEN DRIVE FAULT SET
    561
        004442  072022                          EMT271
        004444  072262                          EHT1
        004446  072362                          EDT1
        004450  072410                          EFT1

    562
    563                             ;ERROR  272     EBL RESET EARLY DURING DATA COMMAND
    564
        004452  072046                          EMT272
        004454  072262                          EHT1
        004456  072362                          EDT1
        004460  072410                          EFT1

    565
    566                             ;ERROR  273     EBL DIDNT RESET ON TIME DURING DATA COMMAND
    567
        004462  072064                          EMT273
        004464  072262                          EHT1
        004466  072362                          EDT1
        004470  072410                          EFT1

    568
    569                             ;ERROR  274     GO NOT RESET DURING DATA COMMAND
    570
        004472  072102                          EMT274
        004474  072262                          EHT1
        004476  072362                          EDT1
        004500  072410                          EFT1

    571
    572                             ;ERROR  275     RUN AND GO NOT SET DURING DATA COMMAND
    573
        004502  072120                          EMT275
        004504  072262                          EHT1
        004506  072362                          EDT1
        004510  072410                          EFT1

    574
    575                             ;ERROR  276     INCORRECT TAG BUS DURING DATA COMMAND
    576
        004512  072140                          EMT276
        004514  072262                          EHT1
        004516  072362                          EDT1
```

ERROR POINTER TABLE

```
        004520  072410                          EFT1

    577
    578                             ;ERROR  277     OPI NOT SET DURING DATA COMMAND WHEN ON
    579                             ;               CYLINDER DIDNT DROP
    580
        004522  072156                          EMT277
        004524  072262                          EHT1
        004526  072362                          EDT1
        004530  072410                          EFT1

    581
    582                             ;ERROR  300     DATA COMMAND DID NOT ABORT WHEN SEEK ERROR SET
    583
        004532  072202                          EMT300
        004534  072262                          EHT1
        004536  072362                          EDT1
        004540  072410                          EFT1

    584
    585                             ;ERROR  301     SEARCH NOT ENABLED DURING DATA COMMAND
    586
        004542  072226                          EMT301
        004544  072262                          EHT1
        004546  072362                          EDT1
        004550  072410                          EFT1

    587
    588                             ;ERROR  302     READ IN PRESET DIDNT CLEAR RMDC
    589
        004552  072244                          EMT302
        004554  072262                          EHT1
        004556  072362                          EDT1
        004560  072410                          EFT1

    590                             ;PUT ERROR TABLE HERE
```

ERROR POINTER TABLE

```
                                        ;THIS ROUTINE HANDLES UNEXPECTED TIMEOUTS

004562  011600                BADTMO: MOV     (SP),R0         ;SAVE PC WHERE THE TIME OUT OCCURED
004564  005740                        TST     -(R0)           ;ADJUST PC -2
004566  022626                        CMP     (SP)+,(SP)+     ;RESTORE STACK POINTER
004570  104401  004576                TYPE    ,65$            ;;TYPE ASCIZ STRING
004574  000417                        BR      64$             ;;GET OVER THE ASCIZ
                                ;;65$:  .ASCIZ  <CRLF>/UNEXPECTED BUS TIMEOUT, PC=/
004634                          64$:
004634  010046                        MOV     R0,-(SP)        ;SETUP FOR TYPING OUT PC
004636  104402                        TYPOC
004640  000240                        NOP                     ;PUT 'HALT(0)' INSTRUCTION HERE IF YOU WISH
                                                                ;TO STOP ON UNEXPECTED TIMEOUT.

                                .SBTTL  START OF PROGRAM

004642  012737  177777  001330  START1: MOV     #-1,CHGADR      ;CHANGE RH/RM BUS ADDRESS
004650  000402                        BR      START2

004652  005037  001330          START:  CLR     CHGADR          ;NO CHANGE IN ADDRESS
004656  000240                  START2: NOP
004660  005227  000000                  INC     #0              ;TTY LOOP, WAIT FOR INCREMENT
004664  001375                        BNE     .-4             ;OF WORD
004666  000005                        RESET                   ;RESET THE WORLD

                                .SBTTL  INITIALIZE THE COMMON TAGS
                                ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
004670  012706  001114                MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
004674  005026                        CLR     (R6)+           ;;CLEAR MEMORY LOCATION
004676  022706  001154                CMP     #SWR,R6         ;;DONE?
004702  001374                        BNE     .-6             ;;LOOP BACK IF NO
004704  012706  001100                MOV     #STACK,SP       ;;SETUP THE STACK POINTER
                                ;;INITIALIZE A FEW VECTORS
004710  012737  056370  000020        MOV     #$SCOPE,@#IOTVEC ;;IOT VECTOR FOR SCOPE ROUTINE
004716  012737  000340  000022        MOV     #340,@#IOTVEC+2 ;;LEVEL 7
004724  012737  057310  000030        MOV     #$ERROR,@#EMTVEC ;;EMT VECTOR FOR ERROR ROUTINE
004732  012737  000340  000032        MOV     #340,@#EMTVEC+2 ;;LEVEL 7
004740  012737  062314  000034        MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
004746  012737  000340  000036        MOV     #340,@#TRAPVEC+2;LEVEL 7
004754  012737  062422  000024        MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
004762  012737  000340  000026        MOV     #340,@#PWRVEC+2 ;;LEVEL 7
004770  013737  054140  054132        MOV     $ENDCT,$EOPCT   ;;SETUP END-OF-PROGRAM COUNTER
004776  005037  001206                CLR     $TIMES          ;;INITIALIZE NUMBER OF ITERATIONS
005002  005037  001210                CLR     $ESCAPE         ;;CLEAR THE ESCAPE ON ERROR ADDRESS
005006  112737  000001  001131        MOVB    #1,$ERMAX       ;;ALLOW ONE ERROR PER TEST
005014  012737  005014  001122        MOV     #.,$LPADR       ;;INITIALIZE THE LOOP ADDRESS FOR SCOPE
005022  012737  005022  001124        MOV     #.,$LPERR       ;;SETUP THE ERROR LOOP ADDRESS
                                ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
                                ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
005030  013746  000004                MOV     @#ERRVEC,-(SP)  ;;SAVE ERROR VECTOR
005034  012737  005070  000004        MOV     #64$,@#ERRVEC   ;;SET UP ERROR VECTOR
005042  012737  177570  001154        MOV     #DSWR,SWR       ;;SETUP FOR A HARDWARE SWICH REGISTER
005050  012737  177570  001156        MOV     #DDISP,DISPLAY  ;;AND A HARDWARE DISPLAY REGISTER
005056  022777  177777  174070        CMP     #-1,@SWR        ;;TRY TO REFERENCE HARDWARE SWR
005064  001012                        BNE     66$             ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
                                                                ;;AND  THE HARDWARE SWR IS NOT = -1
005066  000403                        BR      65$             ;;BRANCH IF NO TIMEOUT
```

```
INITIALIZE THE COMMON TAGS

 005070  012716  005076          64$:    MOV     #65$,(SP)       ;;SET UP FOR TRAP RETURN
 005074  000002                  RTI
 005076  012737  000176  001154  65$:    MOV     #SWREG,SWR      ;;POINT TO SOFTWARE SWR
 005104  012737  000174  001156          MOV     #DISPREG,DISPLAY
 005112  012637  000004          66$:    MOV     (SP)+,@#ERRVEC  ;;RESTORE ERROR VECTOR

 005116  005037  001230                  CLR     $PASS           ;;CLEAR PASS COUNT
 005122  132737  000200  001243          BITB    #APTSIZE,$ENVM  ;;TEST USER SIZE UNDER APT
 005130  001403                          BEQ     67$             ;;YES,USE NON-APT SWITCH
 005132  012737  001244  001154          MOV     #$SWREG,SWR     ;;NO,USE APT SWITCH REGISTER
 005140                          67$:
    24
    25 005140  012737  004562  000004    ;SETUP "TIMEOUT" TRAP VECTOR FOR UNEXPECTED BUS TIMEOUTS
    26 005146  012737  000300  000006            MOV     #BADTMO,ERRVEC  ;SETUP FOR UNEXPECTED TIMEOUT
    27                                      MOV     #PR6,ERRVEC+2   ;LEVEL 6
    28
                                    .SBTTL  TYPE PROGRAM NAME
                                    ;;TYPE THE NAME OF THE PROGRAM IF FIRST PASS
 005154  005227  177777                    INC     #-1             ;;FIRST TIME?
 005160  001032                          BNE     68$             ;;BRANCH IF NO
 005162  022737  054302  000042          CMP     #$ENDAD,@#42    ;;ACT-11?
 005170  001426                          BEQ     68$             ;;BRANCH IF YES
 005172  104401  005200                  TYPE    ,69$            ;;TYPE ASCIZ STRING
 005176  000423                          BR      68$             ;;GET OVER THE ASCIZ
                                  ;;69$:  .ASCIZ  <CRLF>@CZRNBA0 - RM80 DISKLESS TEST, PT 1@<CRLF>
 005246                           68$:
                                    .SBTTL  GET VALUE FOR SOFTWARE SWITCH REGISTER
 005246  005737  000042                    TST     @#42            ;;ARE WE RUNNING UNDER XXDP/ACT?
 005252  001012                          BNE     70$             ;;BRANCH IF YES
 005254  123727  001242  000001          CMPB    $ENV,#1         ;;ARE WE RUNNING UNDER APT?
 005262  001406                          BEQ     70$             ;;BRANCH IF YES
 005264  023727  001154  000176          CMP     SWR,#SWREG      ;;SOFTWARE SWITCH REG SELECTED?
 005272  001005                          BNE     71$             ;;BRANCH IF NO
 005274  104407                          GTSWR                   ;;GET SOFT-SWR SETTINGS
 005276  000403                          BR      71$
 005300  112737  0000C1  001150  70$:    MOVB    #1,$AUTOB       ;;SET AUTO-MODE INDICATOR
 005306                           71$:
    29
    30                              ;THE FOLLOWING FINDS OUT THE PROGRAM CONTROL MODE:
    31                              ;PAPER TAPE (MANUAL), ACT11, XXDP CHAIN OR DUMP
    32
    33 005306  005037  001332                  CLR     XXDP            ;CLEAR 'XXDP' LOAD DEVICE STORAGE
    34 005312  122737  000016  000041          CMPB    #16,@#41        ;LOADED FROM AN RM80 ?
    35 005320  001121                          BNE     3$              ;BR IF NOT
    36 005322  013737  000040  001332          MOV     @#40,XXDP       ;GET DEVICE INDICATOR AND NUMBER
    37 005330  122737  000007  001332          CMPB    #7,XXDP         ;IS IT A VALID NUMBER ?
    38 005336  103002                          BHIS    1$              ;YES
    39 005340  105037  001332                  CLRB    XXDP            ;NO, DEFAULT TO DRIVE 0
    40 005344  005737  000042          1$:     TST     @#42            ;CHAIN MODE OR ACT11 AUTO ACCEPT ?
    41 005350  001425                          BEQ     2$              ;BR IF NEITHER
    42 005352  104401  005360                  TYPE    ,73$            ;;TYPE ASCIZ STRING
 005356  000412                          BR      72$             ;;GET OVER THE ASCIZ
                                  ;;73$:  .ASCIZ  <CRLF>/NOT TESTING DRIVE /
 005404                           72$:
 005404  005046                          CLR     -(SP)           ;CLEAR WORD ON STACK
 005406  113716  001332                  MOVB    XXDP,(SP)       ;GET DRIVE ADDRESS
 005412  104403                          TYPOS                   ;TYPE THE ADDRESS
 005414     001                          .BYTE   1               ;ONLY 1 CHARACTER
```

```
 005415     000                            .BYTE   0                 ;SUPRESS LEADING ZEROS
 005416  104401  001217                    TYPE    ,$CRLF            ;CR-LF
 005422  000460                            BR      3$                ;GET NUMBER OF DRIVES

 005424  005227  177777           2$:      INC     #-1               ;FIRST TIME THRU HERE ?
 005430  001055                            BNE     3$                ;NO
 005432  104401  005440                    TYPE    ,75$              ;;TYPE ASCIZ STRING
 005436  000410                            BR      74$               ;;GET OVER THE ASCIZ
                                  ;;75$:   .ASCIZ  <CRLF>/TO TEST DRIVE /
 005460                           74$:
 005460  005046                            CLR     -(SP)             ;CLEAR WORD ON STACK
 005462  113716  001332                    MOVB    XXDP,(SP)         ;GET DRIVE ADDRESS
 005466  104403                            TYPOS                     ;TYPE DRIVE ADDRESS
 005470     001                            .BYTE   1                 ;ONLY 1 CHARACTER
 005471     000                            .BYTE   0                 ;SUPRESS LEADING ZEROS
 005472  104401  005500                    TYPE    ,76$              ;;TYPE ASCIZ STRING
 005476  000432                            BR      3$                ;;GET OVER THE ASCIZ
                                  ;;76$:   .ASCIZ  /, HALT PROGRAM, CLEAR LOC. 40 AND RESTART PROGRAM./<CRLF>
 005564                           3$:


                                  ;CHECK FOR AUTO MODE OR STANDALONE MODE
 005564  005037  001326                    CLR     AUTSIZ            ;LET AUTO DRIVE SIZING OCCUR
 005570  005737  000042                    TST     @#42              ;RUNNING IN AUTO MODE ?
 005574  001537                            BEQ     STANDALONE        ;BR IF NO
 005576  012737  000377  001300            MOV     #377,$DEVM        ;SET DEVICE MAP FOR ALL DRIVES

                                  ;PROGRAM IS RUNNING IN AUTO MODE - SEE IF SIZING IS ALLOWED
 005604                           XSIZ:
 005604  132737  000200  001243            BITB    #BIT7,$ENVM       ;SIZING ALLOWED ?
 005612  001124                            BNE     12$               ;NO

 005614  005001                            CLR     R1                ;START FROM DRIVE 0
 005616  013700  001276                    MOV     $BASE,R0          ;LOAD THE BASE ADDRESS
 005622  104401  063474                    TYPE    ,SYSTAT           ;TYPE 'UNIT STATUS:'

 005626  136137  063740  001300   1$:      BITB    ATNTBL(R1),$DEVM          ;IS DEVICE PRESENT IN MAP ?
 005634  001507                            BEQ     11$               ;BR IF NO
 005636  104401  001217                    TYPE    ,$CRLF            ;CR-LF
 005642  010146                            MOV     R1,-(SP)          ;;SAVE R1 FOR TYPEOUT
 005644  104403                            TYPOS                     ;;GO TYPE--OCTAL ASCII
 005646     002                            .BYTE   2                 ;;TYPE 2 DIGIT(S)
 005647     000                            .BYTE   0                 ;;SUPPRESS LEADING ZEROS
 005650  104401  063632                    TYPE    ,BLNKS4           ;TYPE 4 BLANKS

 005654  012760  000040  000010            MOV     #CLR,RMCS2(R0)    ;CLEAR MASS BUS
 005662  010160  000010                    MOV     R1,RMCS2(R0)      ;LOAD THE DRIVE ADDRESS
 005666  005760  000012                    TST     RMDS(R0)          ;ACCESS DRIVE REGISTER
 005672  032760  010000  000010            BIT     #NED,RMCS2(R0)    ;IS DRIVE PRESENT ?
 005700  001027                            BNE     3$                ;BR IF NO
 005702  032760  004000  000000            BIT     #DVA,RMCS1(R0)    ;IS DRIVE AVAILABLE ?
 005710  001426                            BEQ     4$                ;BR IF NO
 005712  012737  063512  006052            MOV     #$RM80,10$        ;ASSUME RM80 DEVICE
 005720  022760  020026  000026            CMP     #20026,RMDT(R0)   ;SINGLE PORT RM80 ?
 005726  001407                            BEQ     2$                ;BR IF YES
 005730  022760  024026  000026            CMP     #24026,RMDT(R0)   ;DUAL PORT RM80 ?
 005736  001403                            BEQ     2$                ;BR IF YES
 005740  104401  063517                    TYPE    ,NOTRM            ;DRIVE NOT AN RM80
```

```
     98 005744  000443                          BR      11$             ;CHECK NEXT DRIVE
     99 005746  032760  010000  000012  2$:     BIT     #MOL,RMDS(R0)   ;IS MEDIUM ON LINE ?
    100 005754  001415                          BEQ     6$              ;BR IF NO
    101 005756  000417                          BR      7$
    102
    103 005760  104401  063551          3$:     TYPE    ,NOTPRS         ;DRIVE NOT PRESENT
    104 005764  000402                          BR      5$              ;CHECK NEXT DRIVE
    105
    106 005766  104401  063566          4$:     TYPE    ,NOTAVL         ;DRIVE NOT AVAILABLE
    107 005772  005737  001326          5$:     TST     AUTSIZ          ;AUTO SIZING ON ?
    108 005776  001026                          BNE     11$             ;BR IF NO
    109 006000  146137  063740  001300          BICB    ATNTBL(R1),$DEVM        ;CLEAR DEVICE FROM BIT MAP
    110 006006  000422                          BR      11$             ;CHECK NEXT DRIVE
    111
    112 006010  104401  063605          6$:     TYPE    ,UNTOFF         ;DRIVE OFFLINE
    113 006014  000413                          BR      9$              ;PRINT DRIVE TYPE
    114
    115 006016  005737  001332          7$:     TST     XXDP            ;LOADED FROM RM80 ?
    116 006022  001406                          BEQ     8$              ;NO
    117 006024  123701  001332                  CMPB    XXDP,R1         ;IS THIS THE DRIVE ?
    118 006030  001360                          BNE     5$              ;BR IF NO
    119 006032  104401  063534                  TYPE    ,LODEV          ;DRIVE IS LOAD DEVICE
    120 006036  000755                          BR      5$
    121
    122 006040  104401  063616          8$:     TYPE    ,UNTON          ;DRIVE ONLINE
    123 006044  104401  063634          9$:     TYPE    ,BLNKS2         ;TYPE 2 BLANKS
    124 006050  104401                          TYPE                    ;PRINT DRIVE TYPE
    125 006052  000000                  10$:    .WORD   0               ;MESSAGE ADDRESS HERE
    126
    127 006054  005201                  11$:    INC     R1              ;INCREMENT THE DRIVE ADDRESS
    128 006056  020127  000007                  CMP     R1,#7           ;ALL DRIVES ARE CHECKED ?
    129 006062  003661                          BLE     1$              ;BRANCH IF NOT
    130
    131 006064  104401  001217          12$:    TYPE    ,$CRLF          ;CR-LF
    132 006070  000137  006612                  JMP     CMNSTART        ;JUMP TO COMMON START
```

```
                                .SBTTL  STANDALONE INPUT ROUTINES

                                STANDALONE:
006074  004737  060730                  JSR     PC,$TKINT       ;INITIALIZE CONSOLE

006100  005227  177777                  INC     #-1             ;FIRST TIME THRU HERE ?
006104  001023                          BNE     2$              ;BR IF NO

                                ;SEE IF OPERATOR WANTS HELP TEXT

006106  104401  063064                  TYPE    ,MSHELP         ;WANT HELP ?
006112  104411                          RDCHR                   ;GET RESPONSE
006114  012637  001176                  MOV     (SP)+,$TMP1     ;SAVE AND ECHO RESPONSE
006120  123727  001176  000131          CMPB    $TMP1,#'Y       ;WAS IT A YES RESPONSE ?
006126  001005                          BNE     1$              ;NO
006130  104401  001176                  TYPE    ,$TMP1          ;TYPE 'Y'
006134  104401  104536                  TYPE    ,HELP           ;YES - TYPE HELP TEXT
006140  000414                          BR      3$
006142  104401  063626          1$:     TYPE    ,N              ;TYPE 'N'
006146  104401  001217                  TYPE    ,$CRLF          ;CR-LF
006152  000407                          BR      3$

                                ;SEE IF USER WANTS TO CHANGE UNIBUS ADDRESS
006154                          2$:
006154  005737  001330                  TST     CHGADR          ;CHANGE RH/RM BUS ADDRESS ?
006160  001475                          BEQ     7$              ;BR IF NO
006162  005037  001330                  CLR     CHGADR          ;NO CHANGE NEXT TIME
006166  104401  001217                  TYPE    ,$CRLF          ;CR-LF

                                ;DIALOGUE TO CHANGE THE UNIBUS ADDRESS, VECTOR ADDRESS AND INTERRUPT PRIORITY
006172                          3$:
006172  104401  063115                  TYPE    ,CNSL01         ;TYPE CURRENT BUS ADDRESS
006176  013746  001276                  MOV     $BASE,-(SP)     ;;SAVE $BASE FOR TYPEOUT
006202  104402                          TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
006204  104401  063634                  TYPE    ,BLNKS2         ;TYPE 2 BLANKS
006210  104413                          RDOCT                   ;GET NEW BUS ADDRESS
006212  012637  001176                  MOV     (SP)+,$TMP1     ;CARRIAGE RETURN ?
006216  001412                          BEQ     5$              ;YES-SKIP TO NEXT ENTRY
006220  022737  160000  001176          CMP     #160000,$TMP1   ;BASE ADDRESS IN I/O PAGE ?
006226  101403                          BLOS    4$              ;YES
006230  104401  063125                  TYPE    ,CNSL02         ;TYPE WARNING MESSAGE
006234  000756                          BR      3$              ;TRY AGAIN
006236  013737  001176  001276  4$:     MOV     $TMP1,$BASE     ;STORE NEW BUS ADDRESS

006244  104401  063167          5$:     TYPE    ,CNSL03
006250  005046                          CLR     -(SP)
006252  113716  001272                  MOVB    $VECT1,(SP)     ;GET CURRENT VECTOR ADDRESS
006256  104402                          TYPOC
006260  104401  063634                  TYPE    ,BLNKS2         ;TYPE 2 BLANKS
006264  104413                          RDOCT                   ;GET NEW VECTOR ADDRESS
006266  012637  001176                  MOV     (SP)+,$TMP1     ;CARRIAGE RETURN?
006272  001430                          BEQ     7$              ;YES-SKIP TO NEXT ENTRY
006274  022737  001000  001176          CMP     #1000,$TMP1     ;VECTOR ADDRESS < 1000 ?
006302  101003                          BHI     6$              ;YES!!
006304  104401  063176                  TYPE    ,CNSL04         ;TYPE WARNING MESSAGE
006310  000755                          BR      5$              ;RETRY
006312  113700  001272          6$:     MOVB    $VECT1,R0       ;GET CURRENT VECTOR ADDRESS
```

```
                                                BIC     #^C<377>,R0     ;CLEAR SIGN EXTENSION
                                                TST     (R0)+           ;INCREMENT R0 BY 2
                                                MOV     R0,-2(R0)       ;SETUP TRAP CATCHER ADDRESS AND
                                                CLR     (R0)            ;PUT HALT IN TRAP ADDRESS +2
                                                MOV     $TMP1,R0        ;GET NEW VECTOR ADDRESS
                                                MOV     #IRP,(R0)+      ;GET ADDRESS FOR INTERRUPT VECTOR
                                                MOVB    $VECT1+1,(R0)   ;GET PRIORITY LEVEL
                                                MOVB    $TMP1,$VECT1    ;STORE NEW VECTOR ADDRESS

                                        ;DIALOGUE TO INPUT DEVICE NUMBERS
                                7$:     INC     #-1             ;FIRST TIME THRU ?
                                                BNE     8$              ;BR IF NO
                                                TYPE    ,CNSL07         ;TYPE INPUT INSTRUCTIONS
                                8$:     TYPE    ,$CRLF          ;CR-LF
                                9$:     CLR     $DEVM           ;CLEAR DEVICE MAP
                                                TYPE    ,MSDRVS         ;TYPE 'DRIVE(S): '
                                                RDCHR
                                                MOV     (SP)+,$TMP1     ;GET RESPONSE
                                                CMP     $TMP1,#'A       ;IS INPUT "A" ?
                                                BNE     10$             ;NO
                                                TYPE    ,ALL            ;YES, TYPE "ALL" AND GO
                                                MOV     #377,$DEVM      ;SET DEVICE MAP FOR ALL DRIVES
                                                JMP     XSIZ            ;AUTO SIZE

                                10$:    CMP     $TMP1,#CR       ;CARRIAGE RETURN ?
                                                BEQ     12$             ;YES
                                                TYPE    ,$TMP1          ;ECHO RESPONSE
                                                CMP     $TMP1,#'0       ;NUMBER < 0 ?
                                                BLT     12$             ;YES
                                                CMP     $TMP1,#'7       ;NUMBER > 7 ?
                                                BLE     13$             ;NO
                                                BR      12$             ;ILLEGAL INPUT

                                11$:    RDCHR
                                                MOV     (SP)+,$TMP1     ;GET RESPONSE
                                                CMP     $TMP1,#CR       ;CARRIAGE RETURN ?
                                                BEQ     14$             ;YES
                                                TYPE    ,COMMA          ;TYPE ', '
                                                TYPE    ,$TMP1          ;ECHO RESPONSE
                                                CMP     $TMP1,#'0       ;NUMBER < 0 ?
                                                BLT     12$             ;YES
                                                CMP     $TMP1,#'7       ;NUMBER > 7 ?
                                                BLE     13$             ;NO
                                12$:    TYPE    ,CNSL08         ;TYPE " ?ILLEGAL INPUT"
                                                BR      9$              ;RETRY

                                13$:    MOV     $TMP1,R1        ;R1 = DRIVE NUMBER
                                                BIC     #^C7,R1
                                                BISB    ATNTBL(R1),$DEVM        ;SET DEVICE IN MAP
                                                CMPB    #377,$DEVM      ;DONE ?
                                                BHI     11$             ;NO
                                14$:    INC     AUTSIZ          ;DO NOT AUTO SIZE WHEN TYPING DRIVE STATUS
                                                TYPE    ,$CRLF          ;CR-LF
                                                JMP     XSIZ            ;GO SIZE DEVICES
```

```
                                        ;ASSEMBLE TEST QUE FROM DEVICE MAP
006612                                  CMNSTART:
006612  104401  063416                          TYPE    ,DRIVES         ;TYPE 'DRIVE(S) TO BE TESTED'
006616  013700  001300                          MOV     $DEVM,R0        ;R0 = DEVICE MAP
006622  001004                                  BNE     1$              ;BR IF DRIVES TO TEST
006624  104401  063061                          TYPE    ,COMMA          ;TYPE ','
006630  104401  063445                          TYPE    ,NONE           ;TYPE 'NONE'
006634  012701  001470                  1$:     MOV     #TSTQUE+2,R1    ;R1 = ADDRESS OF FIRST ENTRY IN QUE
006640  010137  001466                          MOV     R1,TSTQUE       ;INITIALIZE ENTRY POINTER
006644  012702  000001                          MOV     #1,R2           ;R2 = DEVICE POINTER
006650  005003                                  CLR     R3              ;R3 = DEVICE NUMBER
006652  030200                          2$:     BIT     R2,R0           ;IS THIS DEVICE IN MAP ?
006654  001413                                  BEQ     3$              ;NO !!
006656  104401  063061                          TYPE    ,COMMA          ;TYPE ','
006662  010311                                  MOV     R3,(R1)         ;YES - ENTER DEVICE NUMBER IN QUE
006664  010346                                  MOV     R3,-(SP)        ;;SAVE R3 FOR TYPEOUT
006666  104403                                  TYPOS                   ;;GO TYPE--OCTAL ASCII
006670     001                                  .BYTE   1               ;;TYPE 1 DIGIT(S)
006671     000                                  .BYTE   0               ;;SUPPRESS LEADING ZEROS
006672  116361  063740  000001                  MOVB    ATNTBL(R3),1(R1);ENTER ATTENTION BIT IN QUE
006700  062701  000002                          ADD     #2,R1           ;ADVANCE ENTRY POINTER
006704  006302                          3$:     ASL     R2              ;ADVANCE DEVICE POINTER
006706  105702                                  TSTB    R2              ;DONE ALL DEVICES ?
006710  001402                                  BEQ     4$              ;YES
006712  005203                                  INC     R3              ;ADVANCE DEVICE NUMBER
006714  000756                                  BR      2$              ;ENTER NEXT DEVICE
006716  005011                          4$:     CLR     (R1)            ;TERMINATE TEST QUE
006720  104401  001217                          TYPE    ,$CRLF          ;TYPE CR-LF

                                        ;SIZE FOR CLOCK
006724  004737  054322                          JSR     PC,SIZCLK       ;SEE IF CLOCK PRESENT
006730  000425                                  BR      6$              ;YES - CLOCK IS PRESENT
006732  104401  006740                          TYPE    ,65$            ;;TYPE ASCIZ STRING
006736  000413                                  BR      64$             ;;GET OVER THE ASCIZ
                                        ;;65$:  .ASCIZ  <CRLF>/NO 'L' OR 'P' CLOCK/
006766                                  64$:
006766  005737  000042                          TST     @#42            ;ANY MONITOR PRESENT ?
006772  001002                                  BNE     5$              ;BR IF YES
006774  000137  004652                          JMP     START           ;JUMP TO START
007000  000137  054272                  5$:     JMP     $GET42          ;RETURN CONTROL TO MONITOR
007004  000413                          6$:     BR      READY1

007006  000240                          READY:  NOP                     ;READY TO START TEST
007010  105737  001300                          TSTB    $DEVM           ;ANY DRIVES IN MAP ?
007014  001007                                  BNE     2$              ;BR IF YES
007016  005737  000042                          TST     @#42            ;ANY MONITOR PRESENT ?
007022  001002                                  BNE     1$              ;BR IF YES
007024  000137  004652                          JMP     START           ;JUMP TO START
007030  000137  054272                  1$:     JMP     $GET42          ;RETURN CONTROL TO MONITOR
007034                                  2$:

007034  105037  001116                  READY1: CLRB    $TSTNM          ;RESET TEST NUMBER
007040  005037  001206                          CLR     $TIMES          ;INITIALIZE NUMBER OF ITERATIONS
007044  004737  060730                          JSR     PC,$TKINT       ;INITIALIZE TTY
007050  012746  000000                          MOV     #PR0,-(SP)      ;;PUT NEW PS ON STACK
007054  012746  007062                          MOV     #64$,-(SP)      ;;PUT NEW PC ON  STACK
007060  000002                                  RTI                     ;;POP NEW PC AND PS
```

STANDALONE INPUT ROUTINES

```
    007062
 50 007062  117737  172400  001234  64$:    MOVB    @TSTQUE,$UNIT   ;LOAD DRIVE NUMBER
 51
 52                                  ;CLEAR MASSBUS CONTROLLER, SELECT DRIVE AND SET LAST TRACK ADDRESS
 53 007070  013700  001276          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
 54 007074  012760  000040  000010  MOV     #CLR,RMCS2(R0)  ;CLEAR MASSBUS
 55 007102  117760  172360  000010  MOVB    @TSTQUE,RMCS2(R0)       ;SELECT DEVICE UNDER TEST
 56 007110  012737  006400  001334  MOV     #TA8!TA4!TA1,LSTRK      ;SET LAST TRACK = 13.
 57
 58                                  ;TYPE DRIVE NUMBER TO BE TESTED($UNIT)
 59 007116  104401  001217          TYPE    ,$CRLF          ;CR-LF
 60 007122  105737  001300          TSTB    $DEVM           ;ANY DRIVES IN MAP ?
 61 007126  001406                  BEQ     1$              ;BR IF NO
 62 007130  104401  063466          TYPE    ,MSGDRV         ;TYPE 'DRIVE'
 63 007134  013746  001234          MOV     $UNIT,-(SP)     ;;SAVE $UNIT FOR TYPEOUT
                                                            ;;TYPE DRIVE NUMBER
    007140  104403                  TYPOS                   ;;GO TYPE--OCTAL ASCII
    007142     002                  .BYTE   2               ;;TYPE 2 DIGIT(S)
    007143     000                  .BYTE   0               ;;SUPPRESS LEADING ZEROS
 64 007144  005004          1$:     CLR     R4              ;THESE TWO LOOPS ARE ADDED TO
 65 007146  005304                  DEC     R4              ;WAIT FOR TTY
 66 007150  001376                  BNE     .-2
 67 007152  005304                  DEC     R4
 68 007154  001376                  BNE     .-2
```

```
                        .SBTTL  REGISTER AND STORAGE USAGE

                        ;REGISTER ASSIGNMENTS
                        ;
                        ;R0     =       UNIBUS ADDRESS OF RH CONTROLLER
                        ;R1     =       ADDRESS OF ENTRY IN TEST QUE CORRESPONDING TO THE
                        ;               UNIT UNDER TEST
                        ;R2,R3  =       WORKING REGISTERS FOR TEST IN PROGRESS, MUST BE
                        ;               SAVED BY SUBROUTINES
                        ;R4,R5  =       GENERAL WORKING REGISTERS, ARE NOT SAVED BY
                        ;               SUBROUTINES
                        ;R6     =       STACK POINTER
                        ;R7     =       LINKAGE REGISTER TO SUBROUTINES

                        ;STORAGE ASSIGNMENTS
                        ;
                        ;$TMP0-$TMP4    TEMPORARY STORAGE, NOT SAVED BY SUBROUTINES
                        ;$GDDAT,$BDDAT  EXPECTED AND RRECEIVED STATUS FOR ERROR TYPEOUT
                        ;$GDADR,$BDADR  ADDRESS OF EXPECTED AND RECEIVED STATUS IF APPLICABLE,
                        ;               ALSO THE ADDRESS OF A REGISTER ERROR
                        ;
                        ;$TSTN  =       TEST NUMBER
                        ;$UNIT  =       NUMBER OF DEVICE BEING TESTED
                        ;RGINBF =       THE REGISTER INPUT BUFFER HAS A STORAGE LOCATION FOR
                        ;               EACH REGISTER, AND IS USED WHEN READING STATUS AND
                        ;               CONTROL DATA
                        ;RGOTBF =       THE REGISTER OUTPUT BUFFER HAS A STORAGE LOCATION FOR
                        ;               EACH REGISTER, AND IS USED FOR ASSEMBLING DATA TO BE
                        ;               WRITTEN IN REGISTERS
```

```
                                          ;;*************************************************************
                                          ;*TEST 1          TRANSFER TEST
                                          ;;*************************************************************
 007156                                   TST1:
 007156  000004                                   SCOPE                           ;SCOPE CALL
 007160  000240                                   NOP
 007162  012706  001100                           MOV     #STACK,SP               ;LOAD THE STACK POINTER
 007166  013700  001276                           MOV     $BASE,R0                ;R0 = UNIBUS ADDRESS
 007172  013701  001466                           MOV     TSTQUE,R1               ;R1 = POINTER TO DEVICE
 007176  012737  000001  001226                   MOV     #1,$TESTN               ;;SET TEST NUMBER IN APT MAIL BOX

 007204  012702  000000                           MOV     #0,R2                   ;R2 = REGISTER INDEX

                                          ;CLEAR THE MASSBUS AND VERIFY THAT NONEXISTANT DEVICE ERROR IS RESET
 007210                                   10$:
 007210  004737  055156                           JSR     PC,CNTCLR               ;GO CLEAR CONTROLLER
 007214  016037  000010  001142                   MOV     RMCS2(R0),$BDDAT                ;STORE RMCS2 AT $BDDAT
 007222  032737  010000  001142                   BIT     #NED,$BDDAT
 007230  001417                                   BEQ     20$
 007232  111137  001140                           MOVB    (R1),$GDDAT
 007236  042737  177770  001140                   BIC     #^CUNTMSK,$GDDAT
 007244  052737  000100  001140                   BIS     #IR,$GDDAT
 007252  010037  001136                           MOV     R0,$BDADR
 007256  062737  000010  001136                   ADD     #RMCS2,$BDADR
 007264  104001                                   EMT     1
 007266  000475                                   BR      60$

                                          ;READ THE REGISTER WHOSE INDEX IS IN R2 AND EXIT TEST IF THE READ
                                          ;DOES NOT SET 'NED'' ERROR
 007270                                   20$:
 007270  010003                                   MOV     R0,R3                   ;R3 = REGISTER ADDRESS
 007272  060203                                   ADD     R2,R3
 007274  011304                                   MOV     (R3),R4                 ;READ REGISTER
 007276  032760  010000  000010                   BIT     #NED,RMCS2(R0)          ;IS 'NED'' SET??
 007304  001470                                   BEQ     70$                     ;NO!!

 007306  004737  055156                           JSR     PC,CNTCLR               ;GO CLEAR CONTROLLER
 007312  016037  000010  001142                   MOV     RMCS2(R0),$BDDAT                ;STORE RMCS2 AT $BDDAT
 007320  032737  010000  001142                   BIT     #NED,$BDDAT
 007326  001417                                   BEQ     30$
 007330  111137  001140                           MOVB    (R1),$GDDAT
 007334  042737  177770  001140                   BIC     #^CUNTMSK,$GDDAT
 007342  052737  000100  001140                   BIS     #IR,$GDDAT
 007350  010037  001136                           MOV     R0,$BDADR
 007354  062737  000010  001136                   ADD     #RMCS2,$BDADR
 007362  104001                                   EMT     1
 007364  000436                                   BR      60$

                                          ;WRITE THE REGISTER WHOSE INDEX IS IN R2 AND EXIT TEST IF THE WRITE
                                          ;DOES NOT SET 'NED'' ERROR
 007366                                   30$:
 007366  012713  000000                           MOV     #0,(R3)                 ;WRITE REGISTER
 007372  032760  010000  000010                   BIT     #NED,RMCS2(R0)          ;IS 'NED'' SET??
 007400  001432                                   BEQ     70$                     ;NO!!

                                          ;COULD NOT READ OR WRITE THE REGISTER WITHOUT SETING 'NED'' ERROR -
```

```
T1      TRANSFER TEST

                                        ;ADVANCE THE REGISTER INDEX AND REPEAT THE TEST FOR THE NEXT
                                        ;AVAILABLE DEVICE REGISTER
007402                                  40$:
007402  062702  000002                        ADD     #2,R2           ;ADVANCE TO NEXT REGISTER
007406  022702  000002                        CMP     #RMWC,R2        ;IS THIS RMWC??
007412  001773                              BEQ     40$             ;YES - TRY NEXT REGISTER
007414  022702  000004                        CMP     #RMBA,R2        ;IS THIS RMBA??
007420  001770                              BEQ     40$             ;YES - TRY NEXT REGISTER
007422  022702  000010                        CMP     #RMCS2,R2       ;IS THIS RMCS2??
007426  001765                              BEQ     40$             ;YES - TRY ANOTHER REGISTER
007430  022702  000016                        CMP     #RMAS,R2        ;IS THIS RMAS ??
007434  001762                              BEQ     40$             ;YES - TRY ANOTHER REGISTER
007436  022702  000022                        CMP     #RMDB,R2        ;IS THIS RMDB??
007442  001757                              BEQ     40$             ;YES - TRY ANOTHER REGISTER
007444  022702  000046                        CMP     #RMEC2,R2       ;IS THIS A LEGAL REGISTER
007450  103257                              BHIS    10$             ;YES - TRY THIS REGISTER

                                        ;GOT 'NONEXISTENT DEVICE' ERROR FOR EVERY REMOTE REGISTER ADDRESS
007452                                  50$:
007452  013737  001276  001136                MOV     $BASE,$BDADR    ;STORE BASE ADDRESS
007460  104002                              EMT     2
007462  000137  054046              60$:    JMP     $EOSP           ;GO SELECT NEXT DEVICE

007466                                  70$:

                                        ;;*****************************************************************
                                        ;*TEST 2        CTOD TEST

                                        ;;*****************************************************************
007466                                  ;;
007466  000004                        TST2:
007470  000240                              SCOPE                   ;SCOPE CALL
007472  012706  001100                        NOP
007476  013700  001276                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
007502  013701  001466                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
007506  012737  000002  001226                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                              MOV     #2,$TESTN       ;;SET TEST NUMBER IN APT MAIL BOX

007514  004737  055156                      JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER

                                        ;WRITE ONES IN REMOTE REGISTERS
007520  012760  000076  000000                MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
007526  012760  177777  000006                MOV     #-1,RMDA(R0)    ;LOAD RMDA
007534  012760  001777  000034                MOV     #CYLMSK,RMDC(R0)        ;LOAD RMDC
007542  012760  017200  000032                MOV     #^CXNUOF,RMOF(R0)       ;LOAD RMOF
007550  012760  017200  000032                MOV     #^CXNUOF,RMOF(R0)       ;LOAD RMOF AGAIN TO SET SSEI

                                        ;READ REMOTE REGISTERS TWICE
007556  012702  000001                      MOV     #1,R2
007562                                  10$:
007562  016037  000000  001336                MOV     RMCS1(R0),RMCS1I        ;STORE RMCS1 IN INPUT BUFFER
007570  016037  000006  001344                MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
007576  016037  000034  001372                MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
007604  016037  000032  001370                MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
007612  005302                              DEC     R2
007614  100362                              BPL     10$

                                        ;SEE IF ANY ONE BITS CAME BACK
```

```
     93 007616  042737  177701  001336          BIC     #^CILF76,RMCS1I ;IS RMCS1 0??
     94 007624  001014                          BNE     20$             ;NO!!
     95 007626  005737  001344                  TST     RMDAI           ;IS RMDA 0??
     96 007632  001011                          BNE     20$             ;NO!!
     97 007634  042737  176000  001372          BIC     #XNUDC,RMDCI    ;IS RMDC 0??
     98 007642  001005                          BNE     20$             ;NO!!
     99 007644  042737  160577  001370          BIC     #XNUOF,RMOFI    ;IS RMOF 0 ??
    100 007652  001001                          BNE     20$             ;NO!!
    101
    102                                 ;CANNOT READ/WRITE A ONE FROM ANY REMOTE REGISTER
    103 007654  104003                          EMT     3
    104 007656                          20$:
    105
    106                                 ;;*****************************************************************
                                        ;*TEST 3        MASSBUS INITIALIZE TEST
                                        ;;*****************************************************************
        007656                          TST3:
        007656  000004                          SCOPE                   ;SCOPE CALL
        007660  000240                          NOP
        007662  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        007666  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        007672  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        007676  012737  000003  001226          MOV     #3,$TESTN       ;;SET TEST NUMBER IN APT MAIL BOX
    107
    108 007704  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    109
    110                                 ;WRITE ONES IN SELECTED REGISTERS
    111 007710  012760  000076  000000          MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
    112 007716  012760  177777  000014          MOV     #-1,RMER1(R0)   ;LOAD RMER1
    113 007724  012760  177777  000042          MOV     #-1,RMER2(R0)   ;LOAD RMER2
    114
    115                                 ;INITIALIZE MASSBUS WITH A CLEAR
    116 007732  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    117
    118                                 ;READ THE REGISTERS THAT WERE WRITTEN
    119 007736  016037  000000  001336          MOV     RMCS1(R0),RMCS1I        ;STORE RMCS1 IN INPUT BUFFER
    120 007744  016037  000014  001352          MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
    121 007752  016037  000042  001400          MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    122
    123                                 ;SEE IF ANY REGISTER BITS WERE CLEARED
    124 007760  052737  177701  001336          BIS     #^CILF76,RMCS1I ;SET ANY BIT NOT WRITTEN
    125 007766  052737  001527  001400          BIS     #XNUER2,RMER2I
    126 007774  022737  177777  001336          CMP     #-1,RMCS1I      ;ANY ZEROS IN RMCS1??
    127 010002  001011                          BNE     10$             ;YES!!
    128 010004  022737  177777  001352          CMP     #-1,RMER1I      ;ANY ZEROS IN RMER1??
    129 010012  001005                          BNE     10$             ;YES!!
    130 010014  022737  177777  001400          CMP     #-1,RMER2I      ;ANY ZEROS IN RMER2??
    131 010022  001001                          BNE     10$
    132
    133                                 ;NONE OF THE BITS WERE CLEARED
    134 010024  104004                          EMT     4
    135 010026                          10$:
    136
    137                                 ;;*****************************************************************
                                        ;*TEST 4        CLEAR STUCK ACTIVE TEST
```

```
                                                  ;;*****************************************************************
 010026                                           TST4:
 010026  000004                                           SCOPE                         ;SCOPE CALL
 010030  000240                                           NOP
 010032  012706  001100                                   MOV     #STACK,SP             ;LOAD THE STACK POINTER
 010036  013700  001276                                   MOV     $BASE,R0              ;R0 = UNIBUS ADDRESS
 010042  013701  001466                                   MOV     TSTQUE,R1             ;R1 = POINTER TO DEVICE
 010046  012737  000004  001226                           MOV     #4,$TESTN             ;;SET TEST NUMBER IN APT MAIL BOX

 010054  004737  055156                                   JSR     PC,CNTCLR             ;GO CLEAR CONTROLLER

                                                  ;WRITE ONES IN TEST REGISTERS
 010060  012760  177777  000014                           MOV     #-1,RMER1(R0)         ;LOAD RMER1
 010066  012760  177777  000042                           MOV     #-1,RMER2(R0)         ;LOAD RMER2
 010074  012760  000001  000024                           MOV     #DMD,RMMR1(R0)        ;LOAD RMMR1

                                                  ;READ TEST REGISTERS AND SEE IF ANY BITS ARE ON
 010102  016037  000014  001352                           MOV     RMER1(R0),RMER1I              ;STORE RMER1 IN INPUT BUFFER
 010110  016037  000042  001400                           MOV     RMER2(R0),RMER2I              ;STORE RMER2 IN INPUT BUFFER
 010116  016037  000024  001362                           MOV     RMMR1(R0),RMMR1I              ;STORE RMMR1 IN INPUT BUFFER
 010124  042737  040000  001352                           BIC     #UNS,RMER1I           ;DONT ACCEPT UNSAFE
 010132  001011                                           BNE     10$                   ;BRANCH IF ANY OTHER BITS ON
 010134  042737  040200  001400                           BIC     #SKI!DVC,RMER2I       ;DONT ACCEPT SKI OR DVC
 010142  001005                                           BNE     10$                   ;BRANCH IF ANY OTHER BITS ON
 010144  032737  000001  001362                           BIT     #DMD,RMMR1I           ;BRANCH IF DMD IS ON
 010152  001001                                           BNE     10$
 010154  104026                                           EMT     26
 010156                                           10$:

                                                  ;;*****************************************************************
                                                  ;*TEST 5          TRISTATE TRANSFER TEST

                                                  ;;*****************************************************************
 010156                                           TST5:
 010156  000004                                           SCOPE                         ;SCOPE CALL
 010160  000240                                           NOP
 010162  012706  001100                                   MOV     #STACK,SP             ;LOAD THE STACK POINTER
 010166  013700  001276                                   MOV     $BASE,R0              ;R0 = UNIBUS ADDRESS
 010172  013701  001466                                   MOV     TSTQUE,R1             ;R1 = POINTER TO DEVICE
 010176  012737  000005  001226                           MOV     #5,$TESTN             ;;SET TEST NUMBER IN APT MAIL BOX

 010204  005002                                           CLR     R2                    ;CLEAR ERROR FLAGS
 010206  004737  055156                                   JSR     PC,CNTCLR             ;GO CLEAR CONTROLLER

                                                  ;WRITE ONES IN SELECTED REGISTERS
 010212  012760  000076  000000                           MOV     #ILF76,RMCS1(R0)              ;LOAD RMCS1
 010220  012760  177777  000006                           MOV     #-1,RMDA(R0)          ;LOAD RMDA
 010226  012760  177777  000014                           MOV     #-1,RMER1(R0)         ;LOAD RMER1
 010234  012760  177777  000032                           MOV     #-1,RMOF(R0)          ;LOAD RMOF
 010242  012760  177777  000032                           MOV     #-1,RMOF(R0)          ;LOAD RMOF AGAIN TO SET SSEI
 010250  012760  177777  000042                           MOV     #-1,RMER2(R0)         ;LOAD RMER2

                                                  ;WRITE ZEROS IN SELECTED REGISTERS
 010256  012760  000000  000000                           MOV     #0,RMCS1(R0)          ;LOAD RMCS1
 010264  012760  000000  000006                           MOV     #0,RMDA(R0)           ;LOAD RMDA
 010272  012760  000000  000014                           MOV     #0,RMER1(R0)          ;LOAD RMER1
 010300  012760  000000  000032                           MOV     #0,RMOF(R0)           ;LOAD RMOF
```

```
    176 010306  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
    177 010314  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
    178
    179                                 ;READ BACK ALL REGISTERS
    180 010322  016037  000000  001336          MOV     RMCS1(R0),RMCS1I        ;STORE RMCS1 IN INPUT BUFFER
    181 010330  016037  000006  001344          MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
    182 010336  016037  000014  001352          MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
    183 010344  016037  000032  001370          MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
    184 010352  016037  000034  001372          MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
    185 010360  016037  000042  001400          MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    186
    187                                 ;CHECK EACH REGISTER CONTENT FOR ZERO BITS WRITTEN & READ
    188 010366  012702  177777                  MOV     #-1,R2          ;ACCUMULATE ZEROS IN R2
    189 010372  052737  177701  001336          BIS     #^CILF76,RMCS1I ;SET ALL BITS NOT WRITTEN
    190 010400  052737  160577  001370          BIS     #XNUOF,RMOFI
    191 010406  052737  176000  001372          BIS     #XNUDC,RMDCI
    192 010414  052737  001527  001400          BIS     #XNUER2,RMER2I
    193 010422  005137  001336                  COM     RMCS1I          ;COMPLEMENT REGISTER CONTENTS
    194 010426  005137  001344                  COM     RMDAI
    195 010432  005137  001352                  COM     RMER1I
    196 010436  005137  001370                  COM     RMOFI
    197 010442  005137  001372                  COM     RMDCI
    198 010446  005137  001400                  COM     RMER2I
    199 010452  043702  001336                  BIC     RMCS1I,R2               ;ACCUMULATE ALL ZERO BITS
    200 010456  043702  001344                  BIC     RMDAI,R2
    201 010462  043702  001352                  BIC     RMER1I,R2
    202 010466  043702  001370                  BIC     RMOFI,R2
    203 010472  043702  001372                  BIC     RMDCI,R2
    204 010476  043702  001400                  BIC     RMER2I,R2
    205 010502  001407                          BEQ     10$             ;BRANCH IF EACH BIT IS ZERO
    206
    207                                 ;ONE OR MORE BIT POSITIONS ARE NOT ZERO
    208 010504  010237  001142                  MOV     R2,$8DDAT               ;SAVE RESULT FOR TYPE
    209 010510  005037  001140                  CLR     $GDDAT          ;LOAD EXPECTED RESULT
    210 010514  104005                          EMT     5
    211 010516  052702  000001                  BIS     #BIT0,R2        ;SET ERROR FLAG
    212
    213 010522                          10$:
        010522  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    214
    215                                 ;PRESET SELECTED REGISTERS TO ZEROS
    216                                 ;(ASSUME RMCS1, RMER1, RMER2 WERE CLEARED BY INIT)
    217 010526  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
    218 010534  012760  000000  000032          MOV     #0,RMOF(R0)     ;LOAD RMOF
    219 010542  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
    220
    221                                 ;WRITE ONES IN SELECTED REGISTERS
    222 010550  012760  000076  000000          MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
    223 010556  012760  177777  000006          MOV     #-1,RMDA(R0)    ;LOAD RMDA
    224 010564  012760  017200  000032          MOV     #^CXNUOF,RMOF(R0)       ;LOAD RMOF
        010572  012760  017200  000032          MOV     #^CXNUOF,RMOF(R0)       ;LOAD RMOF AGAIN TO SET SSEI
    225 010600  012760  001777  000034          MOV     #^CXNUDC,RMDC(R0)       ;LOAD RMDC
    226 010606  012760  177777  000014          MOV     #-1,RMER1(R0)   ;LOAD RMER1
    227 010614  012760  176250  000042          MOV     #^CXNUER2,RMER2(R0)     ;LOAD RMER2
    228
    229                                 ;READ ALL REGISTERS
    230 010622  016037  000000  001336          MOV     RMCS1(R0),RMCS1I        ;STORE RMCS1 IN INPUT BUFFER
```

```
                                                MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
                                                MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
                                                MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
                                                MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
                                                MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER

                                        ;CHECK EACH REGISTER CONTENT FOR ONE BITS WRITTEN & READ
                                                BIC     #^CILF76,RMCS1I         ;CLEAR ALL BITS NOT WRITTEN
                                                BIC     #XNUOF,RMOFI
                                                BIC     #XNUDC,RMDCI
                                                BIC     #XNUER2,RMER2I
                                                CLR     R2              ;ACCUMULATE ONES IN R2
                                                BIS     RMCS1I,R2               ;ACCUMULATE ALL ONE BITS
                                                BIS     RMDAI,R2
                                                BIS     RMOFI,R2
                                                BIS     RMDCI,R2
                                                BIS     RMER1I,R2
                                                BIS     RMER2I,R2
                                                CMP     #-1,R2          ;SEE IF EACH BIT POSITION WAS ONE
                                                BEQ     20$             ;BRANCH IF NONE STUCK

                                        ;ONE OR MORE BIT POSITIONS ARE NOT ONE
                                                MOV     R2,$BDDAT               ;SAVE RESULT FOR TYPE
                                                MOV     #-1,$GDDAT              ;EXPECTED RESULT
                                                EMT     6
                                                BIS     #BIT1,R2        ;SET ERROR FLAG
                                        20$:
                                                TST     R2              ;ANY ERRORS DETECTED ??
                                                BNE     30$             ;YES - DONT DO BIT TEST
                                                MOV     #1,R2           ;R2=BIT POSITION

                                        25$:
                                                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER

                                        ;WRITE THE BIT PATTERN IN SELECTED DEVICE REGISTERS
                                                MOV     R2,RMDA(R0)     ;LOAD RMDA
                                                MOV     R2,RMOF(R0)     ;LOAD RMOF
                                                MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
                                                MOV     R2,RMDC(R0)     ;LOAD RMDC
                                                MOV     R2,RMER1(R0)    ;LOAD RMER1
                                                MOV     R2,RMER2(R0)    ;LOAD RMER2

                                        ;READ BACK THE REGISTERS
                                                MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFFR
                                                MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
                                                MOV     RMDC(R0),RMDCI  ;STORF RMDC IN INPUT BUFFER
                                                MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
                                                MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER

                                        ;CHECK REGISTER CONTENTS FOR CORRECT PATTERN
                                                CLR     R3              ;R3=ACCUMULATED ONE BIT
                                                MOV     #-1,R4          ;R4=ACCUMULATED ZERO BITS
                                                MOV     RMDAi,R5                ;GET ANY GOOD BITS FROM RMDA
                                                BIS     R5,R3
                                                COM     R5
                                                BIC     R5,R4
                                                MOV     RMOFI,R5                ;GET GOOD BITS FROM RMOF
```

```
    286 011124  042705  160577                  BIC     #XNUOF,R5
    287 011130  050503                          BIS     R5,R3
    288 011132  005105                          COM     R5
    289 011134  042705  160577                  BIC     #XNUOF,R5
    290 011140  040504                          BIC     R5,R4
    291 011142  013705  001372                  MOV     RMDCI,R5            ;GET GOOD BITS FROM RMDC
    292 011146  042705  176000                  BIC     #XNUDC,R5
    293 011152  050503                          BIS     R5,R3
    294 011154  005105                          COM     R5
    295 011156  042705  176000                  BIC     #XNUDC,R5
    296 011162  040504                          BIC     R5,R4
    297 011164  013705  001352                  MOV     RMER1I,R5           ;GET GOOD BITS FROM RMER1
    298 011170  050503                          BIS     R5,R3
    299 011172  005105                          COM     R5
    300 011174  040504                          BIC     R5,R4
    301 011176  013705  001400                  MOV     RMER2I,R5           ;GET GOOD BITS FROM RMER2
    302 011202  042705  001527                  BIC     #XNUER2,R5
    303 011206  050503                          BIS     R5,R3
    304 011210  005105                          COM     R5
    305 011212  042705  001527                  BIC     #XNUER2,R5
    306 011216  040504                          BIC     R5,R4
    307 011220  010205                          MOV     R2,R5           ;RESET ALL ONES IN R3 EXCEPT
    308 011222  005105                          COM     R5              ;FOR THE TEST BIT
    309 011224  040503                          BIC     R5,R3
    310 011226  040204                          BIC     R2,R4           ;RESET TEST BIT IN R4
    311 011230  050403                          BIS     R4,R3           ;COMBINE ACCUMULATED 1'S + 0'S
    312 011232  020302                          CMP     R3,R2           ;IS PATTERN OK??
    313 011234  001406                          BEQ     26$             ;YES!!
    314 011236  010237  001140                  MOV     R2,$GDDAT               ;SAVE TEST PATTERN
    315 011242  010337  001142                  MOV     R3,$BDDAT               ;SAVE RESULT
    316 011246  104007                          EMT     7
    317 011250  000404                          BR      30$             ;SKIP TO NEXT
    318
    319                                 ;ADVANCE R2 TO THE NEXT PATTERN AND REPEAT TEST
    320 011252                          26$:
    321 011252  006302                          ASL     R2              ;SHIFT THE BIT
    322 011254  001402                          BEQ     30$             ;EXIT IF DONE
    323 011256  000137  011006                  JMP     25$
    324 011262                          30$:
    325
    331
    332                                 ;;*****************************************************************
                                        ;*TEST 6         REGISTER SELECT TEST
                                        ;*
                                        ;*NOTE: REGISTER SELECT 16 IS TESTED BY THE "ILR" TEST
                                        ;*
                                        ;;*****************************************************************
        011262                          TST6:
        011262  000004                          SCOPE                   ;SCOPE CALL
        011264  000240                          NOP
        011266  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        011272  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        011276  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        011302  012737  000006  001226          MOV     #6,$TESTN       ;;SET TEST NUMBER IN APT MAIL BOX
    333
    334                                 ;THE FOLLOWING TABLE GIVES MASSBUS REGISTER SELECT VALUES FOR
    335                                 ;EACH DEVICE REGISTER
```

```
                                ;       REGISTER        REG SEL
                                ;       NAME            (16,8,4,2,1)
                                ;
                                ;       RMCS1           00000
                                ;       RMDS            00001
                                ;       RMER1           00010
                                ;       RMMR1           00011
                                ;       RMAS            00100
                                ;       RMDA            00101
                                ;       RMDT            00110
                                ;       RMLA            00111
                                ;       RMSN            01000
                                ;       RMOF            01001
                                ;       RMDC            01010
                                ;       RMHR            01011
                                ;       RMMR2           01100
                                ;       RMER2           01101
                                ;       RMEC1           01110
                                ;       RMEC2           01111

                               ;EACH REGISTER SELECT LINE IS TESTED FOR A STUCK AT ONE,
                               ;STUCK AT ZERO FAULT. AS AN EXAMPLE, TO TEST REG SEL 1.
                               ;FOR S-A-0, RMER1 IS WRITTEN WITH ZEROS. THEN THE REGISTER
                               ;THAT HAS THE SAME SELECT VALUE, EXCEPT FOR THE SELECT LINE
                               ;BEING TESTED, IS WRITTEN WITH ONES. IN THIS EXAMPLE,
                               ;RMMR1 IS WRITTEN WITH ONES. IF SELECT LINE 1 IS S-A-0,
                               ;THE ALL ONES WORD WILL BE WRITTEN IN RMER1, AND RMER1
                               ;WILL NOT BE 0 WHEN READ BACK.

011310  005002                         CLR     R2              ;R2= ZEROS SOURCE
011312  012703  177777                 MOV     #-1,R3          ;R3= ONES  SOURCE

                               ;TEST REG SEL 1 FOR S-A-0
011316  004737  055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
011322  010260  000014                 MOV     R2,RMER1(R0)    ;LOAD RMER1
011326  010260  000034                 MOV     R2,RMDC(R0)     ;LOAD RMDC
011332  010360  000024                 MOV     R3,RMMR1(R0)    ;LOAD RMMR1
011336  010360  000036                 MOV     R3,RMHR(R0)     ;LOAD RMHR
011342  016037  000014  001352         MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
011350  016037  000034  001372         MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
011356  020337  001352                 CMP     R3,RMER1I
011362  001007                         BNE     10$
011364  052737  176000  001372         BIS     #XNUDC,RMDCI
011372  020337  001372                 CMP     R3,RMDCI
011376  001001                         BNE     10$
011400  104010                         EMT     10

                               ;TEST REG SEL 1 FOR S-A-1
011402                         10$:
011402  004737  055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
011406  010260  000006                 MOV     R2,RMDA(R0)     ;LOAD RMDA
011412  010260  000032                 MOV     R2,RMOF(R0)     ;LOAD RMOF
011416  010260  000032                 MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
011422  010260  000042                 MOV     R2,RMER2(R0)    ;LOAD RMER2
011426  010360  000016                 MOV     R3,RMAS(R0)     ;LOAD RMAS
011432  010360  000030                 MOV     R3,RMSN(R0)     ;LOAD RMSN
```

```
    392 011436  010360  000040                 MOV     R3,RMMR2(R0)    ;LOAD RMMR2
    393 011442  016037  000006  001344         MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
    394 011450  016037  000032  001370         MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
    395 011456  016037  000042  001400         MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    396 011464  020337  001344                 CMP     R3,RMDAI
    397 011470  001015                         BNE     20$
    398 011472  052737  160577  001370         BIS     #XNUOF,RMOFI
    399 011500  020337  001370                 CMP     R3,RMOFI
    400 011504  001007                         BNE     20$
    401 011506  052737  001527  001400         BIS     #XNUER2,RMER2I
    402 011514  020337  001400                 CMP     R3,RMER2I
    403 011520  001001                         BNE     20$
    404 011522  104011                         EMT     11
    405
    406                                 ;TEST REG SEL 2 FOR S-A-0
    407 011524                          20$:
    408 011524  004737  055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    409 011530  010260  000006                 MOV     R2,RMDA(R0)     ;LOAD RMDA
    410 011534  010260  000032                 MOV     R2,RMOF(R0)     ;LOAD RMOF
        011540  010260  000032                 MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
    411 011544  010260  000042                 MOV     R2,RMER2(R0)    ;LOAD RMER2
    412 011550  010360  000020                 MOV     R3,RMLA(R0)     ;LOAD RMLA
    413 011554  010360  000036                 MOV     R3,RMHR(R0)     ;LOAD RMHR
    414 011560  010360  000046                 MOV     R3,RMEC2(R0)    ;LOAD RMEC2
    415 011564  016037  000006  001344         MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
    416 011572  016037  000032  001370         MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
    417 011600  016037  000042  001400         MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    418 011606  020337  001344                 CMP     R3,RMDAI
    419 011612  001015                         BNE     30$
    420 011614  052737  160577  001370         BIS     #XNUOF,RMOFI
    421 011622  020337  001370                 CMP     R3,RMOFI
    422 011626  001007                         BNE     30$
    423 011630  052737  001527  001400         BIS     #XNUER2,RMER2I
    424 011636  020337  001400                 CMP     R3,RMER2I
    425 011642  001001                         BNE     30$
    426 011644  104012                         EMT     12
    427
    428                                 ;TEST REG SEL 2 FOR S-A-1
    429 011646                          30$:
    430 011646  004737  055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    431 011652  010260  000014                 MOV     R2,RMER1(R0)    ;LOAD RMER1
    432 011656  010260  000034                 MOV     R2,RMDC(R0)     ;LOAD RMDC
    433 011662  012760  000076  000000         MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
    434 011670  010360  000030                 MOV     R3,RMSN(R0)     ;LOAD RMSN
    435 011674  016037  000014  001352         MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
    436 011702  016037  000034  001372         MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
    437 011710  052737  177701  001352         BIS     #^CILF76,RMER1I
    438 011716  020337  001352                 CMP     R3,RMER1I
    439 011722  001007                         BNE     40$
    440 011724  052737  176000  001372         BIS     #XNUDC,RMDCI
    441 011732  020337  001372                 CMP     R3,RMDCI
    442 011736  001001                         BNE     40$
    443 011740  104013                         EMT     13
    444
    445                                 ;TEST REG SEL 4 FOR S-A-0
    446 011742                          40$:
    447 011742  004737  055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
```

```
                                                MOV     R2,RMER1(R0)    ;LOAD RMER1
                                                MOV     R2,RMOF(R0)     ;LOAD RMOF
                                                MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
                                                MOV     R2,RMDC(R0)     ;LOAD RMDC
                                                MOV     R3,RMDT(R0)     ;LOAD RMDT
                                                MOV     R3,RMER2(R0)    ;LOAD RMER2
                                                MOV     R3,RMEC1(R0)    ;LOAD RMEC1
                                                MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
                                                MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
                                                MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
                                                CMP     R3,RMER1I
                                                BNE     50$
                                                BIS     #XNUOF,RMOFI
                                                CMP     R3,RMOFI
                                                BNE     50$
                                                BIS     #XNUDC,RMDCI
                                                CMP     R3,RMDCI
                                                BNE     50$
                                                EMT     14

                                        ;TEST REG SEL 4 FOR S-A-1
                                        50$:
                                                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                                MOV     R2,RMDA(R0)     ;LOAD RMDA
                                                MOV     R2,RMER2(R0)    ;LOAD RMER2
                                                MOV     R3,RMDS(R0)     ;LOAD RMDS
                                                MOV     R3,RMOF(R0)     ;LOAD RMOF
                                                MOV     R3,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSFI
                                                MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
                                                MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
                                                CMP     R3,RMDAI
                                                BNE     60$
                                                BIS     #XNUER2,RMER2I
                                                CMP     R3,RMER2I
                                                BNE     60$
                                                EMT     15

                                        ;TEST REG SEL 8 FOR S-A-0
                                        60$:
                                                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                                MOV     R2,RMER1(R0)    ;LOAD RMER1
                                                MOV     R2,RMDA(R0)     ;LOAD RMDA
                                                MOV     R3,RMDC(R0)     ;LOAD RMDC
                                                MOV     R3,RMER2(R0)    ;LOAD RMER2
                                                MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
                                                MOV     RMDA(R0),RMDAI  ;STORE RMDA IN INPUT BUFFER
                                                CMP     R3,RMER1I
                                                BNE     70$
                                                CMP     R3,RMDAI
                                                BNE     70$
                                                EMT     16

                                        ;TEST REG SEL 8 FOR S-A-1
                                        70$:
                                                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                                MOV     R2,RMOF(R0)     ;LOAD RMOF
                                                MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
```

```
                                        MOV     R2,RMDC(R0)     ;LOAD RMDC
                                        MOV     R2,RMER2(R0)    ;LOAD RMER2
                                        MOV     R3,RMDS(R0)     ;LOAD RMDS
                                        MOV     R3,RMER1(R0)    ;LOAD RMER1
                                        MOV     R3,RMDA(R0)     ;LOAD RMDA
                                        MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
                                        MOV     RMDC(R0),RMDCI  ;STORE RMDC IN INPUT BUFFER
                                        MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
                                        BIS     #XNUOF,RMOFI
                                        BNE     80$
                                        CMP     #XNUDC,RMDCI
                                        CMP     R3,RMDCI
                                        BNE     80$
                                        BIS     #XNUER2,RMER2I
                                        CMP     R3,RMER2I
                                        BNE     80$
                                        EMT     17
                                80$:

                                ;;*******************************************************************
                                ;*TEST 7         DRIVE TYPE TEST

                                ;;*******************************************************************
                                TST7:
                                        SCOPE                   ;SCOPE CALL
                                        NOP
                                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
                                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                                        MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                        MOV     #7,$TESTN       ;;SET TEST NUMBER IN APT MAIL BOX

                                        MOV     RMDT(R0),$BDDAT ;STORE RMDT AT $BDDAT
                                        CMP     #SNGPRT,$BDDAT  ;SINGLE PORT RM80??
                                        BEQ     10$             ;YES!!
                                        CMP     #DULPRT,$BDDAT  ;DUAL PORT RM80??
                                        BEQ     10$             ;YES!!
                                        MOV     R0,$BDADR       ;LOAD BAD ADDRESS
                                        ADD     #RMDT,$BDADR
                                        EMT     57

                                        JMP     $EOSP           ;GO TO NEXT DEVICE
                                10$:

                                ;;*******************************************************************
                                ;*TEST 10        DEVICE AVAILABLE TEST

                                ;;*******************************************************************
                                TST10:
                                        SCOPE                   ;SCOPE CALL
                                        NOP
                                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
                                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                                        MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                        MOV     #10,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

                                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                        MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
```

```
                                        BIC     #^CDVA,$BDDAT   ;CLEAR ALL BUT DVA
                                        BNE     10$             ;BRANCH IF DVA SET
                                        MOV     #DVA,$GDDAT     ;SETUP EXPECTED
                                        MOV     R0,$BDADR       ;SETUP REG ADDRESS
                                        EMT     60
                                10$:

                                ;;**********************************************************************
                                ;*TEST 11        HOLDING REGISTER TRANSFER TEST

                                ;;**********************************************************************
                                TST11:
                                        SCOPE                   ;SCOPE CALL
                                        NOP
                                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
                                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                                        MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                        MOV     #11,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

                                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                        CLR     R3              ;CLEAR ERROR FLAGS
                                        MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
                                        ADD     #RMHR,$BDADR

                                ;WRITE ONES THEN ZEROS IN RMHR AND CHECK FOR S-A-1 BITS.
                                ;NOTE THAT IT IS NECESSARY TO WRITE SOME OTHER REGISTER IN
                                ;ORDER TO WRITE THE HOLDING REGISTER, AND RMDA IS USED FOR THIS
                                ;PURPOSE.
                                        MOV     #-1,RMDA(R0)    ;LOAD RMDA
                                        MOV     #0,RMDA(R0)     ;LOAD RMDA
                                        MOV     RMHR(R0),$BDDAT ;STORE RMHR AT $BDDAT
                                        COM     $BDDAT          ;ANY ERROR??
                                        BEQ     10$             ;NO!!
                                        CLR     $GDDAT          ;LOAD EXPECTED
                                        EMT     61
                                        BIS     #BIT0,R3        ;SET ERROR FLAGS

                                ;WRITE ZEROS THEN ONES IN RMHR AND CHECK FOR S-A-0 BITS.
                                10$:
                                        MOV     #0,RMDA(R0)     ;LOAD RMDA
                                        MOV     #-1,RMDA(R0)    ;LOAD RMDA
                                        MOV     RMHR(R0),$BDDAT ;STORE RMHR AT $BDDAT
                                        COM     $BDDAT          ;RMHR IS COMPLEMENTED WHEN READ
                                        MOV     #-1,$GDDAT      ;SETUP EXPECTED
                                        CMP     $GDDAT,$BDDAT   ;ANY ERROR??
                                        BEQ     20$             ;NO!!
                                        EMT     62
                                        BIS     #BIT1,R3        ;SET ERROR FLAG

                                ;IF NO PREVIOUS ERRORS, WRITE AND READ SHIFTING ONE BIT PATTERN.
                                20$:
                                        TST     R3              ;ANY FLAGS SET??
                                        BNE     50$             ;YES!!
                                        MOV     #1,R2           ;R2=DATA PATTERN
                                30$:
                                        MOV     #0,RMDA(R0)     ;LOAD RMDA
                                        MOV     R2,RMDA(R0)     ;LOAD RMDA
```

```
 589 012742 016037 000036 001142          MOV     RMHR(R0),$BDDAT ;STORE RMHR AT $BDDAT
 590 012750 005137 001142                 COM     $BDDAT          ;RMHR IS COMPLEMENTED
 591 012754 023702 001142                 CMP     $BDDAT,R2       ;ANY ERROR??
 592 012760 001404                        BEQ     40$             ;NO!!
 593 012762 010237 001140                 MOV     R2,$GDDAT       ;SETUP EXPECTED
 594 012766 104063                        EMT     63
 595 012770 000402                        BR      50$             ;DO NOT COLLECT ALL ERRORS
 596
 597 012772 006302                 40$:   ASL     R2              ;SHIFT TO NEXT PATTERN
 598 012774 001355                        BNE     30$             ;CONTINUE IF NOT DONE
 599
 600 012776                        50$:
 601
 602                               ;;*****************************************************************
                                   ;*TEST 12       CONTROL STATUS #1 TRANSFER TEST

                                   ;;*****************************************************************
     012776                        TST12:
     012776 000004                        SCOPE                   ;SCOPE CALL
     013000 000240                        NOP
     013002 012706 001100                 MOV     #STACK,SP       ;LOAD THE STACK POINTER
     013006 013700 001276                 MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     013012 013701 001466                 MOV     TSTVUE,R1       ;R1 = POINTER TO DEVICE
     013016 012737 000012 001226          MOV     #12,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
 603
 604 013024 005003                        CLR     R3              ;R3 = ERROR INDICATOR
 605 013026 004737 055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
 606
 607                               ;WRITE ONES IN RMCS1, BITS 01-05, THEN CLEAR. READ AND
 608                               ;CHECK FOR S-A-1 BITS.
 609 013032 012760 000076 000000          MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
 610
 611 013040 004737 055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
 612 013044 016037 000000 001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
 613 013052 042737 177701 001142          BIC     #^CILF76,$BDDAT
 614 013060 001410                        BEQ     5$
 615 013062 005037 001140                 CLR     $GDDAT
 616 013066 010037 001136                 MOV     R0,$BDADR
 617 013072 062737 000000 001136          ADD     #RMCS1,$BDADR
 618 013100 104043                        EMT     43
 619
 620                               ;WRITE ONES IN RMCS1, BITS 01-05, THEN WRITE ZEROS. READ AND CHECK FOR
 621                               ;S-A-1 BITS.
 622 013102                        5$:
 623 013102 012760 000076 000000          MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
 624 013110 012760 000000 000000          MOV     #0,RMCS1(R0)    ;LOAD RMCS1
 625 013116 016037 000000 001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
 626 013124 042737 177701 001142          BIC     #^CILF76,$BDDAT
 627 013132 001412                        BEQ     10$
 628 013134 005037 001140                 CLR     $GDDAT
 629 013140 010037 001136                 MOV     R0,$BDADR
 630 013144 062737 000000 001136          ADD     #RMCS1,$BDADR
 631 013152 104023                        EMT     23
 632 013154 052703 000001                 BIS     #BIT0,R3        ;SET ERROR FLAG
 633
 634                               ;WRITE ZEROS IN RMCS1, THEN ONES, READ AND CHECK S-A-0 BITS.
 635 013160                        10$:
```

```
                                        MOV     #0,RMCS1(R0)    ;LOAD RMCS1
                                        MOV     #ILF76,RMCS1(R0)        ;LOAD RMCS1
                                        MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
                                        BIC     #^CILF76,$BDDAT
                                        MOV     #ILF76,$GDDAT
                                        CMP     $GDDAT,$BDDAT
                                        BEQ     20$
                                        MOV     R0,$BDADR
                                        ADD     #RMCS1,$BDADR
                                        EMT     24
                                        BIS     #BIT1,R3        ;SET ERROR FLAG

                                ;WRITE A SHIFTING ONE BIT PATTERN IN RMCS1, READ AND CHECK FOR STUCK BITS.
                                20$:
                                        TST     R3              ;OMIT IF ANY ERRORS
                                        BNE     50$
                                        MOV     #2,R2           ;R2 = TEST PATTERN
                                30$:
                                        MOV     R2,R3           ;R3 = EXPECTED RESULT, BITS 1-5
                                        BIC     #^CILF76,R3
                                        MOV     #0,RMCS1(R0)    ;LOAD RMCS1
                                        MOV     R2,RMCS1(R0)    ;LOAD RMCS1
                                        MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
                                        BIC     #^CILF76,$BDDAT
                                        CMP     R3,$BDDAT
                                        BEQ     40$
                                        MOV     R3,$GDDAT
                                        MOV     R0,$BDADR
                                        ADD     #RMCS1,$BDADR
                                        EMT     25
                                40$:    ASL     R2              ;SHIFT TO NEXT BIT
                                        BNE     30$             ;CONTINUE IF R2 NOT ZERO
                                50$:

                                ;;*******************************************************************
                                ;*TEST 13       ERROR REGISTER #1 TRANSFER TEST

                                ;;*******************************************************************
                                TST13:
                                        SCOPE                   ;SCOPE CALL
                                        NOP
                                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
                                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                                        MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                        MOV     #13,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

                                        CLR     R3              ;CLEAR ERROR FLAG

                                ;WRITE ONES IN RMER1, CLEAR AND CHECK FOR S-A-1 BITS
                                        MOV     #-1,RMER1(R0)   ;LOAD RMER1

                                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                        MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
                                        MOV     RMER1I,$BDDAT
                                        BIC     #^C<PAR!RMR!ILF!ILR>,$BDDAT
                                        BEQ     10$
                                        CLR     $GDDAT
```

```
013436  010037  001136                 MOV     R0,$BDADR
013442  062737  000014  001136         ADD     #RMER1,$BDADR
013450  104027                         EMT     27
013452                          10$:
013452  013737  001352  001142         MOV     RMER1I,$BDDAT
013460  042737  074017  001142         BIC     #^C<DCK!IAE!AOE!HCRC!HCE!ECH!WCF!FER>,$BDDAT
013466  001410                         BEQ     20$
013470  005037  001140                 CLR     $GDDAT
013474  010037  001136                 MOV     R0,$BDADR
013500  062737  000014  001136         ADD     #RMER1,$BDADR
013506  104030                         EMT     30
013510                          20$:
013510  013737  001352  001142         MOV     RMER1I,$BDDAT
013516  042737  147777  001142         BIC     #^C<OPI!DTE>,$BDDAT
013524  001410                         BEQ     30$
013526  005037  001140                 CLR     $GDDAT
013532  010037  001136                 MOV     R0,$BDADR
013536  062737  000014  001136         ADD     #RMER1,$BDADR
013544  104031                         EMT     31

                        ;WRITE ONES THEN ZEROS IN RMER1, READ AND CHECK FOR S-A-1 BITS
013546                  30$:
013546  012760  177777  000014         MOV     #-1,RMER1(R0)    ;LOAD RMER1
013554  012760  000000  000014         MOV     #0,RMER1(R0)     ;LOAD RMER1
013562  016037  000014  001352         MOV     RMER1(R0),RMER1I        ;STORE RMER1 IN INPUT BUFFER
013570  013737  001352  001142         MOV     RMER1I,$BDDAT
013576  042737  177770  001142         BIC     #^C<RMR!ILF!ILR>,$BDDAT
013604  001412                         BEQ     40$
013606  005037  001140                 CLR     $GDDAT
013612  010037  001136                 MOV     R0,$BDADR
013616  062737  000014  001136         ADD     #RMER1,$BDADR
013624  104032                         EMT     32
013626  052703  000001                 BIS     #BIT0,R3         ;SET ERROR FLAG
013632  013737  001352  001142  40$:    MOV     RMER1I,$BDDAT
013640  042737  074017  001142         BIC     #^C<DCK!IAE!AOE!HCRC!HCE!ECH!WCF!FER>,$BDDAT
013646  001412                         BEQ     50$
013650  005037  001140                 CLR     $GDDAT
013654  010037  001136                 MOV     R0,$BDADR
013660  062737  000014  001136         ADD     #RMER1,$BDADR
013666  104033                         EMT     33
013670  052703  000001                 BIS     #BIT0,R3         ;SET ERROR FLAG
013674                          50$:
013674  013737  001352  001142         MOV     RMER1I,$BDDAT
013702  042737  147777  001142         BIC     #^C<OPI!DTE>,$BDDAT
013710  001412                         BEQ     60$
013712  005037  001140                 CLR     $GDDAT
013716  010037  001136                 MOV     R0,$BDADR
013722  062737  000014  001136         ADD     #RMER1,$BDADR
013730  104034                         EMT     34
013732  052703  030000                 BIS     #BIT,R3

                        ;WRITE ZEROS THEN ONES IN RMER1,READ AND CHECK FOR S-A-0 BITS
013736                  60$:
013736  012760  000000  000014         MOV     #0,RMER1(R0)     ;LOAD RMER1
013744  012760  177777  000014         MOV     #-1,RMER1(R0)    ;LOAD RMER1
013752  016037  000014  001142         MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
013760  012737  177777  001140         MOV     #-1,$GDDAT
```

```
                                                CMP     $GDDAT,$BDDAT
                                                BEQ     70$
                                                MOV     R0,$BDADR
                                                ADD     #RMER1,$BDADR
                                                EMT     35
                                                BIS     #BIT1,R3

                                ;WRITE A SHIFTING 1 BIT IN RMER1 AND CHECK FOR STUCK BITS
                                ;NOTE:  DONT TEST UNSAFE OR PARITY
                                70$:
                                                TST     R3              ;SKIP THIS PART IF ANY ERRORS
                                                BNE     120$
                                                MOV     #1,R2           ;R2 = TEST PATTERN
                                80$:
                                                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                                MOV     R2,RMER1(R0)    ;LOAD RMER1
                                                MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
                                                BIT     #PAR,R2         ;DONT TEST PAR = 0
                                                BNE     90$
                                                BIC     #PAR,$BDDAT
                                90$:            BIT     #UNS,R2         ;DONT TEST UNS = 0
                                                BNE     100$
                                                BIC     #UNS,$BDDAT
                                100$:           CMP     R2,$BDDAT
                                                BEQ     110$
                                                MOV     R2,$GDDAT
                                                MOV     R0,$BDADR
                                                ADD     #RMER1,$BDADR
                                                EMT     36

                                110$:           ASL     R2              ;SHIFT TO NEXT BIT
                                                BNE     80$             ;CONTINUE IF R2 NOT ZERO
                                120$:

                                ;;*************************************************************
                                ;*TEST 14        CLEAR OFFSET STUCK ACTIVE TEST

                                ;;*************************************************************
                                TST14:
                                                SCOPE                   ;SCOPE CALL
                                                NOP
                                                MOV     #STACK,SP       ;LOAD THE STACK POINTER
                                                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                                                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                                MOV     #14,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

                                                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                                MOV     #-1,RMOF(R0)    ;LOAD RMOF
                                                MOV     #-1,RMOF(R0)    ;LOAD RMOF AGAIN TO SET SSEI
                                                MOV     RMOF(R0),$BDDAT ;STORE RMOF AT $BDDAT
                                                BIC     #^COFD,$BDDAT
                                                BNE     10$             ;BRANCH IF OFD IS A ONE
                                                MOV     #OFD,$GDDAT     ;SETUP ERROR MESSAGE
                                                MOV     R0,$BDADR
                                                ADD     #RMOF,$BDADR
                                                EMT     172
                                10$:                                    ;END OF TEST
```

```
                                ;;*****************************************************************
                                ;*TEST 15       OFFSET REGISTER TRANSFER TEST
                                ;;*****************************************************************
                                ;;
                                TST15:
014234                                  SCOPE                   ;SCOPE CALL
014234  000004                          NOP
014236  000240                          MOV     #STACK,SP       ;LOAD THE STACK POINTER
014240  012706  001100                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
014244  013700  001276                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
014250  013701  001466                  MOV     #15,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
014254  012737  000015  001226
                                
014262  005003                          CLR     R3              ;RESET ERROR FLAGS
014264  010037  001136                  MOV     R0,$BDADR       ;SETUP BAD ADDRESS
014270  062737  000032  001136          ADD     #RMOF,$BDADR
014276  005037  001140                  CLR     $GDDAT          ;SETUP EXPECTED DATA
                                
                                ;WRITE ONES THEN ZEROS IN RMOF AND CHECK FOR S-A-1 BITS.
014302  012760  177777  000032          MOV     #-1,RMOF(R0)    ;LOAD RMOF
014310  012760  177777  000032          MOV     #-1,RMOF(R0)    ;LOAD RMOF AGAIN TO SET SSEI
014316  012760  000000  000032          MOV     #0,RMOF(R0)     ;LOAD RMOF
014324  016037  000032  001370          MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
                                
                                ;CHECK UNUSED BITS OF RMOF FOR ZERO
014332  013737  001370  001142          MOV     RMOFI,$BDDAT    ;GET UNUSED BITS
014340  042737  017200  001142          BIC     #^CXNUOF,$BDDAT
014346  001403                          BEQ     10$             ;BRANCH IF NO ERROR
014350  104053                          EMT     53
014352  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
                                
                                ;CHECK USED BITS OF RMOF FOR ZERO
                                10$:
014356  013737  001370  001142          MOV     RMOFI,$BDDAT    ;GET USED BITS
014364  042737  160577  001142          BIC     #XNUOF,$BDDAT
014372  001403                          BEQ     20$             ;BRANCH IF NO ERROR
014374  104054                          EMT     54
014376  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
                                
                                ;WRITE ZEROS THEN ONES ON RMOF AND CHECK FOR S-A-0 BITS.
                                20$:
014402  012760  000000  000032          MOV     #0,RMOF(R0)     ;LOAD RMOF
014410  012760  177777  000032          MOV     #-1,RMOF(R0)    ;LOAD RMOF
014416  012760  177777  000032          MOV     #-1,RMOF(R0)    ;LOAD RMOF AGAIN TO SET SSEI
014424  016037  000032  001370          MOV     RMOF(R0),RMOFI  ;STORE RMOF IN INPUT BUFFER
                                
                                ;CHECK UNUSED BITS OF RMOF FOR ZERO.
014432  013737  001370  001142          MOV     RMOFI,$BDDAT    ;GET UNUSED BITS
014440  042737  017200  001142          BIC     #^CXNUOF,$BDDAT
014446  001403                          BEQ     30$             ;BRANCH IF NO ERROR
014450  104053                          EMT     53
014452  052703  000001                  BIS     #BIT0,R3
                                
                                ;CHECK USED BITS OF RMOF FOR ONE.
                                30$:
014456  013737  001370  001142          MOV     RMOFI,$BDDAT    ;GET USED BITS
014464  042737  160577  001142          BIC     #XNUOF,$BDDAT
```

```
    831 014472  012737  017200  001140          MOV     #^CXNUOF,$GDDAT ;SETUP EXPECTED STATUS
    832 014500  023737  001140  001142          CMP     $GDDAT,$BDDAT
    833 014506  001403                          BEQ     40$             ;BRANCH IF NO ERROR
    834 014510  104055                          EMT     55
    835 014512  052703  000002                  BIS     #BIT1,R3
    836
    837                                 ;IF NO PREVIOUS ERRORS, TEST RMOF WITH SHIFTING ONE BIT PATTERN
    838                                 ;IN 18 BIT MODE.
    839 014516                          40$:
    840 014516  005703                          TST     R3              ;ANY ERROR??
    841 014520  001062                          BNE     100$            ;YES!!
    842 014522  012702  000001                  MOV     #1,R2           ;STARTING DATA PATTERN
    843 014526                          50$:
    844 014526  012760  000000  000032          MOV     #0,RMOF(R0)     ;LOAD RMOF
    845 014534  010260  000032                  MOV     R2,RMOF(R0)     ;LOAD RMOF
        014540  010260  000032                  MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
    846 014544  016037  000032  001142          MOV     RMOF(R0),$BDDAT ;STORE RMOF AT $BDDAT
    847 014552  010203                          MOV     R2,R3           ;SETUP EXPECTED RESULT
    848 014554  010337  001140                  MOV     R3,$GDDAT
    849 014560  042703  161577                  BIC     #XNUOF!SSEI,R3  ;CLEAR UNUSED BITS
    850 014564  020337  001142                  CMP     R3,$BDDAT       ;COMPARE EXPECTED & RECEIVED
    851 014570  001401                          BEQ     60$             ;BRANCH IF NO ERROR
    852 014572  104056                          EMT     56
    853
    854 014574  006302                  60$:    ASL     R2              ;SHIFT TO NEXT BIT
    855 014576  001353                          BNE     50$             ;CONTINUE IF NOT DONE
    856
    857                                 ;TEST RMOF WITH SHIFTING ONE BIT PATTERN IN 16 BIT MODE
    858 014600                          70$:
    859 014600  012702  000001                  MOV     #1,R2           ;STARTING DATA PATTERN
    860 014604                          80$:
    861 014604  012760  000000  000032          MOV     #0,RMOF(R0)     ;LOAD RMOF
    862 014612  052702  010000                  BIS     #FMT16,R2       ;SET 16 BIT MODE WITH ROTATING PATTERN
    863 014616  010260  000032                  MOV     R2,RMOF(R0)     ;LOAD RMOF
        014622  010260  000032                  MOV     R2,RMOF(R0)     ;LOAD RMOF AGAIN TO SET SSEI
    864 014626  016037  000032  001142          MOV     RMOF(R0),$BDDAT ;STORE RMOF AT $BDDAT
    865 014634  010203                          MOV     R2,R3           ;SETUP EXPECTED RESULTS
    866 014636  010337  001140                  MOV     R3,$GDDAT
    867 014642  042703  160577                  BIC     #XNUOF,R3       ;CLEAR UNUSED BITS
    868 014646  020337  001142                  CMP     R3,$BDDAT       ;CORRECT BITS SET ?
    869 014652  001401                          BEQ     90$             ;YES !!
    870 014654  104056                          EMT     56
    871 014656                          90$:
    872 014656  042702  010000                  BIC     #FMT16,R2       ;DON'T SHIFT FORMAT BIT
    873 014662  006302                          ASL     R2              ;SHIFT PATTERN AND
    874 014664  001347                          BNE     80$             ;TEST NEXT BIT
    875 014666                          100$:
    876
    877                                 ;;*****************************************************************
                                        ;*TEST 16        ERROR REGISTER #2 TRANSFER TEST

                                        ;;*****************************************************************
        014666                          TST16:
        014666  000004                          SCOPE                   ;SCOPE CALL
        014670  000240                          NOP
        014672  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        014676  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
```

```
T16     ERROR REGISTER #2 TRANSFER TEST

        014702  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        014706  012737  000016  001226          MOV     #16,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
    878
    879 014714  005003                          CLR     R3              ;RESET ERROR FLAGS
    880 014716  010037  001136                  MOV     R0,$BDADR       ;SETUP BAD ADDRESS
    881 014722  062737  000042  001136          ADD     #RMER2,$BDADR
    882 014730  005037  001140                  CLR     $GDDAT          ;SETUP EXPECTED DATA
    883 014734  012737  010000  001444          MOV     #FMT16,RMOFO    ;SET 16 BIT FORMAT MODE TO ALLOW
    884                                                                 ;''SSE'' TO BE SET IN RMER2
    885
    886                                 ;WRITE ONES IN RMER2, CLEAR AND CHECK FOR S-A-1 BITS
    887 014742  012760  177777  000042          MOV     #-1,RMER2(R0)   ;LOAD RMER2
    888
    889 014750  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    890 014754  013760  001444  000032          MOV     RMOFO,RMOF(R0)  ;LOAD RMOF
    891 014762  016037  000042  001400          MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    892
    893                                 ;TEST UNUSED BITS FOR ZERO-FAILURE ON IF
    894 014770  013737  001400  001142          MOV     RMER2I,$BDDAT
    895 014776  042737  176250  001142          BIC     #^CXNUER2,$BDDAT
    896 015004  001403                          BEQ     10$             ;BRANCH IF NO ERROR
    897 015006  104044                          EMT     44
    898 015010  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
    899
    900                                 ;TEST ''OPE'', ''IVC'', ''LSC'' FOR ZERO-FAILURE ON CS, IF
    901 015014                          10$:
    902 015014  013737  001400  001142          MOV     RMER2I,$BDDAT
    903 015022  042737  143777  001142          BIC     #^C<OPE!IVC!LSC>,$BDDAT
    904 015030  001403                          BEQ     20$             ;BRANCH IF NO ERROR
    905 015032  104045                          EMT     45
    906 015034  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
    907
    908                                 ;TEST ''LBC'', ''DPE'' FOR ZERO-FAILURE ON DS, IF
    909 015040                          20$:
    910 015040  013737  001400  001142          MOV     RMER2I,$BDDAT
    911 015046  042737  175767  001142          BIC     #^C<LBC!DPE>,$BDDAT
    912 015054  001403                          BEQ     30$             ;BRANCH IF NO ERROR
    913 015056  104046                          EMT     46
    914 015060  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
    915
    916                                 ;WRITE ONES IN RMER2 THEN WRITE ZEROS AND CHECK FOR S-A-1 BITS.
    917 015064                          30$:
    918 015064  012760  177777  000042          MOV     #-1,RMER2(R0)   ;LOAD RMER2
    919 015072  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
    920 015100  016037  000042  001400          MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    921
    922                                 ;TEST ''OPE'', ''IVC'', ''LSC'' FOR ZERO-FAILURE ON CS, IF
    923 015106  013737  001400  001142          MOV     RMER2I,$BDDAT
    924 015114  042737  143777  001142          BIC     #^C<OPE!IVC!LSC>,$BDDAT
    925 015122  001403                          BEQ     40$             ;BRANCH IF NO ERROR
    926 015124  104047                          EMT     47
    927 015126  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
    928
    929                                 ;TEST ''LBC'', ''DPE'' FOR ZERO-FAILURE ON DS, IF
    930 015132                          40$:
    931 015132  013737  001400  001142          MOV     RMER2I,$BDDAT
    932 015140  042737  175767  001142          BIC     #^C<LBC!DPE>,$BDDAT
```

```
    933 015146  001403                        BEQ     50$             ;BRANCH IF NO ERROR
    934 015150  104050                        EMT     50
    935 015152  052703  000001                BIS     #BIT0,R3        ;SET ERROR FLAG
    936
    937                                 ;WRITE ZEROS IN RMER2 THEN WRITE ONES AND CHECK FOR S-A-0 BITS.
    938 015156                          50$:
    939 015156  012760  000000  000042        MOV     #0,RMER2(R0)    ;LOAD RMER2
    940 015164  012760  177777  000042        MOV     #-1,RMER2(R0)   ;LOAD RMER2
    941 015172  016037  000042  001400        MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
    942                                 ;TEST UNUSED BITS FOR ZERO-FAILURE ON IF
    943 015200  013737  001400  001142        MOV     RMER2I,$BDDAT
    944 015206  042737  176250  001142        BIC     #^CXNUER2,$BDDAT
    945 015214  001403                        BEQ     60$             ;BRANCH IF NO ERROR
    946 015216  104044                        EMT     44
    947 015220  052703  000001                BIS     #BIT0,R3        ;SET ERROR FLAG
    948
    949                                 ;TEST USED BITS FOR ONE-FAILURE ON IF
    950 015224                          60$:
    951 015224  013737  001400  001142        MOV     RMER2I,$BDDAT
    952 015232  042737  001527  001142        BIC     #XNUER2,$BDDAT
    953 015240  012737  176250  001140        MOV     #^CXNUER2,$GDDAT
    954 015246  023737  001140  001142        CMP     $GDDAT,$BDDAT
    955 015254  001403                        BEQ     70$             ;BRANCH IF NO ERROR
    956 015256  104051                        EMT     51
    957 015260  052703  000002                BIS     #BIT1,R3        ;SET ERROR FLAG
    958
    959                                 ;IF NO PREVIOUS ERROR, TEST BIT INTERFERENCE WITH SHIFTING ONE BIT.
    960 015264                          70$:
    961 015264  005703                        TST     R3              ;ANY ERRORS?
    962 015266  001044                        BNE     120$            ;YES!!
    963 015270  012702  000001                MOV     #1,R2           ;R2=DATA PATTERN
    964 015274                          80$:
    965 015274  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    966 015300  013760  001444  000032        MOV     RMOFO,RMOF(R0)  ;LOAD RMOF
    967 015306  010260  000042                MOV     R2,RMER2(R0)    ;LOAD RMER2
    968 015312  016037  000042  001142        MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
    969 015320  032702  040000                BIT     #SKI,R2         ;IS SKI BEING SET?
    970 015324  001003                        BNE     90$             ;YES!!
    971 015326  042737  040000  001142        BIC     #SKI,$BDDAT     ;DONT TEST SKI FOR ZERO
    972 015334  032702  000200          90$:  BIT     #DVC,R2         ;IS DVC BEING SET??
    973 015340  001003                        BNE     100$            ;YES!!
    974 015342  042737  000200  001142        BIC     #DVC,$BDDAT     ;DONT TEST DVC FOR ZERO
    975 015350  010237  001140          100$: MOV     R2,$GDDAT
    976 015354  042737  001527  001140        BIC     #XNUER2,$GDDAT  ;UNUSED BITS SHOULD BE ZERO
    977 015362  023737  001140  001142        CMP     $GDDAT,$BDDAT   ;ANY ERRORS??
    978 015370  001401                        BEQ     110$            ;NO!!
    979 015372  104052                        EMT     52
    980
    981 015374  006302                110$:   ASL     R2              ;SHIFT TO NEXT DATA BIT
    982 015376  001336                        BNE     80$             ;CONTINUE IF NOT DONE
    983
    984 015400                          120$:
    985
    986                                 ;;*****************************************************************
                                        ;*TEST 17        SERIAL NUMBER TEST

                                        ;;*****************************************************************
```

```
                015400                          TST17:
                015400  000004                          SCOPE                   ;SCOPE CALL
                015402  000240                          NOP
                015404  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
                015410  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                015414  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                015420  012737  000017  001226          MOV     #17,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
    987
    988         015426  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
    989         015432  010037  001136                  MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS FOR TYPEOUT
    990         015436  062737  000030  001136          ADD     #RMSN,$BDADR
    991         015444  012702  000031                  MOV     #25.,R2         ;READ RMSN 25 TIMES
    992
    993                                                 ;READ RMSN AND USE THE RESULT AS EXPECTED VALUE
    994         015450  016037  000030  001140          MOV     RMSN(R0),$GDDAT ;STORE RMSN AT $GDDAT
    995
    996                                                 ;READ RMSN AND COMPARE WITH INITIAL VALUE
    997         015456                                  10$:
    998         015456  016037  000030  001142          MOV     RMSN(R0),$BDDAT ;STORE RMSN AT $BDDAT
    999         015464  023737  001140  001142          CMP     $GDDAT,$BDDAT
   1000         015472  001401                          BEQ     20$             ;BRANCH IF SERIAL NUMBER CONSISTENT
   1001         015474  104136                          EMT     136
   1002
   1003                                                 ;DECREMENT COUNT AND CONTINUE IF NOT DONE
   1004         015476                                  20$:
   1005         015476  005302                          DEC     R2
   1006         015500  100366                          BPL     10$
   1007         015502                                  30$:                    ;END OF TEST
   1008
   1009                                                 ;;*****************************************************************
                                                        ;*TEST 20       CONTROL BUS PARITY DETECTION TEST

                                                        ;;*****************************************************************
                015502                          TST20:
                015502  000004                          SCOPE                   ;SCOPE CALL
                015504  000240                          NOP
                015506  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
                015512  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                015516  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                015522  012737  000020  001226          MOV     #20,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
   1010
   1011                                                 ;SETUP FOR FIRST TEST LOOP (NO ERROR)
   1012         015530  005037  001140                  CLR     $GDDAT          ;"PAR" SHOULD BE ZERO
   1013         015534  111137  001422                  MOVB    (R1),RMCS20     ;SETUP RMCS2 VALUE
   1014         015540  042737  177770  001422          BIC     #^CUNTMSK,RMCS20
   1015         015546  012737  000001  001450          MOV     #1,RMHRO        ;INITIALIZE DATA PATTERN
   1016         015554  000402                          BR      6$              ;SKIP INCREMENT FIRST TIME
   1017         015556  006337  001450          5$:     ASL     RMHRO           ;SHIFT TO NEXT PATTERN
   1018
   1019                                                 ;CLEAR AND VERIFY THAT "PAR" IS RESET
   1020         015562                                  6$:
   1021         015562  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
   1022         015566  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
   1023         015574  016037  000042  001400          MOV     RMER2(R0),RMER2I        ;STORE RMER2 IN INPUT BUFFER
   1024         015602  042737  177767  001142          BIC     #^CPAR,$BDDAT   ;DID "PAR" RESET?
   1025         015610  001415                          BEQ     20$             ;YES!!
   1026         015612  010037  001136                  MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
```

```
1027 015616 062737 000014 001136          ADD     #RMER1,$BDADR
1028 015624 032737 000010 001400          BIT     #DPE,RMER2I     ;IS "DPE" SET??
1029 015632 001002                        BNE     10$             ;YES!!
1030 015634 104067                        EMT     67
1031 015636 000453                        BR      50$
1032 015640                         10$:
     015640 104070                        EMT     70
1033 015642 000451                        BR      50$
1034
1035                                ;WRITE TEST PATTERN AND VERIFY "PAR" STATUS
1036 015644                         20$:
1037 015644 013760 001422 000010          MOV     RMCS20,RMCS2(R0)        ;LOAD RMCS2
1038 015652 013760 001450 000036          MOV     RMHR0,RMHR(R0)  ;LOAD RMHR
1039 015660 016037 000014 001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
1040 015666 042737 177767 001142          BIC     #^CPAR,$BDDAT
1041 015674 023737 001140 001142          CMP     $GDDAT,$BDDAT   ;IS "PAR" CORRECT??
1042 015702 001410                        BEQ     40$             ;YES!!
1043 015704 032737 000020 001422          BIT     #PAT,RMCS20     ;SHOULD "PAR" BE SET?
1044 015712 001002                        BNE     30$             ;YES!!
1045 015714 104071                        EMT     71
1046 015716 000423                        BR      50$
1047 015720                         30$:
     015720 104072                        EMT     72
1048 015722 000421                        BR      50$             ;SKIP TO NEXT
1049                                ;GO TO NEXT PATTERN
1050 015724 005737 001450           40$:  TST     RMHR0           ;IS DATA PATTERN COMPLETE??
1051 015730 001312                        BNE     5$              ;NO!!
1052 015732 032737 000020 001422          BIT     #PAT,RMCS20     ;IS TEST COMPLETE??
1053 015740 001012                        BNE     50$             ;YES!!
1054                                ;SETUP FOR SECOND TEST LOOP (ERROR)
1055 015742 052737 000020 001422          BIS     #PAT,RMCS20     ;TURN ON BAD PARITY
1056 015750 012737 000010 001140          MOV     #PAR,$GDDAT     ;EXPECT ERROR
1057 015756 012737 000001 001450          MOV     #1,RMHR0        ;INITIALIZE DATA PATTERN
1058 015764 000676                        BR      6$              ;START LOOP
1059
1060 015766                         50$:                            ;END OF TEST
1061
1062                                ;;*****************************************************************
                                    ;*TEST 21        CONTROL BUS PARITY GENERATION TEST

                                    ;;*****************************************************************
     015766                         TST21:
     015766 000004                        SCOPE                   ;SCOPE CALL
     015770 000240                        NOP
     015772 012706 001100                 MOV     #STACK,SP       ;LOAD THE STACK POINTER
     015776 013700 001276                 MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     016002 013701 001466                 MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     016006 012737 000021 001226          MOV     #21,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1063
1064                                ;SETUP FOR TEST (NO ERROR)
1065 016014 012737 000001 001450          MOV     #1,RMHR0        ;INITIALIZE DATA PATTERN
1066 016022 005037 001140                 CLR     $GDDAT          ;MCPE SHOULD BE ZERO
1067 016026 000402                        BR      20$             ;DONT SHIFT FIRST TIME
1068
1069                                ;SHIFT DATA PATTERN
1070 016030                         10$:
1071 016030 006337 001450                 ASL     RMHR0
```

```
1072 016034                                    20$:
1073 016034  004737  055156                            JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1074 016040  013760  001450  000036                    MOV     RMHRO,RMHR(RO)  ;LOAD RMHR
1075
1076                                           ;TRANSFER DATA TO RH, VERIFY NO 'MCPE' ERROR
1077 016046  016037  000036  001374                    MOV     RMHR(RO),RMHRI  ;STORE RMHR IN INPUT BUFFER
1078 016054  016037  000000  001142                    MOV     RMCS1(RO),$BDDAT        ;STORE RMCS1 AT $BDDAT
1079 016062  042737  157777  001142                    BIC     #^CMCPE,$BDDAT  ;WAS BAD PARITY DETECTED??
1080 016070  001402                                    BEQ     30$             ;NO!!
1081 016072  104073                                    EMT     73
1082 016074  000403                                    BR      40$
1083
1084                                           ;GO TO NEXT PATTERN
1085 016076                                    30$:
1086 016076  005737  001450                            TST     RMHRO           ;DONE ALL PATTERNS??
1087 016102  001352                                    BNE     10$             ;NO!!
1088 016104                                    40$:                            ;END OF TEST
1089
1090                                           ;;*****************************************************************
                                               ;*TEST 22       RMDA,RMDC FAULT TEST
                                               ;;*****************************************************************
      016104                                   TST22:
      016104  000004                                  SCOPE                   ;SCOPE CALL
      016106  000240                                  NOP
      016110  012706  001100                          MOV     #STACK,SP       ;LOAD THE STACK POINTER
      016114  013700  001276                          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
      016120  013701  001466                          MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
      016124  012737  000022  001226                  MOV     #22,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1091
1092 016132  004737  055156                            JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1093
1094                                           ;WRITE ZEROS, THEN ONES IN RMDA,RMDC-READ AND TEST FOR S-A-0
1095 016136  012760  000000  000006                    MOV     #0,RMDA(RO)     ;LOAD RMDA
1096 016144  012760  000000  000034                    MOV     #0,RMDC(RO)     ;LOAD RMDC
1097 016152  012760  177777  000006                    MOV     #-1,RMDA(RO)    ;LOAD RMDA
1098 016160  012760  177777  000034                    MOV     #-1,RMDC(RO)    ;LOAD RMDC
1099 016166  016037  000006  001344                    MOV     RMDA(RO),RMDAI  ;STORE RMDA IN INPUT BUFFER
1100 016174  016037  000034  001372                    MOV     RMDC(RO),RMDCI  ;STORE RMDC IN INPUT BUFFER
1101 016202  022737  177777  001344                    CMP     #-1,RMDAI       ;IS ANY REGISTER ALL ONES??
1102 016210  001410                                    BEQ     10$             ;YES!!
1103 016212  052737  176000  001372                    BIS     #XNUDC,RMDCI    ;SET UNUSED BITS
1104 016220  022737  177777  001372                    CMP     #-1,RMDCI
1105 016226  001401                                    BEQ     10$             ;YES!!
1106 016230  104042                                    EMT     42
1107
1108 016232                                    10$:
1109
1110                                           ;;*****************************************************************
                                               ;*TEST 23       DISK ADDRESS TRANSFER TEST
                                               ;;*****************************************************************
      016232                                   TST23:
      016232  000004                                  SCOPE                   ;SCOPE CALL
      016234  000240                                  NOP
      016236  012706  001100                          MOV     #STACK,SP       ;LOAD THE STACK POINTER
      016242  013700  001276                          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
```

```
                016246  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                016252  012737  000023  001226          MOV     #23,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
  1111
  1112 016260   005003                                  CLR     R3              ;R3 = ERROR INDICATOR
  1113 016262   004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
  1114
  1115                                          ;WRITE ONES IN RMDA, THEN WRITE ZEROS, READ BACK AND CHECK FOR S-A-1 BITS
  1116 016266   012760  177777  000006                  MOV     #-1,RMDA(R0)    ;LOAD RMDA
  1117 016274   012760  000000  000006                  MOV     #0,RMDA(R0)     ;LOAD RMDA
  1118 016302   016037  000006  001142                  MOV     RMDA(R0),$BDDAT ;STORE RMDA AT $BDDAT
  1119 016310   005737  001142                          TST     $BDDAT
  1120 016314   001412                                  BEQ     10$
  1121 016316   005037  001140                          CLR     $GDDAT
  1122 016322   010037  001136                          MOV     R0,$BDADR
  1123 016326   062737  000006  001136                  ADD     #RMDA,$BDADR
  1124 016334   104020                                  EMT     20
  1125 016336   052703  000001                          BIS     #BIT0,R3        ;SET ERROR FLAG
  1126                                          ;WRITE ZEROS IN RMDA, THEN WRITE ONES, READ BACK AND CHECK FOR S-A-0 BITS
  1127 016342                                   10$:
                016342  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
  1128 016350   012760  177777  000006                  MOV     #-1,RMDA(R0)    ;LOAD RMDA
  1129 016356   016037  000006  001142                  MOV     RMDA(R0),$BDDAT ;STORE RMDA AT $BDDAT
  1130 016364   023727  001142  177777                  CMP     $BDDAT,#-1
  1131 016372   001413                                  BEQ     20$
  1132 016374   012737  177777  001140                  MOV     #-1,$GDDAT
  1133 016402   010037  001136                          MOV     R0,$BDADR
  1134 016406   062737  000006  001136                  ADD     #RMDA,$BDADR
  1135 016414   104021                                  EMT     21
  1136 016416   052703  000002                          BIS     #BIT1,R3        ;SET ERROR FLAG
  1137                                          ;WRITE A SHIFTING 1 BIT PATTERN IN RMDA, READ, AND CHECK FOR STUCK BITS
  1138 016422   005703                          20$:    TST     R3              ;OMIT BIT TEST IF ANY ERROR
  1139 016424   001027                                  BNE     50$
  1140 016426   012702  000001                          MOV     #1,R2           ;R2 = TEST PATTERN
  1141 016432                                   30$:
                016432  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
  1142 016440   010260  000006                          MOV     R2,RMDA(R0)     ;LOAD RMDA
  1143 016444   016037  000006  001142                  MOV     RMDA(R0),$BDDAT ;STORE RMDA AT $BDDAT
  1144 016452   023702  001142                          CMP     $BDDAT,R2
  1145 016456   001410                                  BEQ     40$
  1146 016460   010237  001140                          MOV     R2,$GDDAT
  1147 016464   010037  001136                          MOV     R0,$BDADR
  1148 016470   062737  000006  001136                  ADD     #RMDA,$BDADR
  1149 016476   104022                                  EMT     22
  1150 016500   006302                          40$:    ASL     R2              ;SHIFT TO NEXT BIT
  1151 016502   001353                                  BNE     30$             ;CONTINUE IF R2 NOT ZERO
  1152 016504                                   50$:
  1153
  1154                                          ;;*******************************************************************
                                                ;*TEST 24        DESIRED CYLINDER TRANSFER TEST

                                                ;;*******************************************************************
                016504                          TST24:
                016504  000004                          SCOPE                   ;SCOPE CALL
                016506  000240                          NOP
                016510  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
                016514  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                016520  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
```

```
        016524  012737  000024  001226          MOV     #24,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
  1155
  1156 016532  005003                           CLR     R3              ;RESET ERROR FLAGS
  1157 016534  004737  055156                   JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
  1158 016540  005037  001140                   CLR     $GDDAT          ;LOAD EXPECTED
  1159 016544  010037  001136                   MOV     R0,$BDADR       ;LOAD REG ADDRESS
  1160 016550  062737  000034  001136           ADD     #RMDC,$BDADR
  1161
  1162                                  ;WRITE ONES IN RMDC AND VERIFY THAT UNUSED BITS ARE ZERO
  1163 016556  012760  177777  000034           MOV     #-1,RMDC(R0)    ;LOAD RMDC
  1164 016564  016037  000034  001142           MOV     RMDC(R0),$BDDAT ;STORE RMDC AT $BDDAT
  1165 016572  042737  001777  001142           BIC     #^CXNUDC,$BDDAT         ;CLEAR ALL USED BITS
  1166 016600  001403                           BEQ     5$                      ;BRANCH IF NO ERROR
  1167 016602  104134                           EMT     134
  1168 016604  052703  000001                   BIS     #BIT0,R3        ;SET ERROR FLAG
  1169
  1170                                  ;WRITE ONES IN RMDC, THEN WRITE ZEROS, READ AND CHECK FOR S-A-1 BITS
  1171 016610                           5$:
  1172 016610  012760  177777  000034           MOV     #-1,RMDC(R0)    ;LOAD RMDC
  1173 016616  012760  000000  000034           MOV     #0,RMDC(R0)     ;LOAD RMDC
  1174 016624  016037  000034  001142           MOV     RMDC(R0),$BDDAT ;STORE RMDC AT $BDDAT
  1175 016632  042737  176000  001142           BIC     #XNUDC,$BDDAT   ;CLEAR UNUSED BITS
  1176 016640  001403                           BEQ     10$             ;BRANCH IF NO ERROR
  1177 016642  104037                           EMT     37
  1178 016644  052703  000001                   BIS     #BIT0,R3        ;SET ERROR FLAG
  1179
  1180                                  ;WRITE ZEROS, THEN ONES IN RMDC, READ AND CHECK FOR S-A-0 BITS
  1181 016650                           10$:
  1182 016650  012760  000000  000034           MOV     #0,RMDC(R0)     ;LOAD RMDC
  1183 016656  012760  177777  000034           MOV     #-1,RMDC(R0)    ;LOAD RMDC
  1184 016664  016037  000034  001142           MOV     RMDC(R0),$BDDAT ;STORE RMDC AT $BDDAT
  1185 016672  052737  176000  001142           BIS     #XNUDC,$BDDAT   ;SET UNUSED BITS
  1186 016700  012737  177777  001140           MOV     #-1,$GDDAT      ;LOAD EXPECTED RESULT
  1187 016706  023737  001140  001142           CMP     $GDDAT,$BDDAT   ;IS RMDC ALL ONES ??
  1188 016714  001403                           BEQ     20$             ;YES !!
  1189 016716  104040                           EMT     40
  1190 016720  052703  000002                   BIS     #BIT1,R3        ;SET ERROR FLAG
  1191
  1192                                  ;OMIT BIT TEST IF ANY ERRORS
  1193 016724                           20$:
  1194 016724  005703                           TST     R3
  1195 016726  001026                           BNE     60$
  1196 016730  012702  000001                   MOV     #1,R2           ;R2 = TEST PATTERN
  1197
  1198                                  ;TEST RMDC WITH SHIFTING ONE BIT
  1199 016734                           30$:
  1200 016734  012760  000000  000034           MOV     #0,RMDC(R0)     ;LOAD RMDC
  1201 016742  010260  000034                   MOV     R2,RMDC(R0)     ;LOAD RMDC
  1202 016746  010203                           MOV     R2,R3           ;R3 = EXPECTED RESULT
  1203 016750  042703  176000                   BIC     #XNUDC,R3       ;CLEAR ANY UNUSED BITS
  1204 016754  016037  000034  001142           MOV     RMDC(R0),$BDDAT ;STORE RMDC AT $BDDAT
  1205 016762  023703  001142                   CMP     $BDDAT,R3
  1206 016766  001404                           BEQ     50$
  1207 016770  010337  001140                   MOV     R3,$GDDAT
  1208 016774  104041                           EMT     41
  1209 016776  000402                           BR      60$             ;SKIP TO NEXT
  1210
```

```
1211 017000  006302                    50$:    ASL     R2              ;SHIFT TO NEXT BIT
1212 017002  001354                            BNE     30$             ;CONTINUE IF R2 NOT ZERO
1213
1214 017004                            60$:
1215
1216                                   ;;*****************************************************************
                                       ;*TEST 25        ILLEGAL REGISTER TEST
                                       ;;*****************************************************************
     017004                            TST25:
     017004  000004                            SCOPE                   ;SCOPE CALL
     017006  000240                            NOP
     017010  012706  001100                    MOV     #STACK,SP       ;LOAD THE STACK POINTER
     017014  013700  001276                    MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     017020  013701  001466                    MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     017024  012737  000025  001226            MOV     #25,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1217
1218 017032  005037  001140                    CLR     $GDDAT          ;"ILR" SHOULD BE ZERO
1219 017036  012702  000000                    MOV     #0,R2           ;R2=REGISTER INDEX
1220
1221                                   ;CLEAR AND VERIFY THAT "ILR" STATUS IS ZERO
1222 017042                            10$:
1223 017042  004737  055156                    JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1224 017046  016037  000014  001142            MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
1225 017054  042737  177775  001142            BIC     #^CILR,$BDDAT
1226 017062  001411                            BEQ     20$             ;BRANCH IF ILR IS RESET
1227 017064  005037  001140                    CLR     $GDDAT          ;SETUP GOOD DATA, REG ADR
1228 017070  010037  001136                    MOV     R0,$BDADR
1229 017074  062737  000014  001136            ADD     #RMER1,$BDADR
1230 017102  104064                            EMT     64
1231 017104  000550                            BR      140$
1232
1233                                   ;WRITE THE REGISTER (INDEX=R2) AND TEST ILR STATUS
1234 017106                            20$:
1235 017106  010003                            MOV     R0,R3           ;R3=REG ADDRESS
1236 017110  060203                            ADD     R2,R3
1237 017112  013746  000004                    MOV     ERRVEC,-(SP)    ;;PUSH ERRVEC ON STACK
1238 017116  013746  000006                    MOV     ERRVEC+2,-(SP)          ;;PUSH ERRVEC+2 ON STACK
1239 017122  012737  017164  000004            MOV     #40$,ERRVEC     ;SETUP FOR BUS TIMEOUT
1240 017130  012737  000300  000006            MOV     #PR6,ERRVEC+2
1241 017136  005004                            CLR     R4              ;R4=REGISTER VALUE
1242 017140  022702  000010                    CMP     #RMCS2,R2
1243 017144  001001                            BNE     30$
1244 017146  111104                            MOVB    (R1),R4         ;SELECT DRIVE IF RMCS2
1245 017150  010413                    30$:    MOV     R4,(R3)         ;WRITE TEST REGISTER
1246 017152  012637  000006                    MOV     (SP)+,ERRVEC+2          ;;POP STACK INTO ERRVEC+2
1247 017156  012637  000004                    MOV     (SP)+,ERRVEC    ;;POP STACK INTO ERRVEC
1248 017162  000416                            BR      60$
1249 017164  012716  017172            40$:    MOV     #45$,(SP)       ;DUMMY RTI ADDRESS
1250 017170  000002                            RTI                     ;RESTORE PRIORITY
1251 017172                            45$:
     017172  012637  000006                    MOV     (SP)+,ERRVEC+2          ;;POP STACK INTO ERRVEC+2
1252 017176  012637  000004                    MOV     (SP)+,ERRVEC    ;;POP STACK INTO ERRVEC
1253 017202  020227  000046                    CMP     R2,#RMEC2       ;WERE ALL REGISTERS READ??
1254 017206  101003                            BHI     50$             ;YES!!
1255 017210  010337  001136                    MOV     R3,$BDADR
1256 017214  104074                            EMT     74
```

```
T25     ILLEGAL REGISTER TEST

1257 017216  000503                    50$:    BR      140$
1258
1259 017220                            60$:
     017220  016037  000014  001142            MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
1260 017226  042737  177775  001142            BIC     #^CILR,$BDDAT
1261 017234  023737  001140  001142            CMP     $GDDAT,$BDDAT   ;IS "ILR" OK??
1262 017242  001411                            BEQ     80$             ;YES!!
1263 017244  010337  001174                    MOV     R3,$TMP0        ;SAVE ADDRESS
1264 017250  032737  000002  001140            BIT     #ILR,$GDDAT     ;SHOULD "ILR" BE SET??
1265 017256  001002                            BNE     70$             ;YES!!
1266 017260  104065                            EMT     65
1267 017262  000401                            BR      80$
1268 017264                            70$:
     017264  104066                            EMT     66
1269
1270                                   ;ADVANCE TO THE NEXT REGISTER ADDRESS
1271 017266                            80$:
1272 017266  062702  000002                    ADD     #2,R2           ;INCREMENT INDEX
1273 017272  022702  000050                    CMP     #50,R2          ;TIME TO TRY RH70 ?
1274 017276  101261                            BHI     10$             ;BRANCH IF NOT
1275 017300  103437                            BLO     110$            ;BRANCH IF ALREADY CHECKED
1280 017302  013746  000004                    MOV     ERRVEC,-(SP)    ;;PUSH ERRVEC ON STACK
1281 017306  013746  000006                    MOV     ERRVEC+2,-(SP)          ;;PUSH ERRVEC+2 ON STACK
1282 017312  012737  017410  000004            MOV     #130$,ERRVEC    ;SETUP FOR TIMEOUT
1283 017320  012737  000300  000006            MOV     #PR6,ERRVEC+2
1296 017326  052737  000002  001140            BIS     #ILR,$GDDAT     ;SET ILR
1297 017334  012702  000054                    MOV     #54,R2          ;START AT INDEX 54 IF RH70/22REG
1298 017340  012760  001400  000000            MOV     #A17!A16,RMCS1(R0)      ;SET EXTEND BITS
1299 017346  016037  000050  001406            MOV     50(R0),RMBAEI   ;READ THE EXTENDED BITS
1300 017354  042737  177774  001406            BIC     #177774,RMBAEI  ;CHOP OFF
1301 017362  001002                            BNE     90$             ;BRANCH IF RH70/22-REG
1302 017364  012702  000050                    MOV     #50,R2          ;OTHERWISE NOT A RH70 OR RH70 WITH 32 REG
1303 017370  012637  000006            90$:    MOV     (SP)+,ERRVEC+2  ;
1304 017374  012637  000004                    MOV     (SP)+,ERRVEC    ;
1305 017400  022702  000074            110$:   CMP     #74,R2          ;DONE ALL TESTS
1306 017404  101410                            BLOS    140$            ;YES!!
1307 017406  000615                    120$:   BR      10$
1308
1309 017410  012716  017416            130$:   MOV     #135$,(SP)      ;DUMMY RTI ADDRESS
1310 017414  000002                            RTI                     ;RESTORE PRIORITY
1311 017416  012637  000006            135$:   MOV     (SP)+,ERRVEC+2  ;
1312 017422  012637  000004                    MOV     (SP)+,ERRVEC    ;
1313 017426                            140$:                           ;END OF TEST
1314
1315                                   ;;*****************************************************************
                                       ;*TEST 26        RESET GO BY INIT TEST

                                       ;;*****************************************************************
     017426                            TST26:
     017426  000004                            SCOPE                   ;SCOPE CALL
     017430  000240                            NOP
     017432  012706  001100                    MOV     #STACK,SP       ;LOAD THE STACK POINTER
     017436  013700  001276                    MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     017442  013701  001466                    MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     017446  012737  000026  001226            MOV     #26,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1316
1317 017454  004737  055156                    JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
```

```
T26     RESET GO BY INIT TEST

 1318 017460  010037  001136                MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS FOR MSG
 1319
 1320                                ;SET GO, INITIALIZE AND VERIFY THAT GO IS RESET
 1321 017464  012760  000001  000000        MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
 1322
 1323 017472  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
 1324 017476  016037  000000  001142        MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
 1325 017504  042737  177776  001142        BIC     #^CGO,$BDDAT
 1326 017512  001403                        BEQ     10$             ;BRANCH IF GO IS RESET
 1327 017514  005037  001140                CLR     $GDDAT
 1328 017520  104137                        EMT     137
 1329
 1330 017522                        10$:                            ;END OF TEST
 1331
 1332                                ;;*****************************************************************
                                     ;*TEST 27        DIAGNOSTIC MODE TEST
                                     ;;*****************************************************************
       017522                        TST27:
       017522  000004                        SCOPE                   ;SCOPE CALL
       017524  000240                        NOP
       017526  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
       017532  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
       017536  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
       017542  012737  000027  001226        MOV     #27,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
 1333
 1334 017550  010037  001136                MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
 1335 017554  062737  000024  001136        ADD     #RMMR1,$BDADR
 1336 017562  005003                        CLR     R3              ;INITIALIZE ERROR FLAGS
 1337
 1338                                ;INITIALIZE AND VERIFY THAT 'DMD' IS RESET
 1339 017564  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
 1340 017570  016037  000024  001142        MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 1341 017576  042737  177776  001142        BIC     #^CDMD,$BDDAT
 1342 017604  001403                        BEQ     10$             ;BRANCH IF 'DMD' IS ZERO
 1343 017606  005037  001140                CLR     $GDDAT
 1344 017612  104075                        EMT     75
 1345
 1346                                ;SET AND RESET 'DMD' USING REGISTER TRANSFER-VERIFY 'DMD' NOT S-A-1
 1347 017614                        10$:
 1348 017614  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
 1349 017622  012760  000000  000024        MOV     #0,RMMR1(R0)    ;LOAD RMMR1
 1350 017630  016037  000024  001142        MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 1351 017636  042737  177776  001142        BIC     #^CDMD,$BDDAT
 1352 017644  001405                        BEQ     20$             ;BRANCH IF DMD NOT S-A-1
 1353 017646  005037  001140                CLR     $GDDAT
 1354 017652  104076                        EMT     76
 1355 017654  052703  000001                BIS     #BIT0,R3        ;SET ERROR FLAG
 1356
 1357                                ;RESET AND SET 'DMD' USING REGISTER TRANSFER-VERIFY 'DMD' NOT S-A-0
 1358 017660                        20$:
 1359 017660  012760  000000  000024        MOV     #0,RMMR1(R0)    ;LOAD RMMR1
 1360 017666  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
 1361 017674  016037  000024  001142        MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 1362 017702  042737  177776  001142        BIC     #^CDMD,$BDDAT
 1363 017710  001006                        BNE     30$             ;BRANCH IF DMD NOT S-A-0
 1364 017712  012737  000001  001140        MOV     #DMD,$GDDAT
```

```
1365 017720  104077                        EMT     77
1366 017722  052703  000002                BIS     #BIT1,R3        ;SET ERROR FLAG
1367
1368                                ;IF NO PREVIOUS ERROR, TEST FOR BIT INTERFERENCE WITH SHIFTING
1369                                ;ONE BIT PATTERN
1370 017726                         30$:
1371 017726  005703                        TST     R3              ;ANY ERRORS DETECTED??
1372 017730  001027                        BNE     60$             ;YES!!
1373 017732  012702  000002                MOV     #BIT1,R2        ;INITAILIZE DATA PATTERN
1374 017736                         40$:
     017736  012760  000000  000024        MOV     #0,RMMR1(R0)    ;LOAD RMMR1
1375 017744  010260  000024                MOV     R2,RMMR1(R0)    ;LOAD RMMR1
1376 017750  016037  000024  001142        MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
1377 017756  042737  177776  001142        BIC     #^CDMD,$BDDAT
1378 017764  001407                        BEQ     50$             ;BRANCH IF DMD NOT SET
1379 017766  010237  001174                MOV     R2,$TMP0        ;SAVE DATA
1380 017772  010237  001174                MOV     R2,$TMP0        ;SAVE DATA
1381 017776  005037  001140                CLR     $GDDAT          ;DMD SHOULD BE ZERO
1382 020002  104100                        EMT     100
1383
1384                                ;SHIFT TO NEXT DATA BIT AND CONTINUE TEST IF NOT DONE
1385 020004                         50$:
1386 020004  006302                        ASL     R2
1387 020006  001353                        BNE     40$
1388 020010                         60$:                            ;END OF TEST
1389
1390                                ;;*************************************************************************
                                    ;*TEST 30        MOL TEST
                                    ;;*************************************************************************
     020010                         TST30:
     020010  000004                        SCOPE                   ;SCOPE CALL
     020012  000240                        NOP
     020014  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
     020020  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     020024  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     020030  012737  000030  001226        MOV     #30,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1391
1392 020036  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1393 020042  010037  001136                MOV     R0,$BDADR       ;R0=REGISTER ADDRESS
1394 020046  062737  000012  001136        ADD     #RMDS,$BDADR
1395 020054  005003                        CLR     R3              ;R3=ERROR FLAG
1396
1397                                ;SET DIAGNOSTIC MODE AND VERIFY THAT 'MOL" IS ZERO
1398 020056  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1399 020064  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1400 020072  042737  167777  001142        BIC     #^CMOL,$BDDAT
1401 020100  001405                        BEQ     10$
1402 020102  005037  001140                CLR     $GDDAT
1403 020106  104101                        EMT     101
1404 020110  052703  000001                BIS     #BIT0,R3        ;SET ERROR FLAG
1405
1406                                ;SET MAINTENANCE UNIT READY AND VERIFY THAT 'MOL" IS ONE
1407 020114                         10$:
1408 020114  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1409 020122  012760  001001  000024        MOV     #DMD!MUR,RMMR1(R0)      ;LOAD RMMR1
1410 020130  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
```

```
1411 020136 042737 167777 001142          BIC     #^CMOL,$BDDAT
1412 020144 001006                        BNE     20$
1413 020146 012737 010000 001140          MOV     #MOL,$GDDAT
1414 020154 104102                        EMT     102
1415 020156 052703 000002                 BIS     #BIT1,R3
1416
1417                                ;IF NO PREVIOUS ERROR, VERIFY VOLUME VALID IS RESET AND
1418                                ;TEST FOR BIT INTERFERENCE
1419 020162                         20$:
1420 020162 005703                        TST     R3              ;ANY ERROR DETECTED??
1421 020164 001057                        BNE     70$             ;YES!!
1422 020166 016037 000012 001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1423 020174 042737 177677 001142          BIC     #^CVV,$BDDAT
1424 020202 001403                        BEQ     25$             ;BRANCH IF VV RESET
1425 020204 005037 001140                 CLR     $GLDAT
1426 020210 104135                        EMT     135
1427 020212                         25$:
1428 020212 012702 000001                 MOV     #1,R2           ;INITIALIZE DATA PATTERN
1429 020216                         30$:
     020216 012760 000001 000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1430 020224 010260 000024                 MOV     R2,RMMR1(R0)    ;LOAD RMMR1
1431 020230 016037 000012 001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1432 020236 042737 167777 001142          BIC     #^CMOL,$BDDAT
1433 020244 005003                        CLR     R3              ;SETUP EXPECTED 'MOL'
1434 020246 032702 001000                 BIT     #MUR,R2
1435 020252 001402                        BEQ     40$
1436 020254 052703 010000                 BIS     #MOL,R3         ;'MOL' SHOULD BE ONE
1437 020260 020337 001142           40$:  CMP     R3,$BDDAT       ;IS MOL OK??
1438 020264 001405                        BEQ     50$             ;YES!!
1439 020266 010237 001174                 MOV     R2,$TMP0        ;SAVE TEST PATTERN
1440 020272 010337 001140                 MOV     R3,$GDDAT
1441 020276 104103                        EMT     103
1442
1443                                ;SHIFT TO NEXT PATTERN
1444 020300                         50$:
1445 020300 042702 000001                 BIC     #DMD,R2         ;DONT SHIFT DMD
1446 020304 001002                        BNE     60$
1447 020306 012702 000001                 MOV     #DMD,R2         ;DONT TRUNCATE TEST
1448 020312 006302                  60$:  ASL     R2              ;SHIFT TO NEXT BIT
1449 020314 001403                        BEQ     70$             ;BRANCH IF DONE
1450 020316 052702 000001                 BIS     #DMD,R2         ;KEEP DMD ON
1451 020322 000735                        BR      30$             ;CONTINUE
1452
1453 020324                         70$:                          ;END OF TEST
1454
1455                                ;;*******************************************************************
                                    ;*TEST 31        WRITE LOCK TEST

                                    ;;*******************************************************************
     020324                         TST31:
     020324 000004                        SCOPE                   ;SCOPE CALL
     020326 000240                        NOP
     020330 012706 001100                 MOV     #STACK,SP       ;LOAD THE STACK POINTER
     020334 013700 001276                 MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     020340 013701 001466                 MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     020344 012737 000031 001226          MOV     #31,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1456
```

```
1457 020352  005003                        CLR     R3              ;R3=ERROR FLAG
1458 020354  010037  001136                MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
1459 020360  062737  000012  001136        ADD     #RMDS,$BDADR
1460 020366  005037  001140                CLR     $GDDAT          ;WRL SHOULD BE ZERO
1461 020372  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1462
1463                                ;SET DIAGNOSTIC MODE AND VERIFY 'WRL" IS ZERO
1464 020376  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1465 020404  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1466 020412  042737  173777  001142        BIC     #^CWRL,$BDDAT
1467 020420  001403                        BEQ     10$             ;BRANCH IF WRL IS ZERO
1468 020422  104104                        EMT     104
1469 020424  052703  000001                BIS     #BIT0,R3        ;SET ERROR FLAG
1470
1471                                ;SET MAINTENANCE WRITE PROTECT AND VERIFY 'WRL" IS ONE
1472 020430                         10$:
1473 020430  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1474 020436  012760  000011  000024        MOV     #DMD!MWP,RMMR1(R0)      ;LOAD RMMR1
1475 020444  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1476 020452  042737  173777  001142        BIC     #^CWRL,$BDDAT
1477 020460  001006                        BNE     20$             ;BRANCH IF WRL IS NOE
1478 020462  012737  004000  001140        MOV     #WRL,$GDDAT     ;WRL SHOULD BE SET
1479 020470  104105                        EMT     105
1480 020472  052703  000002                BIS     #BIT1,R3        ;SET ERROR FLAG
1481
1482                                ;IF NO PREVIOUS ERROR, TEST FOR BIT INTERFERENCE ON 'MWP"
1483 020476                         20$:
1484 020476  005703                        TST     R3              ;ANY OTHER ERROR??
1485 020500  001045                        BNE     70$             ;YES!!
1486 020502  012702  000001                MOV     #1,R2           ;INITIALIZE DATA PATTERN
1487
1488                                ;TRANSFER DATA TO RMMR1, READ RMDS AND VERIFY WRL
1489 020506                         30$:
1490 020506  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1491 020514  010260  000024                MOV     R2,RMMR1(R0)    ;LOAD RMMR1
1492 020520  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1493 020526  042737  173777  001142        BIC     #^CWRL,$BDDAT   ;CLEARUP RECEIVED 'WRL"
1494 020534  005003                        CLR     R3              ;GENERATE EXPECTED 'WRL"
1495 020536  032702  000010                BIT     #MWP,R2
1496 020542  001402                        BEQ     40$
1497 020544  052703  004000                BIS     #WRL,R3         ;WRL SHOULD BE SET
1498 020550  020337  001142        40$:    CMP     R3,$BDDAT       ;IS WRL OK??
1499 020554  001405                        BEQ     50$             ;YES!!
1500 020556  010337  001140                MOV     R3,$GDDAT       ;SAVE EXPECTED
1501 020562  010237  001174                MOV     R2,$TMP0        ;SAVE DATA PATTERN
1502 020566  104106                        EMT     106
1503
1504                                ;ADVANCE TO NEXT DATA BIT
1505 020570                         50$:
1506 020570  042702  000001                BIC     #DMD,R2         ;DONT SHIFT DMD
1507 020574  001002                        BNE     60$
1508 020576  012702  000001                MOV     #DMD,R2         ;DONT TRUNCATE TEST
1509 020602  006302                60$:    ASL     R2              ;SHIFT DATA BIT
1510 020604  001403                        BEQ     70$             ;EXIT IF DONE
1511 020606  052702  000001                BIS     #DMD,R2         ;KEEP DIAGNOSTIC MODE ON
1512 020612  000735                        BR      30$             ;CONTINUE TEST
1513
```

```
1514 020614                                70$:                            ;END OF TEST
1515
1516                                       ;;*************************************************************************
                                           ;*TEST 32       DRIVE FAULT TEST
                                           ;;*************************************************************************
      020614                               TST32:
      020614  000004                               SCOPE                    ;SCOPE CALL
      020616  000240                               NOP
      020620  012706  001100                       MOV     #STACK,SP        ;LOAD THE STACK POINTER
      020624  013700  001276                       MOV     $BASE,R0         ;R0 = UNIBUS ADDRESS
      020630  013701  001466                       MOV     TSTQUE,R1        ;R1 = POINTER TO DEVICE
      020634  012737  000032  001226               MOV     #32,$TESTN       ;;SET TEST NUMBER IN APT MAIL BOX
1517
1518 020642  004737  055156                       JSR     PC,CNTCLR        ;GO CLEAR CONTROLLER
1519 020646  005003                               CLR     R3               ;INITIALIZE ERROR FLAGS
1520 020650  010037  001136                       MOV     R0,$BDADR        ;SETUP REGISTER ADDRESS
1521 020654  062737  000042  001136               ADD     #RMER2,$BDADR
1522 020662  005037  001140                       CLR     $GDDAT           ;"DVC" AND "UNS" SHOULD BE ZERO
1523
1524                                       ;SET AND RESET MAINTENANCE DRIVE FAULT, VERIFY THAT "DVC" IS NOT
1525                                       ;STUCK-AT-ONE.
1526 020666  012760  000001  000024               MOV     #DMD,RMMR1(R0)   ;LOAD RMMR1
1527 020674  012760  000000  000042               MOV     #0,RMER2(R0)     ;LOAD RMER2
1528 020702  012760  000000  000014               MOV     #0,RMER1(R0)     ;LOAD RMER1
1529 020710  016037  000042  001142               MOV     RMER2(R0),$BDDAT         ;STORE RMER2 AT $BDDAT
1530 020716  042737  177577  001142               BIC     #^CDVC,$BDDAT    ;IS "DVC" RESET??
1531 020724  001406                               BEQ     10$              ;YES!!
1532 020726  104107                               EMT     107
1533 020730  052703  000001                       BIS     #BIT0,R3         ;SET ERROR FLAG
1534 020734  012737  040000  001140               MOV     #UNS,$GDDAT
1535
1536                                       ;VERIFY THAT "UNS" IS SAME AS "DVC"
1537 020742                               10$:
1538 020742  016037  000014  001142               MOV     RMER1(R0),$BDDAT         ;STORE RMER1 AT $BDDAT
1539 020750  042737  137777  001142               BIC     #^CUNS,$BDDAT
1540 020756  023737  001140  001142               CMP     $GDDAT,$BDDAT    ;IS "UNS" OK??
1541 020764  001414                               BEQ     30$              ;YES!!
1542 020766  010037  001136                       MOV     R0,$BDADR        ;SETUP REGISTER ADDRESS
1543 020772  062737  000014  001136               ADD     #RMER1,$BDADR
1544 021000  032737  040000  001140               BIT     #UNS,$GDDAT      ;SHOULD "UNS" BE ON??
1545 021006  001002                               BNE     20$              ;YES!!
1546 021010  104110                               EMT     110
1547 021012  000401                               BR      30$
1548 021014                               20$:
1549 021014  104111                               EMT     111
1550
1551                                       ;RESET AND SET "MDF", VERIFY THAT "DVC" IS NOT S-A-0.
1552 021016                               30$:
1553 021016  012737  000200  001140               MOV     #DVC,$GDDAT      ;DVC SHOULD BE ON
1554 021024  012760  000001  000024               MOV     #DMD,RMMR1(R0)   ;LOAD RMMR1
1555 021032  012760  000101  000024               MOV     #DMD!MDF,RMMR1(R0)       ;LOAD RMMR1
1556 021040  016037  000042  001142               MOV     RMER2(R0),$BDDAT         ;STORE RMER2 AT $BDDAT
1557 021046  042737  177577  001142               BIC     #^CDVC,$BDDAT
1558 021054  001012                               BNE     40$              ;BRANCH IF DVC IS SET
1559 021056  010037  001136                       MOV     R0,$BDADR        ;SETUP REGISTER ADDRESS
1560 021062  062737  000042  001136               ADD     #RMER2,$BDADR
```

```
                                        EMT     112
                                        BIS     #BIT1,R3        ;SET ERROR FLAG
                                        CLR     $GDDAT          ;UNS SHOULD BE OFF

                                ;VERIFY THAT "UNS" IS SAME AS "DVC"
                                40$:
                                        TST     $GDDAT          ;CHANGE DVC TO UNS
                                        BEQ     50$
                                        MOV     #UNS,$GDDAT
                                50$:
                                        MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
                                        BIC     #^CUNS,$BDDAT
                                        CMP     $GDDAT,$BDDAT
                                        BEQ     70$             ;BRANCH IF UNS IS OK
                                        MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
                                        ADD     #RMER1,$BDADR
                                        BIT     #UNS,$GDDAT     ;SHOULD UNS BE ON??
                                        BNE     60$             ;YES!!
                                        EMT     113
                                        BR      70$
                                60$:
                                        EMT     114

                                ;IF THERE WERE NO PREVIOUS ERRORS, TEST FOR BIT INTERFERENCE ON
                                ;"MDF"
                                70$:
                                        TST     R3
                                        BNE     120$            ;BRANCH IF ANY OTHER ERRORS
                                        MOV     #1,R2           ;INITIALIZE TEST PATTERN
                                80$:
                                        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
                                        MOV     #0,RMER2(R0)    ;LOAD RMER2
                                        MOV     R2,RMMR1(R0)    ;LOAD RMMR1
                                        MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
                                        BIC     #^CDVC,$BDDAT   ;GET RESULTS
                                        CLR     $GDDAT          ;SETUP EXPECTED
                                        BIT     #MDF,R2         ;WAS MDF SET??
                                        BEQ     90$             ;NO!!
                                        BIS     #DVC,$GDDAT     ;YES-DVC SHOULD BE ON
                                90$:    CMP     $GDDAT,$BDDAT
                                        BEQ     100$            ;BRANCH IF DVC IS OK
                                        MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
                                        ADD     #RMER2,$BDADR
                                        MOV     R2,$TMP0        ;SAVE TEST PATTERN
                                        EMT     115

                                ;SHIFT TO NEXT BIT POSITION
                                100$:
                                        BIC     #DMD,R2         ;DONT SHIFT DMD
                                        BNE     110$
                                        MOV     #DMD,R2         ;DONT TRUNCATE TEST
                                110$:   ASL     R2              ;SHIFT
                                        BEQ     120$            ;EXIT IF DONE
                                        BIS     #DMD,R2         ;KEEP DMD ON
                                        BR      80$             ;CONTINUE

                                120$:                           ;END OF TEST
```

```
                                ;;*****************************************************************
                                ;*TEST 33        SEEK ERROR TEST
                                ;;*****************************************************************
021332                          TST33:
021332  000004                          SCOPE                   ;SCOPE CALL
021334  000240                          NOP
021336  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
021342  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
021346  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
021352  012737  000033  001226          MOV     #33,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1619
1620 021360  004737  055156            JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1621 021364  005003                    CLR     R3              ;CLEAR ERROR FLAGS
1622 021366  010037  001136            MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
1623 021372  062737  000042  001136    ADD     #RMER2,$BDADR
1624
1625                            ;SET DIAGNOSTIC MODE AND VERIFY THAT "SKI" CAN BE RESET
1626 021400  012760  000001  000024    MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1627 021406  012760  000000  000042    MOV     #0,RMER2(R0)    ;LOAD RMER2
1628 021414  016037  000042  001142    MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
1629 021422  042737  137777  001142    BIC     #^CSKI,$BDDAT
1630 021430  001405                    BEQ     10$             ;BRANCH IF SKI IS RESET
1631 021432  005037  001140            CLR     $GDDAT          ;SKI SHOULD BE ZERO
1632 021436  104116                    EMT     116
1633 021440  052703  000001            BIS     #BIT0,R3        ;SET ERROR FLAG
1634
1635                            ;SET MAINTENANCE SEEK ERROR AND VERIFY THAT "SKI" CAN BE SET
1636 021444                     10$:
1637 021444  012760  000001  000024    MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1638 021452  012760  000000  000042    MOV     #0,RMER2(R0)    ;LOAD RMER2
1639 021460  012760  000201  000024    MOV     #DMD!MSER,RMMR1(R0)     ;LOAD RMMR1
1640 021466  016037  000042  001142    MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
1641 021474  042737  137777  001142    BIC     #^CSKI,$BDDAT
1642 021502  001005                    BNE     20$             ;BRANCH IF SKI IS SET
1643 021504  012737  040000  001140    MOV     #SKI,$GDDAT     ;CANT SET SKI
1644 021512  052703  000002            BIS     #BIT1,R3        ;SET ERROR FLAG
1645
1646                            ;IF NO PREVIOUS ERROR, CHECK FOR BIT INTERFERENCE SETTING MAINTENANCE
1647                            ;SEEK ERROR.
1648 021516                     20$:
1649 021516  005703                    TST     R3
1650 021520  001051                    BNE     70$             ;BRANCH IF ANY OTHER ERRORS
1651 021522  012702  000001            MOV     #1,R2           ;INITIALIZE TEST PATTERN
1652 021526                     30$:
1653 021526  012760  000001  000024    MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1654 021534  012760  000000  000042    MOV     #0,RMER2(R0)    ;LOAD RMER2
1655 021542  010260  000024            MOV     R2,RMMR1(R0)    ;LOAD RMMR1
1656 021546  016037  000042  001142    MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
1657 021554  042737  137777  001142    BIC     #^CSKI,$BDDAT   ;GET SKI STATUS
1658 021562  005037  001140            CLR     $GDDAT          ;SETUP EXPECTED RESULT
1659 021566  032702  000200            BIT     #MSER,R2
1660 021572  001403                    BEQ     40$
1661 021574  052737  040000  001140    BIS     #SKI,$GDDAT     ;SKI SHOULD BE ON
1662 021602  023737  001140  001142  40$:    CMP     $GDDAT,$BDDAT
1663 021610  001403                    BEQ     50$             ;BRANCH IF SKI IS OK
```

```
1664 021612  010237  001174                MOV     R2,$TMP0        ;SAVE TEST PATTERN
1665 021616  104120                        EMT     120
1666
1667                                ;ADVANCE TEST PATTERN IN R2
1668 021620                         50$:
1669 021620  042702  000001                BIC     #DMD,R2         ;DONT SHIFT DMD BIT
1670 021624  001002                        BNE     60$
1671 021626  012702  000001                MOV     #DMD,R2         ;DONT TRUNCATE TEST
1672 021632  006302                 60$:   ASL     R2              ;SHIFT TO NEXT BIT
1673 021634  001403                        BEQ     70$             ;EXIT IF DONE
1674 021636  052702  000001                BIS     #DMD,R2         ;KEEP DMD ON
1675 021642  000731                        BR      30$             ;CONTINUE TEST
1676
1677 021644                         70$:                            ;END OF TEST
1678
1679                                ;;*****************************************************************
                                    ;*TEST 34        PIP TEST

                                    ;;*****************************************************************
      021644                        TST34:
      021644  000004                        SCOPE                   ;SCOPE CALL
      021646  000240                        NOP
      021650  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
      021654  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
      021660  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
      021664  012737  000034  001226        MOV     #34,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1680
1681 021672  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1682 021676  005003                        CLR     R3              ;RESET ERROR FLAGS
1683 021700  010037  001136                MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
1684 021704  062737  000012  001136        ADD     #RMDS,$BDADR
1685
1686                                ;SET MAINTENANCE ON CYLINDER 'MOC" AND VERIFY THAT 'PIP" CAN BE RESET.
1687 021712  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1688 021720  012760  000401  000024        MOV     #DMD!MOC,RMMR1(R0)      ;LOAD RMMR1
1689 021726  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1690 021734  042737  157777  001142        BIC     #^CPIP,$BDDAT
1691 021742  001405                        BEQ     10$             ;BRANCH IF PIP IS RESET
1692 021744  005037  001140                CLR     $GDDAT
1693 021750  104121                        EMT     121
1694 021752  052703  000001                BIS     #BIT0,R3        ;SET ERROR FLAG
1695
1696                                ;RESET MAINTENANCE ON CYLINDER AND VERIFY THAT 'PIP" CAN BE SET
1697 021756                         10$:
1698 021756  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1699 021764  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1700 021772  042737  157777  001142        BIC     #^CPIP,$BDDAT
1701 022000  001006                        BNE     20$             ;BRANCH IF PIP IS SET
1702 022002  012737  020000  001140        MOV     #PIP,$GDDAT
1703 022010  104122                        EMT     122
1704 022012  052703  000002                BIS     #BIT1,R3        ;SET ERROR FLAG
1705
1706                                ;IF NO PREVIOUS ERROR, TEST FOR ADJACENT BIT SETTING 'MOC"
1707 022015                         20$:
1708 022016  005703                        TST     R3
1709 022020  001046                        BNE     70$             ;BRANCH IF ANY PREVIOUS ERROR
1710 022022  012702  000001                MOV     #1,R2           ;INITIALIZE TEST PATTERN
```

```
1711
1712                                    ;WRITE THE TEST PATTERN, CHECK MOC USING PIP
1713 022026                             30$:
1714 022026  012760  000001  000024              MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1715 022034  010260  000024                      MOV     R2,RMMR1(R0)    ;LOAD RMMR1
1716 022040  016037  000012  001142              MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
1717 022046  042737  157777  001142              BIC     #^CPIP,$BDDAT   ;GET PIP STATUS
1718 022054  005037  001140                      CLR     $GDDAT          ;SETUP EXPECTED RESULT
1719 022060  032702  000400                      BIT     #MOC,R2
1720 022064  001003                              BNE     40$
1721 022066  052737  020000  001140              BIS     #PIP,$GDDAT     ;PIP SHOULD BE SET
1722 022074  023737  001140  001142  40$:        CMP     $GDDAT,$BDDAT
1723 022102  001403                              BEQ     50$             ;BRANCH IF PIP OK
1724 022104  010237  001174                      MOV     R2,$TMP0        ;SAVE TEST PATTERN
1725 022110  104123                              EMT     123
1726
1727                                    ;ADVANCE THE TEST PATTERN
1728 022112                             50$:
1729 022112  042702  000001                      BIC     #DMD,R2         ;DONT SHIFT DMD
1730 022116  001002                              BNE     60$
1731 022120  012702  000001                      MOV     #DMD,R2         ;DONT TRUNCATE TEST
1732 022124  006302                      60$:    ASL     R2              ;SHIFT BIT
1733 022126  001403                              BEQ     70$             ;EXIT IF DONE
1734 022130  052702  000001                      BIS     #DMD,R2         ;KEEP DMD ON
1735 022134  000734                              BR      30$             ;CONTINUE TEST
1736
1737 022136                             70$:                            ;END OF TEST
1738
1739                                    ;;*****************************************************************
                                        ;*TEST 35        EBL TEST
                                        ;;*****************************************************************
     022136                             TST35:
     022136  000004                             SCOPE                   ;SCOPE CALL
     022140  000240                             NOP
     022142  012706  001100                     MOV     #STACK,SP       ;LOAD THE STACK POINTER
     022146  013700  001276                     MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     022152  013701  001466                     MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     022156  012737  000035  001226             MOV     #35,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1740
1741 022164  005003                             CLR     R3              ;RESET ERROR FLAGS
1742 022166  010037  001136                     MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
1743 022172  062737  000024  001136             ADD     #RMMR1,$BDADR
1744 022200  005037  001140                     CLR     $GDDAT          ;SETUP EXPECTED RESULT
1745
1746                                    ;CLEAR AND VERIFY THAT END OF BLOCK IS RESET
1747 022204  004737  055156                     JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1748 022210  016037  000024  001142             MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
1749 022216  042737  157777  001142             BIC     #^CEBL,$BDDAT
1750 022224  001403                             BEQ     10$             ;BRANCH IF EBL IS RESET
1751 022226  104124                             EMT     124
1752 022230  052703  000001                     BIS     #BIT0,R3        ;SET ERROR FLAG
1753
1754                                    ;SET AND RESET DIAGNOSTIC END OF BLOCK, CHECK FOR EBL S-A-1.
1755 022234                             10$:
1756 022234  012760  000001  000024             MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1757 022242  012760  020001  000024             MOV     #DMD!DEBL,RMMR1(R0)     ;LOAD RMMR1
```

```
1758 022250  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1759 022256  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
1760 022264  042737  157777  001142          BIC     #^CEBL,$BDDAT
1761 022272  001403                          BEQ     20$             ;BRANCH IF EBL IS RESET
1762 022274  104125                          EMT     125
1763 022276  052703  000001                  BIS     #BIT0,R3        ;SET ERROR FLAG
1764
1765                                 ;RESET AND SET DIAGNOSTIC END OF BLOCK, CHECK FOR EBL S-A-0
1766 022302                          20$:
1767 022302  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1768 022310  012760  020001  000024          MOV     #DMD!DEBL,RMMR1(R0)     ;LOAD RMMR1
1769 022316  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
1770 022324  042737  157777  001142          BIC     #^CEBL,$BDDAT
1771 022332  001006                          BNE     30$             ;BRANCH IF EBL IS SET
1772 022334  012737  020000  001140          MOV     #EBL,$GDDAT
1773 022342  104126                          EMT     126
1774 022344  052703  000002                  BIS     #BIT1,R3        ;SET ERROR FLAG
1775
1776                                 ;IF NO PREVIOUS ERRORS, TEST FOR ADJACENT BIT INTERFERENCE ON 'DEBL'.
1777 022350                          30$:
1778 022350  005703                          TST     R3
1779 022352  001042                          BNE     70$             ;BRANCH IF ANY ERROR
1780 022354  012702  000001                  MOV     #1,R2           ;INITIALIZE TEST PATTERN
1781
1782                                 ;WRITE, READ AND VERIFY THE TEST PATTERN IN R2
1783 022360                          40$:
1784 022360  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
1785 022366  010260  000024                  MOV     R2,RMMR1(R0)    ;LOAD RMMR1
1786 022372  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
1787 022400  042737  157777  001142          BIC     #^CEBL,$BDDAT
1788 022406  010203                          MOV     R2,R3           ;GENERATE EXPECTED RESULT
1789 022410  042703  157777                  BIC     #^CEBL,R3
1790 022414  020337  001142                  CMP     R3,$BDDAT
1791 022420  001405                          BEQ     50$             ;BRANCH IF EBL IS OK
1792 022422  010337  001140                  MOV     R3,$GDDAT       ;SAVE EXPECTED RESULT
1793 022426  010237  001174                  MOV     R2,$TMP0        ;SAVE TEST PATTERN
1794 022432  104127                          EMT     127
1795
1796                                 ;SHIFT TO NEXT BIT POSITION
1797 022434                          50$:
1798 022434  042702  000001                  BIC     #DMD,R2         ;DONT SHIFT DMD
1799 022440  001002                          BNE     60$
1800 022442  012702  000001                  MOV     #DMD,R2         ;DONT TRUNCATE DMD
1801 022446  006302                  60$:    ASL     R2              ;SHIFT TO NEXT BIT
1802 022450  001403                          BEQ     70$             ;EXIT IF DONE
1803 022452  052702  000001                  BIS     #DMD,R2         ;KEEP DMD ON
1804 022456  000740                          BR      40$             ;CONTINUE TEST
1805
1806 022460                          70$:                            ;END OF TEST
1807
1819
1820                                 ;;*****************************************************************
                                     ;*TEST 36       LAST SECTOR, LAST TRACK TEST
                                     ;*TRANSFER TEST PATTERN TO RMDA THEN VERIFY LAST SECTOR 'LS' AND LAST
                                     ;*SECTOR/TRACK 'LST' FOR EACH TRANSFER. THE TABLE BELOW LISTS THE VALUE
                                     ;*OF RMDA FOR WHICH LS AND LST ARE SET.
                                     ;*
```

T36 LAST SECTOR, LAST TRACK TEST

```
                                        ;*      18 BIT MODE     16 BIT MODE     16 BIT MODE W/ SSEI SET
                                        ;*LS =  XXX035          XXX036          XXX037
                                        ;*
                                        ;*LST=  006435          006436          006437
                                        ;*
                                        ;*****************************************************************
022460                                  TST36:
022460  000004                                SCOPE                   ;SCOPE CALL
022462  000240                                NOP
022464  012706  001100                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
022470  013700  001276                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
022474  013701  001466                        MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
022500  012737  000003  001206                MOV     #3,$TIMES       ;;DO 3 ITERATIONS
022506  012737  000036  001226                MOV     #36,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1821
1822 022514  005002                          CLR     R2              ;INITIALIZE TEST PATTERN
1823 022516  010037  001136                  MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
1824 022522  062737  000024  001136          ADD     #RMMR1,$BDADR
1825 022530  005037  001444                  CLR     RMOFO           ;START IN 18 BIT MODE
1826 022534  013737  001334  023114          MOV     LSTRK,80$       ;SETUP LAST TRACK AND
1827 022542  112737  000035  023114          MOVB    #035,80$        ;LAST SECTOR (29.)
1828 022550                             10$:
1829 022550  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
1830 022554  013760  001444  000032          MOV     RMOFO,RMOF(R0)  ;LOAD RMOF
1831 022562  016037  000032  001176          MOV     RMOF(R0),$TMP1  ;STORE RMOF AT $TMP1
1832 022570  010260  000006                  MOV     R2,RMDA(R0)     ;LOAD RMDA
1833 022574  016037  000024  001362          MOV     RMMR1(R0),RMMR1I        ;STORE RMMR1 IN INPUT BUFFER
1834 022602  013737  001362  001142          MOV     RMMR1I,$BDDAT   ;VERIFY 'LS''
1835 022610  042737  177773  001142          BIC     #^CLS,$BDDAT
1836 022616  005037  001140                  CLR     $GDDAT          ;GENERATE EXPECTED 'LS''
1837 022622  032737  010000  001444          BIT     #FMT16,RMOFO    ;16 BIT MODE ?
1838 022630  001010                          BNE     20$             ;YES!!
1839 022632  032737  001000  001444          BIT     #SSEI,RMOFO     ;16 BIT MODE W/ SSEI ?
1840 022640  001010                          BNE     25$             ;YES !!
1841 022642  123702  023114                  CMPB    80$,R2          ;18 BIT MODE LAST SECTOR ?
1842 022646  001014                          BNE     35$             ;NO !!
1843 022650  000410                          BR      30$
1844 022652  123702  023114          20$:    CMPB    80$,R2          ;16 BIT MODE LAST SECTOR ?
1845 022656  001010                          BNE     35$             ;NO !!
1846 022660  000404                          BR      30$
1847 022662  123737  023114  001140  25$:    CMPB    80$,$GDDAT      ;16 BIT MODE W/ SSEI LAST SECTOR ?
1848 022670  001003                          BNE     35$             ;NO !!
1849
1850 022672  052737  000004  001140  30$:    BIS     #LS,$GDDAT      ;LS SHOULD BE ON-16 BIT MODE
1851 022700  023737  001140  001142  35$:    CMP     $GDDAT,$BDDAT
1852 022706  001404                          BEQ     40$             ;BRANCH IF LS IS CORRECT
1853 022710  010237  001174                  MOV     R2,$TMP0        ;SAVE TEST PATTERN
1854 022714  104130                          EMT     130
1855 022716  000477                          BR      90$             ;SKIP TO NEXT
1856
1857 022720  013737  001362  001142  40$:    MOV     RMMR1I,$BDDAT   ;VERIFY 'LST''
1858 022726  042737  177775  001142          BIC     #^CLST,$BDDAT
1859 022734  005037  001140                  CLR     $GDDAT          ;GENERATE EXPECTED 'LST''
1860 022740  032737  010000  001444          BIT     #FMT16,RMOFO    ;16 BIT MODE??
1861 022746  001010                          BNE     50$             ;YES!!
1862 022750  032737  001000  001444          BIT     #SSEI,RMOFO     ;16 BIT MODE W/ SSEI ?
1863 022756  001010                          BNE     55$             ;YES !!
```

```
1864 022760  023702  023114                    CMP     80$,R2          ;18 BIT MODE LAST TRACK/SECTOR ?
1865 022764  001013                            BNE     65$             ;NO !!
1866 022766  000407                            BR      60$
1867 022770  023702  023114          50$:      CMP     80$,R2          ;16 BIT MODE LAST TRACK/SECTOR ?
1868 022774  001007                            BNE     65$             ;NO !!
1869 022776  000403                            BR      60$
1870 023000  023702  023114          55$:      CMP     80$,R2          ;16 BIT MODE W/ SSEI LAST TRACK/SECTOR ?
1871 023004  001003                            BNE     65$             ;NO !!
1872 023006  052737  000002  001140  60$:      BIS     #LST,$GDDAT     ;LST SHOULD BE SET
1873 023014  023737  001140  001142  65$:      CMP     $GDDAT,$BDDAT   ;IS LST STATUS CORRECT ?
1874 023022  001404                            BEQ     70$             ;BR IF YES
1875 023024  010237  001174                    MOV     R2,$TMP0        ;SAVE TEST PATTERN
1876 023030  104131                            EMT     131
1877 023032  000431                            BR      90$             ;SKIP TO NEXT
1878
1879                                ;ADVANCE TO NEXT TEST PATTERN, CHANGE TO 16 BIT MODE IF ALL
1880                                ;18 BIT TESTS DONE.
1881 023034                         70$:
1882 023034  005202                            INC     R2              ;INCREMENT PATTERN
1883 023036  001244                            BNE     10$             ;CONTINUE IF NOT DONE
1884 023040  032737  010000  001444            BIT     #FMT16,RMOF0    ;DONE 16 BIT TEST ?
1885 023046  001007                            BNE     75$             ;YES!!
1886 023050  012737  010000  001444            MOV     #FMT16,RMOF0    ;DO 16 BIT FORMAT TEST
1887 023056  112737  000036  023114            MOVB    #036,80$        ;STORE LAST SECTOR ADDRESS
1888 023064  000631                            BR      10$
1889
1890 023066  032737  001000  001444  75$:      BIT     #SSEI,RMOF0     ;DONE 16 BIT FORMAT W/ SSEI SET ?
1891 023074  001410                            BEQ     90$             ;YES !!
1892 023076  052737  001000  001444            BIS     #SSEI,RMOF0     ;SET SSEI WITH 16 BIT MODE AND
1893 023104  112737  000037  023114            MOVB    #037,80$        ;STORE LAST SECTOR ADDRESS
1894 023112  000616                            BR      10$             ;TEST AGAIN
1895
1896 023114  000000                ;80$:       .WORD   0               ;HOLDS LAST TRACK/SECTOR ADDRESS
1897
1898 023116                         90$:
1899
1903                                ;;*****************************************************************
                                    ;*TEST 37        RMDA COUNT TEST

                                    ;;*****************************************************************
     023116                         TST37:
     023116  000004                         SCOPE                   ;SCOPE CALL
     023120  000240                         NOP
     023122  012706  001100                 MOV     #STACK,SP       ;LOAD THE STACK POINTER
     023126  013700  001276                 MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     023132  013701  001466                 MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     023136  012737  000003  001206         MOV     #3,$TIMES       ;;DO 3 ITERATIONS
     023144  012737  000037  001226         MOV     #37,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
1904
1905 023152  010037  001136                 MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
1906 023156  062737  000006  001136         ADD     #RMDA,$BDADR
1907 023164  005037  001444                 CLR     RMOF0           ;START WITH 18 BIT FORMAT
1908 023170  012737  000035  023622         MOV     #29.,110$       ;SETUP LAST SECTOR FOR 18 BIT
1909 023176  012737  000001  001140         MOV     #1,$GDDAT       ;SETUP FIRST COUNT
1910
1911                                ;INCREMENT SECTOR COUNT USING DIAGNOSTIC END OF BLOCK STARTING AT
1912                                ;SECTOR 0 AND CONTINUING UNTIL TRACK ADDRESS INCREMENTS
```

```
                                        ;       .CLEAR THE MASSBUS
                                        ;       .SET FORMAT
                                        ;       .LOAD SECTOR AND TRACK ADDRESS
                                        ;       .ENABLE DEBUG CLOCK
                                        ;       .SET GO BIT
023204                                  10$:
023204  004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
023210  012760  000001  000024                  MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
023216  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
023224  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
023232  012760  000000  000006                  MOV     #0,RMDA(R0)     ;LOAD RMDA
023240  013760  001444  000032                  MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
023246  016037  000032  001174                  MOV     RMOF(R0),$TMP0  ;STORE RMOF AT $TMP0
023254  012760  040001  000024                  MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
023262  012760  000001  000000                  MOV     #GO,RMCS1(R0)   ;LOAD RMCS1

                                        ;SET AND RESET EBL TO INCREMENT RMDA THEN VERIFY RMDA.
023270                                  25$:
023270  012760  060001  000024                  MOV     #DMD!DBEN!DEBL,RMMR1(R0)        ;LOAD RMMR1
023276  012760  040001  000024                  MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
023304  016037  000006  001142                  MOV     RMDA(R0),$BDDAT ;STORE RMDA AT $BDDAT
023312  023737  001142  001140                  CMP     $BDDAT,$GDDAT
023320  001402                                  BEQ     30$             ;BRANCH IF RMDA OK
023322  104132                                  EMT     132
023324  000416                                  BR      50$             ;OUT OF SYNC-SKIP TO NEXT

                                        ;ADVANCE EXPECTED SECTOR COUNT AND CONTINUE IF ONE CYCLE NOT
                                        ;COMPLETE
023326                                  30$:
023326  005237  001140                          INC     $GDDAT          ;INCREMENT EXPECTED SECTOR
023332  123737  001142  023622                  CMPB    $BDDAT,110$     ;WAS THE LAST SECTOR JUST COUNTED??
023340  001004                                  BNE     40$             ;NO!!
023342  105037  001140                          CLRB    $GDDAT          ;YES-NEXT SECTOR SHOULD BE ZERO
023346  105237  001141                          INCB    $GDDAT+1        ;INCREMENT TRACK ADDRESS
023352  105737  001142                  40$:    TSTB    $BDDAT          ;HAS A FULL CYCLE BEEN COUNTED??
023356  001401                                  BEQ     50$             ;YES-DO NEXT
023360  000743                                  BR      25$             ;CONTINUE SECTOR TEST

                                        ;INCREMENT TRACK COUNT USING DIAGNOSTIC END OF BLOCK.  START AT TRACK 0,
                                        ;LAST SECTOR AND COUNT ONE COMPLETE TRACK CYCLE.
023362                                  50$:
023362  013737  023622  001420                  MOV     110$,RMDA0      ;STARTING TRACK ADDRESS = 0
023370  012737  000400  001140                  MOV     #TA1,$GDDAT     ;FIRST VALUE AFTER INCREMENT

                                        ;       .CLEAR THE MASSBUS
                                        ;       .SET FORMAT
                                        ;       .LOAD LAST SECTOR ADDRESS AND TEST TRACK ADDRESS
                                        ;       .ENABLE DEBUG CLOCK
                                        ;       .SET GO BIT
023376                                  60$:
023376  004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
023402  013760  001444  000032                  MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
023410  013760  001420  000006                  MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
023416  012760  000001  000024                  MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
023424  012760  040001  000024                  MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
023432  012760  000001  000000                  MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
```

```
                                        ;CLOCK RMDA USING DIAGNOSTIC END OF BLOCK
023440  012760  060001  000024            MOV     #DMD!DBEN!DEBL,RMMR1(R0)        ;LOAD RMMR1
023446  012760  040001  000024            MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1

                                        ;VERIFY RMDA ACCORDING TO $GDDAT
023454  016037  000006  001142            MOV     RMDA(R0),$BDDAT ;STORE RMDA AT $BDDAT
023462  023737  001140  001142            CMP     $GDDAT,$BDDAT
023470  001402                            BEQ     70$
023472  104133                            EMT     133
023474  000453                            BR      120$            ;OUT OF SYNC-SKIP TO NEXT

                                        ;SETUP FOR NEXT INCREMENT OF RMDA TRACK ADDRESS
023476                                  70$:
023476  105237  001141                    INCB    $GDDAT+1        ;ADVANCE EXPECTED TRACK
023502  123737  001143  001335            CMPB    $BDDAT+1,LSTRK+1        ;WAS THE LAST TRACK JUST COUNTED??
023510  001002                            BNE     80$             ;NO!!
023512  005037  001140                    CLR     $GDDAT          ;YES-NEXT TRACK, SECTOR SHOULD BE ZERO
023516  013737  001142  001420  80$:      MOV     $BDDAT,RMDAO    ;HAS A FULL CYCLE BEEN COUNTED??
023524  001404                            BEQ     90$             ;YES!!
023526  113737  023622  001420            MOVB    110$,RMDAO      ;INCREMENT FROM LAST SECTOR
023534  000720                            BR      60$
023536                                  90$:
023536  032737  010000  001444            BIT     #FMT16,RMOFO    ;DONE BOTH FORMATS??
023544  001007                            BNE     95$             ;YES!!
023546  012737  010000  001444            MOV     #FMT16,RMOFO    ;SET FORMAT BIT FOR 16
023554  012737  000036  023622            MOV     #30.,110$       ;SET LAST SECTOR FOR 16 MODE
023562  000412                            BR      100$
023564                                  95$:
023564  032737  001000  001444            BIT     #SSEI,RMOFO     ;DONE 16 BIT MODE W/ SSEI SET ?
023572  001014                            BNE     120$            ;YES !!
023574  052737  001000  001444            BIS     #SSEI,RMOFO     ;SET SSEI W/ 16 BIT MODE AND
023602  012737  000037  023622            MOV     #31.,110$       ;SET LAST SECTOR

023610  012737  000001  001140  100$:     MOV     #1,$GDDAT       ;SET FIRST COUNT VALUE
023616  000137  023204                    JMP     10$             ;REPEAT TEST

023622  000000                          110$:   .WORD                   ;STORAGE FOR LAST SECTOR VALUE

023624                                  120$:

                                        ;;*****************************************************************
                                        ;*TEST 40       RMDC COUNT TEST

                                        ;;*****************************************************************
023624                                  TST40:
023624  000004                            SCOPE                   ;SCOPE CALL
023626  000240                            NOP
023630  012706  001100                    MOV     #STACK,SP       ;LOAD THE STACK POINTER
023634  013700  001276                    MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
023640  013701  001466                    MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
023644  012737  000003  001206            MOV     #3,$TIMES       ;;DO 3 ITERATIONS
023652  012737  000040  001226            MOV     #40,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

                                        ;CLEAR RMDC, SET FORMAT AND SETUP PROGRAM PARAMETERS
023660  010037  001136                    MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
023664  062737  000034  001136            ADD     #RMDC,$BDADR
023672  005037  001444                    CLR     RMOFO           ;START WITH 18 BIT FORMAT
```

```
2016 023676  013737  001334  001420          MOV     LSTRK,RMDAO     ;LOAD LAST TRACK AND
2017 023704  112737  000035  001420          MOVB    #29.,RMDAO      ;LAST SECTOR
2018 023712                              10$:
2019 023712  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2020 023716  012737  000001  001140          MOV     #1,$GDDAT       ;LOAD FIRST INCREMENTAL VALUE
2021 023724  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
2022
2023                                     ;       .CLEAR THE MASSBUS
2024                                     ;       .SET OFFSET
2025                                     ;       .LOAD LAST SECTOR AND TRACK ADDRESS
2026                                     ;       .ENABLE DEBUG CLOCK
2027                                     ;       .SET GO BIT
2028 023732                              20$:
2029 023732  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2030 023736  013760  001444  000032          MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
2031 023744  016037  000032  001174          MOV     RMOF(R0),$TMP0  ;STORE RMOF AT $TMP0
2032 023752  013760  001420  000006          MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
2033 023760  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2034 023766  012760  040001  000024          MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
2035 023774  012760  000001  000000          MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
2036
2037                                     ;CLOCK THE CYLINDER ADDRESS USING DEBL
2038 024002  012760  060001  000024          MOV     #DMD!DBEN!DEBL,RMMR1(R0)        ;LOAD RMMR1
2039 024010  012760  040001  000024          MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
2040 024016  016037  000034  001142          MOV     RMDC(R0),$BDDAT ;STORE RMDC AT $BDDAT
2041 024024  023737  001140  001142          CMP     $GDDAT,$BDDAT
2042 024032  001402                          BEQ     30$             ;BRANCH IF RMDC=RMDC+1
2043 024034  104140                          EMT     140
2044 024036  000442                          BR      60$             ;OUT OF SYNC-SKIP TO END
2045
2046                                     ;ADVANCE EXPECTED RESULT FOR NEXT INCREMENT
2047 024040                              30$:
2048 024040  005237  001140                  INC     $GDDAT          ;ADVANCE NEXT RESULT
2049 024044  022737  002000  001140          CMP     #1024.,$GDDAT   ;SHOULD NEXT VALUE BE ZERO??
2050 024052  001002                          BNE     40$             ;NO!!
2051 024054  005037  001140                  CLR     $GDDAT          ;YES-RMDC SHOULD OVERFLOW
2052 024060  005737  001142          40$:    TST     $BDDAT          ;IS ONE CYCLE COMPLETE??
2053 024064  001401                          BEQ     50$             ;YES!!
2054 024066  000721                          BR      20$             ;CONTINUE
2055 024070                              50$:
2056 024070  032737  010000  001444          BIT     #FMT16,RMOF0    ;DONE 16 BIT FORMAT MODE ?
2057 024076  001007                          BNE     55$             ;YES !!
2058 024100  012737  010000  001444          MOV     #FMT16,RMOF0    ;SET 16 BIT FORMAT AND
2059 024106  112737  000036  001420          MOVB    #30.,RMDA0      ;LAST SECTOR
2060 024114  000676                          BR      10$
2061 024116                              55$:
2062 024116  032737  001000  001444          BIT     #SSEI,RMOF0     ;DONE 16 BIT MODE W/ SSEI SET ?
2063 024124  001007                          BNE     60$             ;YES !!
2064 024126  052737  001000  001444          BIS     #SSEI,RMOF0     ;SET SSEI W/ 16 BIT MODE AND
2065 024134  112737  000037  001420          MOVB    #31.,RMDA0      ;LAST SECTOR
2066 024142  000663                          BR      10$             ;REPEAT TEST
2067 024144                              60$:
2068
2069                                     ;;*****************************************************************
                                         ;*TEST 41        LBT TEST
                                         ;;*****************************************************************
```

```
                024144                          TST41:
                024144  000004                          SCOPE                   ;SCOPE CALL
                024146  000240                          NOP
                024150  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
                024154  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                024160  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                024164  012737  000003  001206          MOV     #3,$TIMES       ;:DO 3 ITERATIONS
                024172  012737  000041  001226          MOV     #41,$TESTN      ;:SET TEST NUMBER IN APT MAIL BOX
   2070
   2071 024200  010037  001136                          MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
   2072 024204  062737  000012  001136                  ADD     #RMDS,$BDADR
   2073
   2074 024212  005037  001444                          CLR     RMOF0           ;START WITH 18 BIT MODE
   2075 024216  013737  001334  001420                  MOV     LSTRK,RMDA0     ;SET LAST TRACK AND
   2076 024224  112737  000035  001420                  MOVB    #29.,RMDA0      ;LAST SECTOR
   2077
   2078                                         ;       CLEAR THE MASSBUS
   2079                                         ;       SET FORMAT
   2080                                         ;       LOAD LAST TRACK AND SECTOR
   2081                                         ;       LOAD LAST CYLINDER
   2082                                         ;
   2083                                         ;       VERIFY THAT "LBT" IS RESET
   2084 024232                                  10$:
   2085 024232  004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
   2086 024236  012760  001060  000034                  MOV     #560.,RMDC(R0)  ;LOAD RMDC
   2087 024244  013760  001420  000006                  MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
   2088 024252  013760  001444  000032                  MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
   2089 024260  016037  000032  001174                  MOV     RMOF(R0),$TMP0  ;STORE RMOF AT $TMP0
   2090 024266  016037  000012  001142                  MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
   2091 024274  042737  175777  001142                  BIC     #^CLBT,$BDDAT
   2092 024302  001403                                  BEQ     20$             ;BRANCH IF LBT IS RESET
   2093 024304  005037  001140                          CLR     $GDDAT          ;LBT SHOULD BE ZERO
   2094 024310  104141                                  EMT     141
   2095
   2096                                         ;       ENABLE DEBUG CLOCK
   2097                                         ;       SET GO
   2098                                         ;       FORCE EBL
   2099                                         ;
   2100                                         ;       VERIFY THAT LBT IS SET
   2101 024312                                  20$:
   2102 024312  012760  000001  000024                  MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
   2103 024320  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
   2104 024326  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
   2105 024334  012760  000001  000000                  MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
   2106 024342  012760  060001  000024                  MOV     #DMD!DBEN!DEBL,RMMR1(R0)        ;LOAD RMMR1
   2107 024350  012760  040001  000024                  MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
   2108 024356  016037  000012  001142                  MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
   2109 024364  042737  175777  001142                  BIC     #^CLBT,$BDDAT
   2110 024372  001005                                  BNE     30$             ;BRANCH IF LBT IS SET
   2111 024374  012737  002000  001140                  MOV     #LBT,$GDDAT
   2112 024402  104142                                  EMT     142
   2113 024404  000426                                  BR      40$
   2114 024406                                  30$:
   2115 024406  032737  010000  001444                  BIT     #FMT16,RMOF0    ;DONE 16 BIT FORMAT ?
   2116 024414  001007                                  BNE     35$             ;YES !!
   2117 024416  012737  010000  001444                  MOV     #FMT16,RMOF0    ;SET 16 BIT MODE AND
   2118 024424  112737  000036  001420                  MOVB    #30.,RMDA0      ;LAST SECTOR
```

```
                                        BR      10$             ;TEST AGAIN.
                                35$:
                                        BIT     #SSEI,RMOFO     ;DONE 16 BIT MODE W/ SSEI SET ?
                                        BNE     40$             ;YES !!
                                        BIS     #SSEI,RMOFO     ;SET SSEI W/ 16 BIT MODE AND
                                        MOVB    #31.,RMDAO      ;LAST SECTOR
                                        BR      10$             ;TEST AGAIN.
                                40$:

                                ;;*****************************************************************
                                ;*TEST 42        COMPOSITE ERROR TEST

                                ;;*****************************************************************
                                TST42:
                                        SCOPE                   ;SCOPE CALL
                                        NOP
                                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
                                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                                        MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                        MOV     #42,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

                                        MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
                                        ADD     #RMDS,$BDADR

                                ;USING DIAGNOSTIC MODE, CLEAR ALL ERRORS AND VERIFY THAT COMPOSITE
                                ;ERROR IS RESET.
                                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
                                        MOV     #0,RMER1(R0)    ;LOAD RMER1
                                        MOV     #0,RMER2(R0)    ;LOAD RMER2
                                        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
                                        BIC     #^CERR,$BDDAT
                                        BEQ     10$             ;BRANCH IF ERR IS RESET
                                        CLR     $GDDAT
                                        EMT     143
                                10$:    MOV     #ERR,$GDDAT

                                ;SET BOTH ERROR REGISTERS AND VERIFY THAT COMPOSITE ERROR IS SET
                                        MOV     #-1,RMER1(R0)   ;LOAD RMER1
                                        MOV     #-1,RMER2(R0)   ;LOAD RMER2
                                        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
                                        BIC     #^CERR,$BDDAT
                                        BNE     20$             ;BRANCH IF ERR IS SET
                                        EMT     144

                                ;VERIFY THAT COMPOSITE ERROR SETS FOR EACH BIT OF RMER1
                                20$:
                                        MOV     #1,R2           ;INITIALIZE TEST PATTERN

                                ;WRITE THE TEST PATTERN AND VERIFY THAT ERR IS SET
                                30$:
                                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
                                        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
                                        MOV     #0,RMER1(R0)    ;LOAD RMER1
                                        MOV     #0,RMER2(R0)    ;LOAD RMER2
                                        MOV     R2,RMER1(R0)    ;LOAD RMER1
                                        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
```

```
2166 024702 042737 137777 001142          BIC     #^CERR,$BDDAT
2167 024710 001005                        BNE     40$             ;BRANCH IF COMPOSITE ERROR SET
2168 024712 010237 001174                 MOV     R2,$TMP0        ;SAVE RMER1 TEST PATTERN
2169 024716 005037 001176                 CLR     $TMP1           ;SAVE RMER2 TEST PATTERN
2170 024722 104145                        EMT     145
2171
2172                                ;ADVANCE THE TEST PATTERN FOR RMER1
2173 024724                         40$:
2174 024724 006302                        ASL     R2
2175 024726 001345                        BNE     30$             ;CONTINUE IF TEST NOT DONE
2176
2177                                ;VERIFY THAT COMPOSITE ERROR SETS FOR EACH BIT OF RMER2
2178 024730                         50$:
2179 024730 012702 000001                 MOV     #1,R2           ;INITIALIZE TEST PATTERN
2180 024734 012737 010000 001444          MOV     #FMT16,RMOF0    ;SET 16 BIT FORMAT
2181
2182                                ;WRITE THE TEST PATTERN AND VERIFY THAT ERR IS SET
2183 024742                         60$:
2184 024742 004737 055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2185 024746 012760 000001 000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2186 024754 012760 000000 000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
2187 024762 012760 000000 000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
2188 024770 010260 000042                 MOV     R2,RMER2(R0)    ;LOAD RMER2
2189 024774 013760 001444 000032          MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
2190 025002 016037 000012 001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
2191 025010 042737 137777 001142          BIC     #^CERR,$BDDAT
2192 025016 012737 040000 001140          MOV     #ERR,$GDDAT     ;SETUP EXPECTED VALUE FOR COMP ERROR
2193 025024 032702 001527                 BIT     #XNUER2,R2
2194 025030 001402                        BEQ     65$             ;BRANCH IF TEST BIT IS A USED BIT
2195 025032 005037 001140                 CLR     $GDDAT          ;TEST BIT IS NOT USED - ERR SHOULD BE 0
2196 025036 023737 001140 001142  65$:    CMP     $GDDAT,$BDDAT
2197 025044 001405                        BEQ     70$             ;BRANCH IF COMP ERROR IS OK
2198 025046 005037 001174                 CLR     $TMP0           ;SAVE RMER1 TEST PATTERN
2199 025052 010237 001176                 MOV     R2,$TMP1        ;SAVE RMER2 TEST PATTERN
2200 025056 104145                        EMT     145
2201
2202                                ;ADVANCE THE TEST PATTERN FOR RMER2
2203 025060                         70$:
2204 025060 006302                        ASL     R2
2205 025062 001327                        BNE     60$             ;CONTINUE IF TEST NOT DONE
2206 025064                         80$:
2207
2208                                ;;*************************************************************************
                                    ;*TEST 43        WRITE GO TEST

                                    ;;*************************************************************************
     025064                         TST43:
     025064 000004                        SCOPE                   ;SCOPE CALL
     025066 000240                        NOP
     025070 012706 001100                 MOV     #STACK,SP       ;LOAD THE STACK POINTER
     025074 013700 001276                 MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     025100 013701 001466                 MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     025104 012737 000043 001226          MOV     #43,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
2209
2210 025112 010037 001136                 MOV     R0,$BDADR       ;COPY RMCS1 ADDRESS
2211 025116 005002                        CLR     R2              ;INITIALIZE FUNCTION CODE
2212
```

```
                                        ;CLEAR THE MASSBUS, SET DIAGNOSTIC MODE AND ENABLE DEBUG CLOCK
                                        10$:
025120  004737  055156                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
025124  012760  000001  000024                MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
025132  012760  041001  000024                MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
025140  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
025146  012760  000000  000042                MOV     #0,RMER2(R0)    ;LOAD RMER2

                                        ;TRANSFER THE FUNCTION CODE AND GO BIT TO RMCS1, VERIFY GO IS SET
025154  010203                              MOV     R2,R3           ;SETUP FUNCTION CODE
025156  052703  000001                      BIS     #GO,R3
025162  010360  000000                      MOV     R3,RMCS1(R0)    ;LOAD RMCS1
025166  016037  000000  001142              MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
025174  032737  000001  001142              BIT     #GO,$BDDAT
025202  001007                              BNE     20$             ;BRANCH IF GO IS SET

                                        ;REPORT THE ERROR-CANT SET GO WITH THIS FUNCTION CODE
025204  042737  177700  001142              BIC     #^CFNCMSK,$BDDAT
025212  010337  001140                      MOV     R3,$GDDAT       ;SAVE FUNCTION CODE
025216  104146                              EMT     146
025220  000405                              BR      30$

                                        ;ADVANCE R2 TO THE NEXT FUNCTION CODE
                                        20$:
025222                                      ADD     #2,R2
025222  062702  000002                      CMP     #ILF76,R2
025226  022702  000076                      BHIS    10$
025232  103332

025234                                  30$:                            ;END OF TEST

                                        ;;*****************************************************************
                                        ;*TEST 44       BRANCH MULTIPLEXOR TEST

                                        ;;*****************************************************************
025234                                  TST44:
025234  000004                              SCOPE                       ;SCOPE CALL
025236  000240                              NOP
025240  012706  001100                      MOV     #STACK,SP       ;LOAD THE STACK POINTER
025244  013700  001276                      MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
025250  013701  001466                      MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
025254  012737  000044  001226              MOV     #44,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

025262  010037  001136                      MOV     R0,$BDADR       ;COPY REGISTER ADDRESS
025266  062737  000040  001136              ADD     #RMMR2,$BDADR
025274  012702  025520                      MOV     #100$,R2        ;INITIALIZE TABLE POINTER

                                        ;CLEAR THE MASSBUS AND SET DEBUG CLOCK ENABLE
025300                                  10$:
025300  004737  055156                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
025304  012760  000001  000024                MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
025312  012760  041001  000024                MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
025320  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
025326  012760  000000  000042                MOV     #0,RMER2(R0)    ;LOAD RMER2

                                        ;THE TEST BIT SHOULD BE ONE BECAUSE THE ADDRESS IS ALL ONES WHEN
                                        ;THE COMMAND SEQUENCER IS INITIALIZED.
025334  016037  000040  001142              MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
```

```
2260 025342  032737  010000  001142          BIT     #TST,$BDDAT
2261 025350  001010                          BNE     15$             ;BRANCH IF TEST BIT IS ON
2262 025352  042737  167777  001142          BIC     #^CTST,$BDDAT   ;SETUP FOR ERROR TYPE
2263 025360  012737  010000  001140          MOV     #TST,$GDDAT
2264 025366  104147                          EMT     147
2265 025370  000452                          BR      40$             ;SKIP REST OF TEST
2266
2267                                 ;GET THE FUNCTION CODE FROM THE TABLE AND TRANSFER IT TO THE DEVICE,
2268                                 ;THEN STEP THE COMMAND SEQUENCER ACCORDING TO THE TABLE.
2269 025372                         15$:
2270 025372  111203                          MOVB    (R2),R3
2271 025374  052703  000001                  BIS     #GO,R3
2272 025400  042703  177700                  BIC     #^CFNCMSK,R3    ;R3=FUNCTION CODE, GO BIT
2273 025404  010360  000000                  MOV     R3,RMCS1(R0)    ;LOAD RMCS1
2274 025410  010337  001174                  MOV     R3,$TMP0        ;SAVE R3 FOR ERROR MSG
2275
2276 025414  116203  000001                  MOVB    1(R2),R3        ;GET CLOCK COUNT IN R3
2277 025420  042703  177400                  BIC     #^C377,R3
2278 025424                          20$:
2279 025424  012760  141001  000024          MOV     #DMD!DBEN!MUR!DBCK,RMMR1(R0)    ;LOAD RMMR1
2280 025432  012760  041001  000024          MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
2281 025440  005303                          DEC     R3              ;DECREMENT CLOCK COUNT
2282 025442  001370                          BNE     20$             ;ISSUE CLOCKS TILL ZERO
2283
2284                                 ;GET THE TEST BIT AND COMPARE IT WITH THE TABLE ENTRY
2285 025444  016037  000040  001142          MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
2286 025452  042737  167777  001142          BIC     #^CTST,$BDDAT
2287 025460  016237  000002  001140          MOV     2(R2),$GDDAT
2288 025466  023737  001140  001142          CMP     $GDDAT,$BDDAT
2289 025474  001402                          BEQ     30$             ;BRANCH IF TEST BIT OK
2290 025476  104150                          EMT     150
2291 025500  000406                          BR      40$             ;SKIP REST OF TEST
2292
2293                                 ;MOVE THE TABLE POINTER AND CONTINUE IF NEXT ENTRY POSITIVE
2294 025502                          30$:
2295 025502  062702  000004                  ADD     #4,R2
2296 025506  105762  000001                  TSTB    1(R2)
2297 025512  100401                          BMI     40$             ;BRANCH IF DONE TEST
2298 025514  000671                          BR      10$             ;REPEAT TEST
2299 025516  000436                  40$:    BR      200$            ;JUMP OVER TABLE
2300
2301                                 ;TABLE OF FUNCTION CODES, CLOCK COUNTS, AND TEST BITS
2302 025520                          100$:
2303 025520     000                          .BYTE   NOP             ;MUX ADDRESS=DATA COMMAND
2304 025521     001                          .BYTE   1
2305 025522  000000                          .WORD   0               ;TEST BIT=0
2306
2307 025524     000                          .BYTE   NOP             ;MUX ADDRESS=UNIT READY
2308 025525     002                          .BYTE   2
2309 025526  000000                          .WORD   0               ;TEST BIT=0
2310
2311 025530     010                          .BYTE   DRVCLR          ;MUX ADDRESS=F4
2312 025531     001                          .BYTE   1
2313 025532  010000                          .WORD   TST             ;TEST BIT=1
2314
2315 025534     050                          .BYTE   WCD             ;MUX ADDRESS=F4
2316 025535     001                          .BYTE   1
```

```
025536  000000                  .WORD   0               ;TEST BIT=0
025540     012                  .BYTE   RLEASE          ;MUX ADDRESS=F4
025541     001                  .BYTE   1
025542  010000                  .WORD   TST             ;TEST BIT=1
025544     052                  .BYTE   WCH             ;MUX ADDRESS=F4
025545     001                  .BYTE   1
025546  000000                  .WORD   0               ;TEST BIT=0
025550     020                  .BYTE   RIP             ;MUX ADDRESS=F4
025551     001                  .BYTE   1
025552  010000                  .WORD   TST             ;TEST BIT=1
025554     060                  .BYTE   WD              ;MUX ADDRESS=F4
025555     001                  .BYTE   1
025556  000000                  .WORD   0               ;TEST BIT=0
025560     022                  .BYTE   PAKACK          ;MUX ADDRESS=F4
025561     001                  .BYTE   1
025562  010000                  .WORD   TST             ;TEST BIT=1
025564     062                  .BYTE   WH              ;MUX ADDRESS=F4
025565     001                  .BYTE   1
025566  000000                  .WORD   0               ;TEST BIT=0
025570     030                  .BYTE   SEARCH          ;MUX ADDRESS=F4
025571     001                  .BYTE   1
025572  010000                  .WORD   TST             ;TEST BIT=1
025574     070                  .BYTE   RD              ;MUX ADDRESS=F4
025575     001                  .BYTE   1
025576  000000                  .WORD   0               ;TEST BIT=0
025600     032                  .BYTE   ILF32           ;MUX ADDRESS=F4
025601     001                  .BYTE   1
025602  010000                  .WORD   TST             ;TEST BIT=1
025604     072                  .BYTE   RH              ;MUX ADDRESS=F4
025605     001                  .BYTE   1
025606  000000                  .WORD   0               ;TEST BIT=0
025610     000                  .BYTE                   ;END OF TABLE
025611     377                  .BYTE   -1
025612  000000                  .WORD
025614                  200$:                           ;END OF TEST

                        ;;*****************************************************************
                        ;*TEST 45       SET/RESET GO TEST

                        ;;*****************************************************************
025614                  TST45:
025614  000004                  SCOPE                   ;SCOPE CALL
025616  000240                  NOP
025620  012706  001100          MOV     #STACK,SP       ;LOAD THE STACK POINTER
025624  013700  001276          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
025630  013701  001466          MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
```

```
                025634  012737  000045  001226          MOV     #45,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
   2365
   2366 025642  012702  026256                          MOV     #200$,R2        ;INITIALIZE FUNCTION CODE POINTER
   2367
   2368                                                ;CLEAR, THEN SET DIAGNOSTIC MODE, CLEAR COMPOSITE ERROR, SET MEDIUM
   2369                                                ;ON LINE AND ENABLE DEBUG CLOCK
   2370 025646                                        10$:
   2371 025646  004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
   2372 025652  012760  000001  000024                  MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
   2373 025660  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
   2374 025666  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
   2375 025674  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
   2376
   2377                                                ;TRANSFER THE FUNCTION CODE AND GO BIT TO RMCS1 AND VERIFY GO IS SET
   2378 025702  111203                                  MOVB    (R2),R3         ;GET FUNCTION CODE
   2379 025704  042703  177701                          BIC     #^C1LF76,R3     ;CLEAR UNUSED BITS
   2380 025710  052703  000001                          BIS     #GO,R3          ;SET GO
   2381 025714  010360  000000                          MOV     R3,RMCS1(R0)    ;LOAD RMCS1
   2382 025720  016037  000000  001142                  MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
   2383 025726  032737  000001  001142                  BIT     #GO,$BDDAT
   2384 025734  001011                                  BNE     20$             ;BRANCH IF GO IS SET
   2385 025736  042737  177700  001142                  BIC     #^CFNCMSK,$BDDAT
   2386 025744  010337  001140                          MOV     R3,$GDDAT       ;SAVE EXPECTED RESULT
   2387 025750  010037  001136                          MOV     R0,$BDADR       ;COPY REGISTER ADDRESS
   2388 025754  104151                                  EMT     151
   2389 025756  000536                                  BR      100$
   2390
   2391                                                ;GET READY STATUS AND VERIFY THAT IT IS THE COMPLEMENT OF GO
   2392 025760                                        20$:
   2393 025760  005037  001140                          CLR     $GDDAT          ;EXPECT DRY TO BE OFF
   2394 025764  032737  000001  001142                  BIT     #GO,$BDDAT      ;WAS GO SET??
   2395 025772  001003                                  BNE     30$             ;YES!!
   2396 025774  012737  000200  001140                  MOV     #DRY,$GDDAT     ;GO WAS NOT SET, DRY SHOULD BE
   2397 026002                                        30$:
        026002  016037  000012  001142                  MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
   2398 026010  042737  177577  001142                  BIC     #^CDRY,$BDDAT
   2399 026016  023737  001140  001142                  CMP     $GDDAT,$BDDAT
   2400 026024  001406                                  BEQ     40$             ;BRANCH IF DRY IS OK
   2401 026026  010037  001136                          MOV     R0,$BDADR       ;COPY REGISTER ADDRESS
   2402 026032  062737  000012  001136                  ADD     #RMDS,$BDADR
   2403 026040  104152                                  EMT     152
   2404
   2405                                                ;STEP THE DEBUG CLOCK AND VERIFY THAT GO REMAINS SET
   2406 026042                                        40$:
   2407 026042  116204  000001                          MOVB    1(R2),R4        ;GET NUMBER OF CLOCK CYCLES
   2408 026046  042704  177400                          BIC     #^C377,R4
   2409 026052                                        50$:
   2410 026052  012760  141001  000024                  MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
   2411 026060  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
   2412 026066  016037  000000  001142                  MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
   2413 026074  042737  177700  001142                  BIC     #^CFNCMSK,$BDDAT  ;CLEAR UNUSED BITS
   2414 026102  010037  001136                          MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
   2415 026106  010337  001140                          MOV     R3,$GDDAT       ;SAVE EXPECTED RESULT
   2416
   2417                                                ;DECREMENT CLOCK COUNT AND EXIT LOOP IF ZERO
   2418 026112  005304                                  DEC     R4
   2419 026114  001406                                  BEQ     60$
```

```
2420 026116  032737  000001  001142          BIT     #GO,$BDDAT      ;IS GO STILL SET??
2421 026124  001352                          BNE     50$             ;YES!!
2422 026126  104153                          EMT     153
2423 026130  000[ 1                          BR      100$            ;OUT OF SYNC=SKIP TO NEXT
2424
2425                                 ;GO SHOULD NOW BE RESET AND DRY SHOULD BE SET
2426 026132                          60$:
2427 026132  032737  000001  001142          BIT     #GO,$BDDAT      ;IS GO RESET??
2428 026140  001405                          BEQ     70$             ;YES!!
2429 026142  042737  000001  001140          BIC     #GO,$GDDAT      ;SETUP EXPECTED RESULT
2430 026150  104154                          EMT     154
2431 026152  000440                          BR      100$
2432 026154                          70$:
2433 026154  012737  000200  001140          MOV     #DRY,$GDDAT     ;EXPECT DRIVE READY TO BE SET
2434 026162  032737  000001  001142          BIT     #GO,$BDDAT      ;DID GO RESET??
2435 026170  001402                          BEQ     80$             ;YES!!
2436 026172  005037  001140                  CLR     $GDDAT          ;GO IS SET-
2437 026176                          80$:
     026176  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
2438 026204  042737  177577  001142          BIC     #^CDRY,$BDDAT
2439 026212  010037  001136                  MOV     R0,$BDADR       ;COPY REGISTER ADDRESS
2440 026216  062737  000012  001136          ADD     #RMDS,$BDADR
2441 026224  023737  001140  001142          CMP     $GDDAT,$BDDAT   ;IS DRIVE READY OK??
2442 026232  001401                          BEQ     90$             ;YES!!
2443 026234  104152                          EMT     152
2444
2445                                 ;ADVANCE TO THE NEXT FUNCTION CODE TO BE TESTED-EXIT IF DONE
2446 026236                          90$:
2447 026236  062702  000002                  ADD     #2,R2           ;MOVE TABLE POINTER
2448 026242  105762  000001                  TSTB    1(R2)           ;END OF TABLE??
2449 026246  100402                          BMI     100$            ;YES!!
2450 026250  000137  025646                  JMP     10$             ;TEST THIS FUNCTION CODE
2451 026254  000423                  100$:   BR      300$            ;GO TO NEXT TEST
2452
2453                                 ;TABLE OF FUNCTION CODES AND CLOCK COUNTS USED DURING TEST
2454 026256                          200$:
2455 026256       002                        .BYTE   ILF02           ;ILLEGAL FUNCTION CODE #2
2456 026257       001                        .BYTE   1
2457
2458 026260       004                        .BYTE   SEEK            ;SEEK COMMAND
2459 026261       001                        .BYTE   1
2460
2461 026262       006                        .BYTE   RECAL           ;RECALIBRATE COMMAND
2462 026263       001                        .BYTE   1
2463
2464 026264       014                        .BYTE   OFFSET          ;OFFSET COMMAND
2465 026265       001                        .BYTE   1
2466
2467 026266       016                        .BYTE   RTC             ;RETURN TO CENTER LINE COMMAND
2468 026267       001                        .BYTE   1
2469
2470 026270       024                        .BYTE   ILF24           ;ILLEGAL FUNCTION CODE #24
2471 026271       001                        .BYTE   1
2472
2473 026272       026                        .BYTE   ILF26           ;ILLEGAL FUNCTION CODE #26
2474 026273       001                        .BYTE   1
2475
```

```
2476 026274 034                         .BYTE   ILF34           ;ILLEGAL FUNCTION CODE #34
2477 026275 001                         .BYTE   1
2478
2479 026276 036                         .BYTE   ILF36           ;ILLEGAL FUNCTION CODE #36
2480 026277 001                         .BYTE   1
2481
2482 026300 042                         .BYTE   ILF42           ;ILLEGAL FUNCTION CODE #42
2483 026301 001                         .BYTE   1
2484
2485 026302 044                         .BYTE   ILF44           ;ILLEGAL FUNCTION CODE #44
2486 026303 001                         .BYTE   1
2487
2488 026304 046                         .BYTE   ILF46           ;ILLEGAL FUNCTION CODE #46
2489 026305 001                         .BYTE   1
2490
2491 026306 054                         .BYTE   ILF54           ;ILLEGAL FUNCTION CODE #54
2492 026307 001                         .BYTE   1
2493
2494 026310 056                         .BYTE   ILF56           ;ILLEGAL FUNCTION CODE #56
2495 026311 001                         .BYTE   1
2496
2497 026312 064                         .BYTE   ILF64           ;ILLEGAL FUNCTION CODE #64
2498 026313 001                         .BYTE   1
2499
2500 026314 066                         .BYTE   ILF66           ;ILLEGAL FUNCTION CODE #66
2501 026315 001                         .BYTE   1
2502
2503 026316 074                         .BYTE   ILF74           ;ILLEGAL FUNCTION CODE #74
2504 026317 001                         .BYTE   1
2505
2506 026320 076                         .BYTE   ILF76           ;ILLEGAL FUNCTION CODE #76
2507 026321 001                         .BYTE   1
2508
2509 026322 000                         .BYTE                   ;END OF TABLE
2510 026323 377                         .BYTE   -1
2511
2512 026324                     300$:                           ;END OF TEST
2513
2514                             ;;**************************************************************************
                                ;*TEST 46        END 1 RESET GO TEST

                                ;;**************************************************************************
     026324                     TST46:
     026324 000004                      SCOPE                   ;SCOPE CALL
     026326 000240                      NOP
     026330 012706 001100               MOV     #STACK,SP       ;LOAD THE STACK POINTER
     026334 013700 001276               MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     026340 013701 001466               MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     026344 012737 000046 001226        MOV     #46,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
2515
2516 026352 012702 026610               MOV     #100$,R2        ;INITIALIZE TABLE POINTER
2517 026356 010037 001136               MOV     R0,$BDADR       ;COPY RMCS1 ADDRESS
2518
2519                            ;CLEAR MASSBUS, THEN SET MEDIUM ON LINE AND ENABLE DEBUG CLOCK
2520 026362                     10$:
2521 026362 004737 055156               JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2522 026366 012760 000001 000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
```

```
2523 026374  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
2524 026402  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
2525 026410  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
2526
2527                                  ;TRANSFER THE FUNCTION CODE AND GO BIT TO RMCS1, VERIFY GO IS SET
2528 026416  111203                           MOVB    (R2),R3         ;GET FUNCTION CODE FROM
2529 026420  042703  177701                   BIC     #^C1F76,R3      ;TABLE AND SET GO
2530 026424  052703  000001                   BIS     #GO,R3
2531 026430  010337  001140                   MOV     R3,$GDDAT       ;SAVE FUNCTION CODE FOR MSG
2532 026434  010360  000000                   MOV     R3,RMCS1(R0)    ;LOAD RMCS1
2533 026440  016037  000000  001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
2534 026446  032737  000001  001142          BIT     #GO,$BDDAT
2535 026454  001005                           BNE     20$             ;BRANCH IF GO IS SET
2536 026456  042737  177700  001142          BIC     #^CFNCMSK,$BDDAT
2537 026464  104151                           EMT     151
2538 026466  000447                           BR      60$             ;OUT OF SYNC-SKIP
2539
2540                                  ;GET THE NUMBER OF CLOCK CYCLES FROM THE TABLE, SAVE EXPECTED STATUS
2541 026470                           20$:
2542 026470  116204  000001                   MOVB    1(R2),R4        ;R4=CLOCK COUNT
2543 026474  042704  177400                   BIC     #^C377,R4
2544
2545                                  ;STEP THE DEBUG CLOCK AND VERIFY GO STATUS ON UNTIL CLOCK COUNT EXPIRE
2546 026500                           30$:
2547 026500  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
2548 026506  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
2549 026514  016037  000000  001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
2550 026522  042737  177700  001142          BIC     #^CFNCMSK,$BDDAT
2551 026530  005304                           DEC     R4
2552 026532  001406                           BEQ     40$             ;BRANCH IF GO SHOULD BE OFF
2553 026534  032737  000001  001142          BIT     #GO,$BDDAT
2554 026542  001356                           BNE     30$             ;CONTINUE IF GO IS ON
2555 026544  104153                           EMT     153
2556 026546  000417                           BR      60$             ;OUT OF SYNC-SKIP
2557
2558                                  ;VERIFY THAT GO RESET AT END1
2559 026550                           40$:
2560 026550  032737  000001  001142          BIT     #GO,$BDDAT      ;DID GO RESET??
2561 026556  001405                           BEQ     50$             ;YES!!
2562 026560  042737  000001  001140          BIC     #GO,$GDDAT
2563 026566  104154                           EMT     154
2564 026570  000406                           BR      60$
2565
2566                                  ;GET THE NEXT FUNCTION CODE FROM THE TABLE
2567 026572                           50$:
2568 026572  062702  000002                   ADD     #2,R2
2569 026576  105762  000001                   TSTB    1(R2)
2570 026602  100401                           BMI     60$             ;BRANCH IF END OF TABLE
2571 026604  000666                           BR      10$             ;TEST THIS FUNCTION CODE
2572 026606  000404                    60$:   BR      200$            ;JUMP OVER TABLE
2573
2574                                  ;TABLE OF FUNCTION CODES AND CLOCK COUNTS USED DURING TEST
2575 026610                           100$:
2576 026610      012                          .BYTE   RLEASE          ;RELEASE COMMAND
2577 026611      002                          .BYTE   2
2578
2579 026612      030                          .BYTE   SEARCH          ;SEARCH COMMAND
```

```
T46     END 1 RESET GO TEST

2580 026613     002                             .BYTE   2
2581
2582 026614     032                             .BYTE   ILF32           ;ILLEGAL FUNCTON #32
2583 026615     002                             .BYTE   2
2584
2585 026616     000                             .BYTE                   ;END OF TABLE
2586 026617     377                             .BYTE   -1
2587 026620                             200$:                           ;END OF TEST
2588
2589                                    ;;*******************************************************************
                                        ;*TEST 47        SET PULSE TEST
                                        ;;*******************************************************************
     026620                             TST47:
     026620  000004                             SCOPE                   ;SCOPE CALL
     026622  000240                             NOP
     026624  012706  001100                     MOV     #STACK,SP       ;LOAD THE STACK POINTER
     026630  013700  001276                     MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     026634  013701  001466                     MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     026640  012737  000047  001226             MOV     #47,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
2590
2591 026646  010037  001136                     MOV     R0,$BDADR       ;COPY REG ADDRESS FOR MSG
2592 026652  062737  000024  001136             ADD     #RMMR1,$BDADR
2593 026660  012702  027116                     MOV     #100$,R2        ;INITIALIZE TABLE POINTER
2594
2595                                    ;CLEAR THE MASS BUS, ENABLE DEBUG CLOCK, AND RESET ERROR REGISTERS
2596 026664                             10$:
2597 026664  004737  055156                     JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2598 026670  012760  000001  000024             MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2599 026676  012760  041001  000024             MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
2600 026704  012760  000000  000014             MOV     #0,RMER1(R0)    ;LOAD RMER1
2601 026712  012760  000000  000042             MOV     #0,RMER2(R0)    ;LOAD RMER2
2602
2603                                    ;VERIFY THAT CONTINUE, "CONT" IS RESET AFTER CLEAR
2604 026720  016037  000024  001142             MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
2605 026726  042737  177677  001142             BIC     #^CCONT,$BDDAT
2606 026734  001404                             BEQ     20$             ;BRANCH IF CONT WAS CLEARED
2607 026736  005037  001140                     CLR     $GDDAT          ;FOR ERROR MSG
2608 026742  104155                             EMT     155
2609 026744  000463                             BR      70$
2610
2611                                    ;GET THE FUNCTION CODE FROM THE TABLE AND TRANSFER IT TO RMCS1
2612 026746                             20$:
2613 026746  111203                             MOVB    (R2),R3
2614 026750  052703  000001                     BIS     #GO,R3
2615 026754  042703  177700                     BIC     #^CFNCMSK,R3    ;R3=FUNCTION CODE AND GO
2616 026760  010360  000000                     MOV     R3,RMCS1(R0)    ;LOAD RMCS1
2617 026764  010337  001174                     MOV     R3,$TMP0        ;SAVE FUNCTION CODE FOR MSG
2618
2619                                    ;GET THE CLOCK COUNT FROM THE TABLE
2620 026770  116203  000001                     MOVB    1(R2),R3
2621 026774  042703  177400                     BIC     #^C377,R3
2622
2623                                    ;GET THE BIT STREAM FOR CONTINUE FROM THE TABLE
2624 027000  016204  000002                     MOV     2(R2),R4
2625
2626                                    ;STEP THE COMMAND SEQUENCER AND VERIFY CONTINUE STATUS
```

```
2627 027004                                    30$:
2628 027004  012760  141001  000024                    MOV     #DMD!DBEN!MUR!DBCK,RMMR1(R0)    ;LOAD RMMR1
2629 027012  012760  041001  000024                    MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
2630 027020  016037  000024  001142                    MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
2631 027026  042737  177677  001142                    BIC     #^CCONT,$BDDAT
2632 027034  005037  001140                            CLR     $GDDAT          ;GENERATE EXPECTED CONTINUE
2633 027040  032704  000001                            BIT     #BIT0,R4
2634 027044  001403                                    BEQ     40$
2635 027046  012737  000100  001140                    MOV     #CONT,$GDDAT
2636 027054  023737  001140  001142  40$:      CMP     $GDDAT,$BDDAT
2637 027062  001402                                    BEQ     50$             ;BRANCH IF CONTINUE IS OK
2638 027064  104156                                    EMT     156
2639 027066  000412                                    BR      70$             ;SKIP
2640
2641                                           ;DECREMENT CLOCK COUNT AND SHIFT BIT STREAM
2642 027070                                    50$:
2643 027070  005303                                    DEC     R3
2644 027072  001402                                    BEQ     60$             ;BRANCH IF CLOCK COUNT EXPIRED
2645 027074  006204                                    ASR     R4              ;SHIFT TO NEXT CONTINUE BIT
2646 027076  000742                                    BR      30$             ;TEST NEXT CLOCK CYCLE
2647
2648                                           ;ADVANCE TABLE POINTER-EXIT IF DONE
2649 027100                                    60$:
2650 027100  062702  000004                            ADD     #4,R2
2651 027104  105762  000001                            TSTB    1(R2)
2652 027110  100401                                    BMI     70$             ;EXIT IF CLOCK COUNT NEGATIVE
2653 027112  000664                                    BR      10$             ;CONTINUE TEST
2654 027114  000442                            70$:    BR      200$            ;JUMP OVER TABLE
2655
2656                                           ;TABLE OF FUNCTION CODES, CLOCK COUNTS AND CONTINUE BITS FOR TEST
2657 027116                                    100$:
2658 027116     000                                    .BYTE   NOP             ;NOP COMMAND
2659 027117     004                                    .BYTE   4               ;4 CLOCKS
2660 027120  000000                                    .WORD   ^B0000          ;CONTINUE=0000
2661
2662 027122     002                                    .BYTE   ILF02           ;ILLEGAL FUNCTION 2
2663 027123     002                                    .BYTE   2
2664 027124  000000                                    .WORD   ^B00
2665
2666 027126     004                                    .BYTE   SEEK            ;SEEK COMMAND
2667 027127     002                                    .BYTE   2
2668 027130  000000                                    .WORD   ^B00
2669
2670 027132     006                                    .BYTE   RECAL           ;RECALIBRATE COMMAND
2671 027133     002                                    .BYTE   2
2672 027134  000000                                    .WORD   ^B00
2673
2674 027136     010                                    .BYTE   DRVCLR          ;DRIVE CLEAR COMMAND
2675 027137     002                                    .BYTE   2
2676 027140  000001                                    .WORD   ^B01
2677
2678 027142     012                                    .BYTE   RLEASE          ;RELEASE COMMAND
2679 027143     003                                    .BYTE   3
2680 027144  000000                                    .WORD   ^B000
2681
2682 027146     014                                    .BYTE   OFFSET          ;OFFSET COMMAND
2683 027147     002                                    .BYTE   2
```

```
 2684 027150  000000                        .WORD   ^B00
 2685
 2686 027152     016                        .BYTE   RTC             ;RETURN TO CENTER COMMAND
 2687 027153     002                        .BYTE   2
 2688 027154  000000                        .WORD   ^B00
 2689
 2690 027156     020                        .BYTE   RIP             ;READ IN PRESET COMMAND
 2691 027157     004                        .BYTE   4
 2692 027160  000016                        .WORD   ^B1110
 2693
 2694 027162     022                        .BYTE   PAKACK          ;PACK ACKNOWLEDGE
 2695 027163     004                        .BYTE   4
 2696 027164  000016                        .WORD   ^B1110
 2697
 2698 027166     024                        .BYTE   ILF24           ;ILLEGAL FUNCTION 24
 2699 027167     002                        .BYTE   2
 2700 027170  000000                        .WORD   ^B00
 2701
 2702 027172     026                        .BYTE   ILF26           ;ILLEGAL FUNCTION 26
 2703 027173     002                        .BYTE   2
 2704 027174  000000                        .WORD   ^B00
 2705
 2706 027176     030                        .BYTE   SEARCH          ;SEARCH COMMAND
 2707 027177     003                        .BYTE   3
 2708 027200  000000                        .WORD   ^B000
 2709
 2710 027202     032                        .BYTE   ILF32           ;ILLEGAL FUNCTION 32
 2711 027203     003                        .BYTE   3
 2712 027204  000000                        .WORD   ^B000
 2713
 2714 027206     034                        .BYTE   ILF34           ;ILLEGAL FUNCTION 34
 2715 027207     002                        .BYTE   2
 2716 027210  000000                        .WORD   ^B00
 2717
 2718 027212     036                        .BYTE   ILF36           ;ILLEGAL FUNCTION 36
 2719 027213     002                        .BYTE   2
 2720 027214  000000                        .WORD   ^B00
 2721
 2722 027216     000                        .BYTE                   ;END OF TABLE
 2723 027217     377                        .BYTE   -1
 2724 027220  000000                        .WORD
 2725
 2726 027222                        200$:                           ;END OF TEST
 2727
 2728                                ;;*****************************************************************
                                     ;*TEST 50        SET/RESET IVC TEST
                                     ;;*****************************************************************
      027222                         TST50:
      027222  000004                        SCOPE                   ;SCOPE CALL
      027224  000240                        NOP
      027226  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
      027232  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
      027236  013701  001266                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
      027242  012737  000050  001226        MOV     #50,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
 2729
 2730 027250  010037  001136                MOV     R0,$BDADR       ;SETUP REG ADDRESS
```

```
2731 027254  062737  000042  001136          ADD     #RMER2,$BDADR
2732 027262  005002                          CLR     R2                  ;R2=FUNCTION CODE
2733
2734                                 ;INITIALIZE AND VERIFY THAT IVC STATUS IS ZERO.
2735 027264                          10$:
2736 027264  004737  055156                     JSR     PC,CNTCLR           ;GO CLEAR CONTROLLER
2737 027270  012760  000001  000024            MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2738 027276  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
2739 027304  012760  000000  000014            MOV     #0,RMER1(R0)    ;LOAD RMER1
2740 027312  012760  000000  000042            MOV     #0,RMER2(R0)    ;LOAD RMER2
2741 027320  016037  000042  001142            MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
2742 027326  042737  167777  001142            BIC     #^CIVC,$BDDAT
2743 027334  001404                          BEQ     20$                 ;BRANCH IF IVC IS ZERO
2744 027336  005037  001140                  CLR     $GDDAT
2745 027342  104157                          EMT     157
2746 027344  000444                          BR      40$                 ;SKIP REST OF TEST
2747
2748                                 ;LOAD THE FUNCTION CODE WITH GO BIT, STEP THE COMMAND SEQUENCER OFF
2749                                 ;ADDRESS 0 AND VERIFY IVC STATUS.
2750 027346                          20$:
2751 027346  010203                          MOV     R2,R3               ;SETUP FUNCTION CODE
2752 027350  052703  000001                  BIS     #GO,R3
2753 027354  010360  000000                  MOV     R3,RMCS1(R0)    ;LOAD RMCS1
2754 027360  012760  141001  000024            MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
2755 027366  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
2756 027374  016037  000042  001142            MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
2757 027402  042737  167777  001142            BIC     #^CIVC,$BDDAT   ;SET ACTUAL STATUS
2758 027410  016237  063640  001140            MOV     FNCDTB(R2),$GDDAT  ;SETUP EXPECTED STATUS FROM
2759 027416  042737  167777  001140            BIC     #^CIVC,$GDDAT   ;FUNCTION CODE TABLE
2760 027424  023737  001140  001142            CMP     $GDDAT,$BDDAT
2761 027432  001403                          BEQ     30$                 ;BRANCH IF IVC IS OK
2762 027434  010237  001174                  MOV     R2,$TMP0            ;SAVE FUNCTION CODE FOR MSG
2763 027440  104160                          EMT     160
2764
2765                                 ;ADVANCE FUNCTION CODE AND REPEAT TEST IF NOT DONE
2766 027442                          30$:
2767 027442  062702  000002                  ADD     #2,R2
2768 027446  022702  000076                  CMP     #ILF76,R2
2769 027452  103401                          BLO     40$                 ;BRANCH IF DONE TEST
2770 027454  000703                          BR      10$
2771
2772 027456                          40$:                                ;END OF TEST
2773
2774                                 ;;*****************************************************************
                                     ;*TEST 51        SET LSC TEST

                                     ;;*****************************************************************
     027456                          TST51:
     027456  000004                          SCOPE                       ;SCOPE CALL
     027460  000240                          NOP
     027462  012706  001100                  MOV     #STACK,SP           ;LOAD THE STACK POINTER
     027466  013700  001276                  MOV     $BASE,R0            ;R0 = UNIBUS ADDRESS
     027472  013701  001466                  MOV     TSTQUE,R1           ;R1 = POINTER TO DEVICE
     027476  012737  000051  001226          MOV     #51,$TESTN          ;;SET TEST NUMBER IN APT MAIL BOX
2775
2776 027504  010037  001136                  MOV     R0,$BDADR
2777 027510  062737  000042  001136          ADD     #RMER2,$BDADR
```

```
T51     SET LSC TEST

2778
2779                                    ;INITIALIZE AND VERIFY THAT LOSS OF SYSTEM CLOCK, "LSC", IS RESET
2780 027516  004737  055156                    JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2781 027522  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2782 027530  012760  040001  000024          MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
2783 027536  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
2784 027544  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
2785 027552  016037  000042  001142          MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
2786 027560  042737  173777  001142          BIC     #^CLSC,$BDDAT
2787 027566  001403                          BEQ     10$             ;BRANCH IF LSC IS ZERO
2788 027570  005037  001140                  CLR     $GDDAT
2789 027574  104161                          EMT     161
2790
2791                                    ;WITH DEBUG CLOCK ENABLED, SET GO AND WAIT FOR ONE SHOT TO SET
2792 027576                              10$:
     027576  012760  000001  000000          MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
2793 027604  012737  000001  001534          MOV     #1,WATCH        ;SET WATCHDOG TIMER VALUE
     027612  004777  151720                  JSR     PC,@CLOCK       ;START THE CLOCK
2794 027616  005737  001534          20$:    TST     WATCH
2795 027622  001375                          BNE     20$             ;WAIT FOR WATCH ZERO
2796 027624  004777  151710                  JSR     PC,@STOPCL      ;STOP THE CLOCK
2797
2798                                    ;ONE SHOT SHOULD BE SET-DISABLE DIAGNOSTIC CLOCK AND LSC SHOULD SET.
2799 027630  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2800 027636  016037  000042  001142          MOV     RMER2(R0),$BDDAT        ;STORE RMER2 AT $BDDAT
2801 027644  042737  173777  001142          BIC     #^CLSC,$BDDAT
2802 027652  001004                          BNE     30$             ;BRANCH IF LSC SET
2803 027654  012737  004000  001140          MOV     #LSC,$GDDAT
2804 027662  104162                          EMT     162
2805
2806 027664                             30$:                            ;END OF TEST
2807
2808                                    ;;*****************************************************************
                                        ;*TEST 52        DECODE TEST

                                        ;;*****************************************************************
     027664                             TST52:
     027664  000004                            SCOPE                   ;SCOPE CALL
     027666  000240                            NOP
     027670  012706  001100                    MOV     #STACK,SP       ;LOAD THE STACK POINTER
     027674  013700  001276                    MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     027700  013701  001466                    MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     027704  012737  000052  001226            MOV     #52,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
2809
2810 027712  005037  001426                    CLR     RMER10          ;NO ERROR FIRST TEST
2811 027716                             5$:
2812 027716  004737  030276                    JSR     PC,100$         ;INITIALIZE
2813
2814                                    ;EXECUTE A PACK ACKNOWLEDGE AND CHECK VOLUME VALID
2815 027722  013760  001426  000014          MOV     RMER10,RMER1(R0)        ;LOAD RMER1
2816 027730  012760  000023  000000          MOV     #PACACK!GO,RMCS1(R0)    ;LOAD RMCS1
2817 027736  012703  000003                  MOV     #3,R3
2818 027742                             10$:
     027742  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
2819 027750  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
2820 027756  005303                          DEC     R3
2821 027760  001370                          BNE     10$             ;ISSUE NEXT CLOCK IF COUNT NOT 0
```

```
 2822 027762  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
 2823 027770  042737  177677  001142          BIC     #^CVV,$BDDAT
 2824 027776  001414                          BEQ     20$             ;BRANCH IF VV IS ZERO
 2825 030000  005737  001426                  TST     RMER10
 2826 030004  001527                          BEQ     70$             ;BRANCH IF VV SHOULD BE SET
 2827 030006  005037  001140                  CLR     $GDDAT          ;SETUP ERROR MESSAGE
 2828 030012  010037  001136                  MOV     R0,$BDADR
 2829 030016  062737  000012  001136          ADD     #RMDS,$BDADR
 2830 030024  104163                          EMT     163
 2831 030026  000522                          BR      80$             ;SKIP
 2832 030030                          20$:
 2833 030030  004737  030276                  JSR     PC,100$         ;INITIALIZE AND SET DIAGNOSTIC MODE
 2834
 2835                                 ;EXECUTE A READ IN PRESET AND CHECK VOLUME VALID
 2836 030034  013760  001426  000014          MOV     RMER10,RMER1(R0)        ;LOAD RMER1
 2837 030042  012760  000021  000000          MOV     #RIP!GO,RMCS1(R0)       ;LOAD RMCS1
 2838 030050  012703  000003                  MOV     #3,R3           ;R3=CLOCK COUNT
 2839 030054                          30$:
      030054  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
 2840 030062  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 2841 030070  005303                          DEC     R3
 2842 030072  001370                          BNE     30$             ;ISSUE NEXT CLOCK IF COUNT NOT ZERO
 2843 030074  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
 2844 030102  042737  177677  001142          BIC     #^CVV,$BDDAT
 2845 030110  001414                          BEQ     40$             ;BRANCH IF VOLUME VALID NOT SET
 2846 030112  005737  001426                  TST     RMER10
 2847 030116  001462                          BEQ     70$             ;BRANCH IF VOLUME VALID SHOULD BE SET
 2848 030120  005037  001140                  CLR     $GDDAT          ;SETUP ERROR MESSAGE
 2849 030124  010037  001136                  MOV     R0,$BDADR
 2850 030130  062737  000012  001136          ADD     #RMDS,$BDADR
 2851 030136  104163                          EMT     163
 2852 030140  000455                          BR      80$             ;SKIP
 2853 030142                          40$:
 2854 030142  004737  030276                  JSR     PC,100$         ;INITIALIZE AND SET DIAGNOSTIC MODE
 2855
 2856                                 ;EXECUTE A WRITE CHECK DATA AND CHECK OCCUPIED
 2857 030146  013760  001426  000014          MOV     RMER10,RMER1(R0)        ;LOAD RMER1
 2858 030154  012760  000051  000000          MOV     #WCD!GO,RMCS1(R0)       ;LOAD RMCS1
 2859 030162  012703  000002                  MOV     #2,R3           ;R3=CLOCK COUNT
 2860 030166                          50$:
      030166  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
 2861 030174  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 2862 030202  005303                          DEC     R3
 2863 030204  001370                          BNE     50$             ;ISSUE NEXT CLOCK IF COUNT NOT ZERO
 2864 030206  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 2865 030214  042737  077777  001142          BIC     #^COCC,$BDDAT
 2866 030222  001414                          BEQ     60$             ;BRANCH IF OCCUPIED IS RESET
 2867 030224  005737  001426                  TST     RMER10
 2868 030230  001415                          BEQ     70$             ;BRANCH IF OCCUPIED SHOULD BE SET
 2869 030232  005037  001140                  CLR     $GDDAT          ;SETUP ERROR MESSAGE
 2870 030236  010037  001136                  MOV     R0,$BDADR
 2871 030242  062737  000024  001136          ADD     #RMMR1,$BDADR
 2872 030250  104164                          EMT     164
 2873 030252  000410                          BR      80$
 2874
 2875                                 ;VOLUME VALID AND OCCUPIED DID NOT SET-SEE IF COMP ERROR WAS ACTIVE
 2876 030254                          60$:
```

```
                                        TST     RMER10
                                        BNE     80$             ;BRANCH IF COMP ERROR WAS SET

                                ;COULD NOT SET VV OR OCCUPIED-SUSPECT DECODE FLOP NOT SETTING
                                        EMT     165

                                ;REPEAT TEST WITH COMPOSITE ERROR ACTIVE-VERIFY THAT DECODE FLOP
                                ;DOES NOT SET, AS INDICATED BY VOLUME VALID AND OCCUPIED.
                                70$:
030264  012737  040000  001426          MOV     #UNS,RMER10     ;USE UNSAFE TO SET COMP ERROR
030272  000611                          BR      5$

030274  000510                  80$:    BR      200$            ;END OF TEST

                                ;;**************************************************************************
                                ;SUBROUTINE USED DURING TEST
                                ;;**************************************************************************

                                ;USING DIAGNOSTIC MODE, RESET VOLUME VALID AND COMPOSITE ERROR.
                                ;VERIFY THAT VV, ERR, AND OCC ARE ZERO.
030276                          100$:
030276  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
030302  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
030310  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
030316  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
030324  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
030332  005037  001140                  CLR     $GDDAT          ;SETUP FOR ERROR MSG
030336  010037  001136                  MOV     R0,$BDADR
030342  062737  000012  001136          ADD     #RMDS,$BDADR
030350  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
030356  042737  137777  001142          BIC     #^CERR,$BDDAT
030364  001402                          BEQ     110$            ;BRANCH IF COMP ERROR ZERO
030366  104143                          EMT     143
030370  000447                          BR      140$            ;SKIP TEST
030372                          110$:
030372  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
030400  042737  177677  001142          BIC     #^CVV,$BDDAT
030406  001402                          BEQ     120$            ;BRANCH IF VOLUME VALID ZERO
030410  104135                          EMT     135
030412  000436                          BR      140$            ;SKIP TEST
030414                          120$:
030414  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
030422  042737  077777  001142          BIC     #^COCC,$BDDAT
030430  001407                          BEQ     130$            ;BRANCH IF OCCUPIED ZERO
030432  010037  001136                  MOV     R0,$BDADR       ;SETUP ERROR MESSAGE
030436  062737  000024  001136          ADD     #RMMR1,$BDADR
030444  104166                          EMT     166
030446  000420                          BR      140$            ;SKIP TEST

                                ;TO VERIFY THAT THE DECODE FLOP IS RESET, LOAD AN ILLEGAL FUNCTION
                                ;IN RMCS1 AND VERIFY THAT ILF DOES NOT SET.
030450                          130$:
030450  012760  000024  000000          MOV     #ILF24,RMCS1(R0)        ;LOAD RMCS1
030456  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
030464  042737  177776  001142          BIC     #^CILF,$BDDAT
030472  001410                          BEQ     150$            ;BRANCH IF ILF IS ZERO
030474  010037  001136                  MOV     R0,$BDADR       ;SETUP ERROR MESSAGE
```

```
2932 030500 062737 000014 001136          ADD     #RMER1,$BDADR
2933 030506 104167                        EMT     167
2934 030510 012716 030516          140$:  MOV     #200$,(SP)      ;DONT GO BACK TO TEST
2935
2936 030514 000207                 150$:  RTS     PC              ;RETURN TO TEST OR EXIT TEST
2937
2938 030516                        200$:
2939
2940                               ;;*****************************************************************
                                   ;*TEST 53       SET/RESET VOLUME VALID TEST
                                   ;;*****************************************************************
     030516                        TST53:
     030516 000004                         SCOPE                   ;SCOPE CALL
     030520 000240                         NOP
     030522 012706 001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     030526 013700 001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     030532 013701 001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     030536 012737 000053 001226           MOV     #53,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
2941
2942 030544 010037 001136                 MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS
2943 030550 062737 000012 001136          ADD     #RMDS,$BDADR
2944 030556 012702 030762                 MOV     #100$,R2        ;R2=TABLE POINTER
2945
2946                               ;INITIALIZE AND USE DIAGNOSTIC MODE TO RESET VOLUME VALID
2947 030562                        10$:
2948 030562 004737 055156                 JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
2949 030566 012760 000001 000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
2950 030574 012760 041001 000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
2951 030602 012760 000000 000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
2952 030610 012760 000000 000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
2953 030616 016037 000012 001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
2954 030624 042737 177677 001142          BIC     #^CVV,$BDDAT
2955 030632 001403                        BEQ     20$             ;BRANCH IF VOLUME VALID ZERO
2956 030634 005037 001140                 CLR     $GDDAT
2957 030640 104135                        EMT     135
2958
2959                               ;EXECUTE THE FUNCTION CODE IN THE TABLE
2960 030642                        20$:
2961 030642 111203                        MOVB    (R2),R3         ;GET FUNCTION CODE
2962 030644 042703 177701                 BIC     #^CILF76,R3
2963 030650 052703 000001                 BIS     #GO,R3
2964 030654 010360 000000                 MOV     R3,RMCS1(R0)    ;LOAD RMCS1
2965 030660 116204 000001                 MOVB    1(R2),R4        ;GET CLOCK COUNT
2966 030664 042704 177400                 BIC     #^C377,R4
2967 030670                        30$:
     030670 012760 141001 000024          MOV     #DMD!DBEN!MUR!DBCK,RMMR1(R0)    ;LOAD RMMR1
2968 030676 012760 041001 000024          MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
2969 030704 005304                        DEC     R4
2970 030706 001370                        BNE     30$             ;ISSUE COCKS TIL R4 ZERO
2971 030710 016037 000012 001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
2972 030716 042737 177677 001142          BIC     #^CVV,$BDDAT
2973 030724 001007                        BNE     40$             ;BRANCH IF VOLUME VALID SET
2974 030726 010337 001174                 MOV     R3,$TMP0        ;SAVE FUNCTION CODE FOR MSG
2975 030732 012737 000100 001140          MOV     #VV,$GDDAT
2976 030740 104170                        EMT     170
2977 030742 000406                        BR      50$
```

```
                                        ;ADVANCE THE TABLE POINTER, EXIT IF DONE
                                        40$:
030744                                          ADD     #2,R2
030744  062702  000002                          TSTB    1(R2)
030750  105762  000001                          BMI     50$             ;EXIT IF COUNT IS NEGATIVE
030754  100401                                  BR      10$
030756  000701
030760  000403                        50$:      BR      200$            ;JUMP OVER TABLE

                                        ;TABLE OF FUNCTION CODES AND CLOCK COUNTS
030762                                  100$:
030762      020                                 .BYTE   RIP             ;READ IN PRESET COMMAND
030763      003                                 .BYTE   3

030764      022                                 .BYTE   PAKACK          ;PACK ACKNOWLEDGE COMMAND
030765      003                                 .BYTE   3

030766      000                                 .BYTE                   ;END OF TABLE
030767      377                                 .BYTE   -1

030770                                  200$:                           ;END OF TEST

                                        ;;*****************************************************************
                                        ;*TEST 54        ILLEGAL FUNCTION TEST

                                        ;;*****************************************************************
030770                                  TST54:
030770  000004                                  SCOPE                   ;SCOPE CALL
030772  000240                                  NOP
030774  012706  001100                          MOV     #STACK,SP       ;LOAD THE STACK POINTER
031000  013700  001276                          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
031004  013701  001466                          MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
031010  012737  000054  001226                  MOV     #54,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

031016  005002                                  CLR     R2              ;INITIALIZE FUNCTION CODE VALUE
031020                                  10$:
031020  004737  054732                          JSR     PC,SETVV        ;GO SET VOLUME VALID
031024  000402                                  BR      20$             ;BRANCH TO 20$ IF NO ERROR
031026  104000                                  EMT
031030  000460                                  BR      50$             ;SKIP TEST IF ERROR
031032  012704  000002                20$:      MOV     #2,R4           ;R4=CLOCK COUNT

                                        ;EXECUTE THE TEST FUNCTION CODE AND VERIFY ILF
031036  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
031044  010203                                  MOV     R2,R3           ;SETUP FUNCTION CODE IN R3
031046  052703  000001                          BIS     #GO,R3
031052  010360  000000                          MOV     R3,RMCS1(R0)    ;LOAD RMCS1
031056                                  30$:
031056  012760  141001  000024                  MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
031064  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
031072  005304                                  DEC     R4
031074  001370                                  BNE     30$
031076  016037  000014  001142                  MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
031104  042737  177776  001142                  BIC     #^CILF,$BDDAT   ;SETUP ACTUAL ILF STATUS
031112  016237  063640  001140                  MOV     FNCDTB(R2),$GDDAT  ;GET EXPECTED ILF STATUS
031120  042737  177776  001140                  BIC     #^CILF,$GDDAT
031126  023737  001140  001142                  CMP     $GDDAT,$BDDAT
```

```
3022 031134  001410                        BEQ     40$             ;BRANCH IF ILF IS OK
3023 031136  010037  001136                MOV     R0,$BDADR       ;SETUP FOR ERROR MSG
3024 031142  062737  000014  001136        ADD     #RMER1,$BDADR
3025 031150  010237  001174                MOV     R2,$TMP0
3026 031154  104171                        EMT     171
3027
3028                                ;ADVANCE TO THE NEXT FUNCTION CODE AND REPEAT TEST
3029 031156                         40$:
3030 031156  062702  000002                ADD     #2,R2
3031 031162  022702  000076                CMP     #ILF76,R2
3032 031166  103401                        BLO     50$
3033 031170  000713                        BR      10$
3034 031172                         50$:                            ;END OF TEST
3035
3036                                ;;*******************************************************************
                                    ;*TEST 55        OCCUPIED TEST

                                    ;;*******************************************************************
     031172                         TST55:
     031172  000004                        SCOPE                   ;SCOPE CALL
     031174  000240                        NOP
     031176  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
     031202  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     031206  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     031212  012737  000055  001226        MOV     #55,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3037
3038 031220  005002                        CLR     R2                      ;INITIALIZE FUNCTION CODE
3039
3040                                ;GET THE DEVICE READY
3041 031222                         10$:
3042 031222  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     031226  000402                        BR      20$             ;BRANCH TO 20$ IF NO ERROR
     031230  104000                        EMT
3043 031232  000464                        BR      50$
3044
3045                                ;ENABLE DEBUG CLOCK AND LOAD THE FUNCTION CODE
3046 031234                         20$:
3047 031234  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3048 031242  010203                        MOV     R2,R3                   ;ASSEMBLE FUNCTION CODE AND
3049 031244  052703  000001                BIS     #GO,R3                  ;GO BIT IN R3
3050 031250  010360  000000                MOV     R3,RMCS1(R0)    ;LOAD RMCS1
3051 031254  012704  000002                MOV     #2,R4                   ;R4=CLOCK COUNT
3052
3053                                ;STEP THE DEBUG CLOCK UNTIL SET PULSE IS ACTIVE
3054 031260                         30$:
3055 031260  012760  141001  000024        MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3056 031266  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3057 031274  005304                        DEC     R4
3058 031276  001370                        BNE     30$                     ;ISSUE NEXT CLOCK TIL R4 ZERO
3059
3060                                ;VERIFY OCCUPIED STATUS
3061 031300  016037  000024  001142        MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
3062 031306  042737  077777  001142        BIC     #^COCC,$BDDAT
3063 031314  005037  001140                CLR     $GDDAT          ;GENERATE OCC FROM AOE
3064 031320  032762  001000  063640        BIT     #AOE,FNCDTB(R2)
3065 031326  001403                        BEQ     35$
3066 031330  012737  100000  001140        MOV     #OCC,$GDDAT
```

```
3067 031336  023737  001140  001142  35$:    CMP     $GDDAT,$BDDAT
3068 031344  001411                          BEQ     40$                     ;BRANCH IF OCC IS OK
3069 031346  010237  001174                  MOV     R2,$TMP0                ;SAVE FUNCTION CODE
3070 031352  010037  001136                  MOV     R0,$BDADR               ;SETUP REGISTER ADDRESS
3071 031356  062737  000024  001136          ADD     #RMMR1,$BDADR
3072 031364  104173                          EMT     173
3073 031366  000406                          BR      50$
3074
3075                                 ;ADVANCE TO NEXT FUNCTIONCODE, EXIT IF DONE
3076 031370                          40$:
3077 031370  062702  000002                  ADD     #2,R2
3078 031374  022702  000076                  CMP     #ILF76,R2
3079 031400  103401                          BLO     50$                     ;EXIT IF DONE
3080 031402  000707                          BR      10$
3081
3082 031404                          50$:                                    ;END OF TEST
3083
3084                                 ;;*****************************************************************
                                     ;*TEST 56        READ IN PRESET TEST
                                     ;;*****************************************************************
     031404                          TST56:
     031404  000004                          SCOPE                   ;SCOPE CALL
     031406  000240                          NOP
     031410  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     031414  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     031420  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     031424  012737  000056  001226          MOV     #56,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3085
3086                                 ;CLEAR AND ENABLE DEBUG CLOCK - LEAVE VOLUME VALID RESET
3087 031432  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
3088 031436  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
3089 031444  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3090 031452  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
3091 031460  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
3092
3093                                 ;LOAD ALL ONES IN RMDA, RMDC AND RMOF
3094 031466  012760  177777  000006          MOV     #-1,RMDA(R0)    ;LOAD RMDA
3095 031474  012760  177777  000034          MOV     #-1,RMDC(R0)    ;LOAD RMDC
3096 031502  012760  177777  000032          MOV     #-1,RMOF(R0)    ;LOAD RMOF
     031510  012760  177777  000032          MOV     #-1,RMOF(R0)    ;LOAD RMOF AGAIN TO SET SSEI
3097
3098                                 ;LOAD READ IN PRESET COMMAND AND STEP THE CLOCK TILL SET PULSE
3099 031516  012760  000021  000000          MOV     #RIP!GO,RMCS1(R0)       ;LOAD RMCS1
3100 031524  012702  000003                  MOV     #3,R2                   ;R2=CLOCK COUNT
3101 031530                          10$:
3102 031530  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3103 031536  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3104 031544  005302                          DEC     R2
3105 031546  001370                          BNE     10$                     ;ISSUE 3 CLOCKS
3106
3107                                 ;SEE IF RMDA OR RMDC OR RMOF IS ZERO
3108 031550  016002  000006                  MOV     RMDA(R0),R2     ;STORE RMDA AT R2
3109 031554  005702                          TST     R2
3110 031556  001413                          BEQ     20$                     ;BRANCH IF RMDA IS ZERO
3111 031560  016002  000034                  MOV     RMDC(R0),R2     ;STORE RMDC AT R2
3112 031564  042702  176000                  BIC     #XNUDC,R2               ;CLEAR UNUSED BITS
```

```
3113 031570  001406                        BEQ     20$                     ;BRANCH IF RMDC IS ZERO
3114 031572  016002  000032                MOV     RMOF(R0),R2     ;STORE RMOF AT R2
3115 031576  042702  160577                BIC     #XNUOF,R2               ;CLEAR UNUSED BITS
3116 031602  001401                        BEQ     20$                     ;BRANCH IF RMOF IS ZERO
3117
3118                                ;READ IN PRESET COMMAND DIDNT CLEAR ANY OF THE 3 REGISTERS
3119 031604  104174                        EMT     174
3120
3121 031606                         20$:                                    ;END OF TEST
3122
3123                                ;;*****************************************************************
                                    ;*TEST 57        RIP/RMOF TEST

                                    ;;*****************************************************************
     031606                         TST57:
     031606  000004                        SCOPE                   ;SCOPE CALL
     031610  000240                        NOP
     031612  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
     031616  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     031622  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     031626  012737  000057  001226        MOV     #57,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3124
3125 031634  010037  001136                MOV     R0,$BDADR               ;SETUP REGISTER ADDRESS AND
3126 031640  062737  000032  001136        ADD     #RMOF,$BDADR
3127 031646  005037  001140                CLR     $GDDAT                  ;EXPECTED RMOF
3128
3129                                ;INITIALIZE AND SET BITS IN RMOF
3130 031652  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
3131 031656  012760  000001  000024        MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
3132 031664  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3133 031672  012760  000000  000014        MOV     #0,RMER1(R0)    ;LOAD RMER1
3134 031700  012760  000000  000042        MOV     #0,RMER2(R0)    ;LOAD RMER2
3135 031706  012760  177777  000032        MOV     #-1,RMOF(R0)    ;LOAD RMOF
     031714  012760  177777  000032        MOV     #-1,RMOF(R0)    ;LOAD RMOF AGAIN TO SET SSEI
3136
3137                                ;EXECUTE A READ IN PRESET IN DIAGNOSTIC MODE TILL SET PULSE
3138 031722  012760  000021  000000        MOV     #RIP!GO,RMCS1(R0)       ;LOAD RMCS1
3139 031730  012702  000003                MOV     #3,R2                   ;R2=CLOCK COUNT
3140 031734                         10$:
     031734  012760  141001  000024        MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3141 031742  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3142 031750  005302                        DEC     R2
3143 031752  001370                        BNE     10$                     ;ISSUE 3 CLOCKS
3144
3145                                ;VERIFY THAT RMOF IS ZERO
3146 031754  016037  000032  001142        MOV     RMOF(R0),$BDDAT ;STORE RMOF AT $BDDAT
3147 031762  042737  160577  001142        BIC     #XNUOF,$BDDAT
3148 031770  001401                        BEQ     20$                     ;BRANCH IF RMOF IS ZERO
3149 031772  104175                        EMT     175
3150
3151 031774                         20$:                                    ;END OF TEST
3152
3153                                ;;*****************************************************************
                                    ;*TEST 60        RMDA/RMDC/RIP TEST

                                    ;;*****************************************************************
     031774                         TST60:
```

```
032174  000004                          SCOPE                   ;SCOPE CALL
032176  000240                          NOP
032200  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
032204  013700  001276                  MOV     $BASE,R0        ;R0   JNIBUS ADDRESS
032210  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
032214  012737  000060  001226          MOV     #60,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3154
3155 032022  005037  001140             CLR     $GDDAT
3156
3157                                  ;CLEAR, ENABLE DEBUG CLOCK, THEN PRESET RMDA AND RMDC
3158 032026  004737  055156             JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
3159 032032  012760  000001  000024     MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
3160 032040  012760  041001  000024     MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3161 032046  012760  000000  000014     MOV     #0,RMER1(R0)    ;LOAD RMER1
3162 032054  012760  000000  000014     MOV     #0,RMER1(R0)    ;LOAD RMER1
3163 032062  012760  177777  000006     MOV     #-1,RMDA(R0)    ;LOAD RMDA
3164 032070  012760  177777  000034     MOV     #-1,RMDC(R0)    ;LOAD RMDC
3165
3166                                  ;EXECUTE READ IN PRESET TILL SET PULSE
3167 032076  012760  000021  000000     MOV     #RIP!GO,RMCS1(R0)       ;LOAD RMCS1
3168 032104  012702  000003             MOV     #3,R2
3169 032110                           10$:
     032110  012760  141001  000024     MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3170 032116  012760  041001  000024     MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3171 032124  005302                     DEC     R2
3172 032126  001370                     BNE     10$                     ;ISSUE 3 CLOCKS
3173
3174                                  ;VERIFY RMDA IS ZERO
3175 032130  016037  000006  001142     MOV     RMDA(R0),$BDDAT ;STORE RMDA AT $BDDAT
3176 032136  005737  001142             TST     $BDDAT
3177 032142  001406                     BEQ     20$                     ;BRANCH IF RMDA RESET
3178 032144  010037  001136             MOV     R0,$BDADR
3179 032150  062737  000006  001136     ADD     #RMDA,$BDADR
3180 032156  104176                     EMT     176
3181
3182                                  ;VERIFY RMDC IS ZERO
3183 032160                           20$:
3184 032160  016037  000034  001142     MOV     RMDC(R0),$BDDAT ;STORE RMDC AT $BDDAT
3185 032166  042737  176000  001142     BIC     #XNUDC,$BDDAT
3186 032174  001406                     BEQ     30$                     ;BRANCH IF RMDC RESET
3187 032176  010037  001136             MOV     R0,$BDADR
3188 032202  062737  000034  001136     ADD     #RMDC,$BDADR
3189 032210  104302                     EMT     302
3190
3191 032212                           30$:                            ;END OF TEST
3192
3193                                  ;;*****************************************************************
                                      ;*TEST 61        OFFSET COMMAND TEST
                                      ;;*****************************************************************
     032212                           TST61:
     032212  000004                          SCOPE                   ;SCOPE CALL
     032214  000240                          NOP
     032216  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     032222  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     032226  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     032232  012737  000061  001226          MOV     #61,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
```

```
3194
3195 032240  010037  001136                MOV     R0,$BDADR
3196 032244  062737  000012  001136        ADD     #RMDS,$BDADR
3197 032252  012737  000001  001140        MOV     #OM,$GDDAT
3198
3199 032260  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     032264  000402                        BR      10$             ;BRANCH TO 10$ IF NO ERROR
     032266  104000                        EMT
3200 032270  000433                        BR      40$
3201 032272                        10$:
     032272  012760  000000  000034        MOV     #0,RMDC(R0)     ;LOAD RMDC
3202
3203                               ;ENABLE DEBUG CLOCK AND EXECUTE OFFSET COMMAND
3204 032300  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3205 032306  012760  000015  000000        MOV     #OFFSET!GO,RMCS1(R0)    ;LOAD RMCS1
3206 032314  012702  000002                MOV     #2,R2                   ;R2=CLOCK COUNT
3207 032320                        20$:
     032320  012760  141001  000024        MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3208 032326  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3209 032334  005302                        DEC     R2
3210 032336  001370                        BNE     20$                     ;ISSUE 2 CLOCKS
3211
3212                               ;VERIFY THAT OFFSET MODE IS SET
3213 032340  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
3214 032346  042737  177776  001142        BIC     #^COM,$BDDAT
3215 032354  001001                        BNE     40$                     ;BRANCH IF OM IS SET
3216 032356  104200                        EMT     200
3217 032360                        40$:                                    ;END OF TEST
3218
3219                               ;;*****************************************************************
                                   ;*TEST 62        RETURN TO CENTER TEST
                                   ;;*****************************************************************
     032360                        TST62:
     032360  000004                        SCOPE                   ;SCOPE CALL
     032362  000240                        NOP
     032364  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
     032370  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     032374  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     032400  012737  000062  001226        MOV     #62,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3220
3221 032406  010037  001136                MOV     R0,$BDADR
3222 032412  062737  000012  001136        ADD     #RMDS,$BDADR
3223
3224 032420  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     032424  000402                        BR      10$             ;BRANCH TO 10$ IF NO ERROR
     032426  104000                        EMT
3225 032430  000465                        BR      60$
3226
3227                               ;SET OFFSET DIRECTION AND OFFSET MODE
3228 032432                        10$:
3229 032432  012760  000200  000032        MOV     #OFD,RMOF(R0)
3230
3231 032440  004737  055054                JSR     PC,SETOM        ;GO SET OFFSET MODE
     032444  000401                        BR      20$             ;BRANCH TO 20$ IF NO ERROR
     032446  104000                        EMT
3232
```

```
                                        ;ENABLE DEBUG CLOCK AND EXECUTE RETURN TO CENTER COMMAND
                                        20$:
032450  004737  054732                          JSR     PC,SETVV        ;GO SET VOLUME VALID
032454  000402                                  BR      30$             ;BRANCH TO 30$ IF NO ERROR
032456  104000                                  EMT
032460  000451                                  BR      60$
032462                                  30$:
032462  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
032470  012760  000017  000000                  MOV     #RTC!GO,RMCS1(R0)       ;LOAD RMCS1
032476  012702  000002                          MOV     #2,R2
032502                                  40$:
032502  012760  141001  000024                  MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
032510  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
032516  005302                                  DEC     R2
032520  001370                                  BNE     40$                     ;ISSUE 2 CLOCKS

                                        ;VERIFY THAT OFFSET MODE IS RESET
032522  016037  000012  001142                  MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
032530  042737  177776  001142                  BIC     #^COM,$BDDAT
032536  001403                                  BEQ     50$                     ;BRANCH IF OFFSET MODE RESET
032540  005037  001140                          CLR     $GDDAT
032544  104201                                  EMT     201

                                        ;VERIFY THAT OFFSET DIRECTION IS RESET
032546                                  50$:
032546  016037  000032  001142                  MOV     RMOF(R0),$BDDAT ;STORE RMOF AT $BDDAT
032554  042737  177577  001142                  BIC     #^COFD,$BDDAT
032562  001410                                  BEQ     60$                     ;BRANCH IF OFD IS RESET
032564  005037  001140                          CLR     $GDDAT
032570  010037  001136                          MOV     R0,$BDADR
032574  062737  000032  001136                  ADD     #RMOF,$BDADR
032602  104202                                  EMT     202
032604                                  60$:                                    ;END OF TEST

                                        ;;*****************************************************************
                                        ;*TEST 63        RMDC CLEAR OFFSET TEST

                                        ;;*****************************************************************
032604                                  TST63:
032604  000004                          SCOPE                   ;SCOPE CALL
032606  000240                          NOP
032610  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
032614  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
032620  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
032624  012737  000063  001226          MOV     #63,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX

032632  010037  001136                  MOV     R0,$BDADR
032636  062737  000012  001136          ADD     #RMDS,$BDADR

032644  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
032650  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
032652  104000                          EMT
032654  000421                          BR      40$                     ;SKIP REST OF TEST
032656                                  10$:
032656  004737  055054                  JSR     PC,SETOM        ;GO SET OFFSET MODE
032662  000401                          BR      20$             ;BRANCH TO 20$ IF NO ERROR
032664  104000                          EMT
```

```
3273
3274                                    ;WRITE THE DESIRED CYLINDER REGISTER AND VERIFY THAT OFFSET IS ZERO
3275 032666                             20$:
3276 032666  012760  000000  000034            MOV     #0,RMDC(R0)     ;LOAD RMDC
3277 032674  016037  000012  001142            MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
3278 032702  042737  177776  001142            BIC     #^COM,$BDDAT
3279 032710  001403                            BEQ     40$
3280 032712  005037  001140                    CLR     $GDDAT
3281 032716  104203                            EMT     203
3282
3283 032720                             40$:                                    ;END OF TEST
3284
3285                                    ;;*******************************************************************
                                        ;*TEST 64        EBL CLEAR OFFSET TEST

                                        ;;*******************************************************************
       032720                           TST64:
       032720  000004                          SCOPE                   ;SCOPE CALL
       032722  000240                          NOP
       032724  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
       032730  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
       032734  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
       032740  012737  000064  001226          MOV     #64,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3286
3287 032746  013737  001334  001420            MOV     LSTRK,RMDA0             ;SET LAST TRACK AND
3288 032754  112737  000036  001420            MOVB    #30.,RMDA0              ;LAST SECTOR
3289 032762  010037  001136                    MOV     R0,$BDADR               ;SETUP REGISTER FOR ERROR MSG
3290 032766  062737  000012  001136            ADD     #RMDS,$BDADR
3291
3292 032774  004737  054732                    JSR     PC,SETVV        ;GO SET VOLUME VALID
       033000  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
       033002  104000                          EMT
3293 033004  000440                          BR      30$                     ;SKIP REST OF TEST IF ERROR
3294 033006                             10$:
3295 033006  004737  055054                    JSR     PC,SETOM        ;GO SET OFFSET MODE
       033012  000401                          BR      20$             ;BRANCH TO 20$ IF NO ERROR
       033014  104000                          EMT
3296 033016                             20$:
3297 033016  012760  010000  000032            MOV     #FMT16,RMOF(R0)
3298 033024  013760  001420  000006            MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
3299
3300                                    ;FORCE END OF BLOCK AND VERIFY THAT OFFSET MODE IS CLEARED
3301 033032  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3302 033040  012760  000001  000000            MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
3303 033046  012760  061001  000024            MOV     #DMD!MUR!DBEN!DEBL,RMMR1(R0)    ;LOAD RMMR1
3304 033054  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3305 033062  016037  000012  001142            MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
3306 033070  042737  177776  001142            BIC     #^COM,$BDDAT
3307 033076  001403                            BEQ     30$                     ;BRANCH IF OFFSET IS ZERO
3308 033100  005037  001140                    CLR     $GDDAT
3309 033104  104204                            EMT     204
3310 033106                             30$:                                    ;END OF TEST
3311
3312                                    ;;*******************************************************************
                                        ;*TEST 65        RUN AND GO TEST

                                        ;;*******************************************************************
```

```
                033106                                  TST65:
                033106  000004                                  SCOPE                   ;SCOPE CALL
                033110  000240                                  NOP
                033112  012706  001100                          MOV     #STACK,SP       ;LOAD THE STACK POINTER
                033116  013700  001276                          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                033122  013701  001466                          MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                033126  012737  000065  001226                  MOV     #65,$TESTN      ;:SET TEST NUMBER IN APT MAIL BOX
     3313
     3314       033134  005037  001140                          CLR     $GDDAT                  ;INITIALIZE EXPECTED RESULT
     3315       033140  005002                                  CLR     R2                      ;INTIALIZE FUNCTION CODE
     3316       033142  010037  001136                          MOV     R0,$BDADR
     3317       033146  062737  000024  001136                  ADD     #RMMR1,$BDADR
     3318
     3319                                                  ;CLEAR THE MASSBUS AND ENABLE DEBUG CLOCK
     3320       033154                                  10$:
     3321       033154  004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
     3322       033160  012760  000001  000024                  MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
     3323       033166  012760  040001  000024                  MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
     3324       033174  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
     3325       033202  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
     3326
     3327                                                  ;LOAD THE FUNCTION CODE AND VERIFY RUN AND GO FLOP
     3328       033210  010203                                  MOV     R2,R3                   ;ASSEMBLE FUNCTION CODE AND GO
     3329       033212  052703  000001                          BIS     #GO,R3
     3330       033216  012737  000200  001534                  MOV     #200,WATCH      ;SET WATCHDOG TIMER VALUE
                033224  004777  146306                          JSR     PC,@CLOCK       ;START THE CLOCK
     3331       033230  010360  000000                          MOV     R3,RMCS1(R0)    ;LOAD RMCS1
     3332       033234                                  15$:
                033234  016037  000024  001142                  MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
     3333       033242  042737  137777  001142                  BIC     #^CRG,$BDDAT
     3334       033250  023737  001140  001142                  CMP     $GDDAT,$BDDAT
     3335       033256  001411                                  BEQ     20$                     ;BRANCH IF RUN AND GO FLOP OK
     3336       033260  005737  001534                          TST     WATCH           ;TAKE ANOTHER SAMPLE IF CLOCK NOT ZERO
     3337       033264  001363                                  BNE     15$
     3338       033266  004777  146246                          JSR     PC,@STOPCL      ;STOP THE CLOCK
     3339       033272  010237  001174                          MOV     R2,$TMP0                ;SAVE FUNCTION CODE FOR MSG
     3340       033276  104205                                  EMT     205
     3341       033300  000416                                  BR      40$                     ;SKIP REST OF
     3342       033302                                  20$:
     3343       033302  004777  146232                          JSR     PC,@STOPCL      ;STOP THE CLOCK
     3344
     3345                                                  ;ADVNACE TO NEXT FUNCTION CODE - EXIT IF DONE
     3346       033306  062702  000002                          ADD     #2,R2
     3347       033312  022702  000076                          CMP     #ILF76,R2
     3348       033316  103407                                  BLO     40$                     ;EXIT IF DONE
     3349       033320  020227  000050                          CMP     R2,#WCD                 ;CHANGE EXPECTED RESULTI IF
     3350       033324  103403                                  BLO     30$                     ;DATA COMMAND
     3351       033326  012737  040000  001140                  MOV     #RG,$GDDAT
     3352       033334  000707                          30$:    BR      10$                     ;REPEAT TEST
     3353
     3354       033336                                  40$:                                    ;END OF TEST
     3355
     3356                                                  ;;*****************************************************************
                                                          ;*TEST 66       SET IAE TEST

                                                          ;;*****************************************************************
                033336                                  TST66:
```

```
033336  000004                          SCOPE                   ;SCOPE CALL
033340  000240                          NOP
033342  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
033346  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
033352  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
033356  012737  000066  001226          MOV     #66,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3357
3358 033364  012702  033532                  MOV     #100$,R2                ;R2=TABLE POINTER
3359 033370                          10$:
3360 033370  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
033374  000402                          BR      20$             ;BRANCH TO 20$ IF NO ERROR
033376  104000                          EMT
3361 033400  000453                          BR      50$                     ;SKIP REST OF TEST
3362
3363                                 ;LOAD INVALID TRACK, SECTOR AND CYLINDER ADDRESS AND SET FORMAT TO 18
3364 033402                          20$:
3365 033402  012760  177777  000006          MOV     #-1,RMDA(R0)    ;LOAD RMDA
3366 033410  012760  177777  000034          MOV     #-1,RMDC(R0)    ;LOAD RMDC
3367 033416  012760  000000  000032          MOV     #0,RMOF(R0)     ;LOAD RMOF
3368
3369                                 ;ENABLE DEBUG CLOCK AND LOAD FUNCTION CODE IN RMCSI WITH GO ON
3370 033424  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3371 033432  111203                          MOVB    (R2),R3
3372 033434  042703  177701                  BIC     #^CILF76,R3
3373 033440  052703  000001                  BIS     #GO,R3
3374 033444  010360  000000                  MOV     R3,RMCS1(R0)    ;LOAD RMCS1
3375 033450  116204  000001                  MOVB    1(R2),R4                ;GET CLOCK COUNT
3376 033454  042704  177400                  BIC     #^C377,R4
3377
3378                                 ;CLOCK THE COMMAND SEQUENCER
3379 033460                          30$:
3380 033460  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3381 033466  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3382 033474  005304                          DEC     R4
3383 033476  001370                          BNE     30$
3384
3385                                 ;SEE IF IAE HAS SET
3386 033500  016004  000014                  MOV     RMER1(R0),R4    ;STORE RMER1 AT R4
3387 033504  042704  175777                  BIC     #^CIAE,R4
3388 033510  001007                          BNE     50$                     ;BRANCH IF IAE SET
3389
3390                                 ;IAE DID NOT SET - TRY ANOTHER FUNCTION CODE
3391 033512  062702  000002                  ADD     #2,R2
3392 033516  105762  000001                  TSTB    1(R2)
3393 033522  100401                          BMI     40$                     ;BRANCH IF ALL CODES TRIED
3394 033524  000721                          BR      10$
3395
3396                                 ;CANNOT SET IAE WITH ANY COMBINATION OF ADDRESS AND FUNCTION CODE
3397 033526                          40$:
3398 033526  104206                          EMT     206
3399
3400 033530  000411                  50$:    BR      200$                    ;JUMP OVER TABLE
3401
3402                                 ;TABLE OF FUNCTION CODES AND CLOCK COUNTS FOR TEST
3403 033532                          100$:
3404 033532      030                         .BYTE   SEARCH                  ;SEARCH COMMAND
3405 033533      002                         .BYTE   2
```

```
3406
3407 033534  004                    .BYTE   SEEK                    ;SEEK COMMAND
3408 033535  002                    .BYTE   2
3409
3410 033536  062                    .BYTE   WH                      ;WRITE HEADER COMMAND
3411 033537  002                    .BYTE   2
3412
3413 033540  052                    .BYTE   WCH                     ;WRITE CHECK HEADER COMMAND
3414 033541  002                    .BYTE   2
3415
3416 033542  072                    .BYTE   RH                      ;READ HEADER COMMAND
3417 033543  002                    .BYTE   2
3418
3419 033544  060                    .BYTE   WD                      ;WRITE DATA COMMAND
3420 033545  002                    .BYTE   2
3421
3422 033546  050                    .BYTE   WCD                     ;WRITE CHECK DATA COMMAND
3423 033547  002                    .BYTE   2
3424
3425 033550  070                    .BYTE   RD                      ;READ DATA COMMAND
3426 033551  002                    .BYTE   2
3427
3428 033552  000                    .BYTE                           ;END OF TABLE
3429 033553  377                    .BYTE   -1
3430
3431 033554                  200$:                                 ;END OF TEST
3432
3433                         ;;*****************************************************************
                            ;*TEST 67       SEARCH, SEEK, READ, WRITE TEST

                            ;;*****************************************************************
                            ;;
                            TST67:
       033554
       033554  000004               SCOPE                         ;SCOPE CALL
       033556  000240               NOP
       033560  012706  001100       MOV     #STACK,SP             ;LOAD THE STACK POINTER
       033564  013700  001276       MOV     $BASE,R0              ;R0 = UNIBUS ADDRESS
       033570  013701  001466       MOV     TSTQUE,R1             ;R1 = POINTER TO DEVICE
       033574  012737  000067  001226  MOV  #67,$TESTN             ;;SET TEST NUMBER IN APT MAIL BOX
3434
3435 033602  005002                 CLR     R2                            ;INITIALIZE FUNCTION CODE
3436 033604                  10$:
3437 033604  004737  054732       JSR     PC,SETVV              ;GO SET VOLUME VALID
       033610  000402               BR      20$                   ;BRANCH TO 20$ IF NO ERROR
       033612  104000               EMT
3438 033614  000472               BR      50$
3439
3440                        ;LOAD INVALID TRACK, SECTOR AND CYLINDER ADDRESS AND SET FORMAT
3441                        ;TO 18 BIT MODE
3442 033616                  20$:
3443 033616  012760  177777  000006  MOV     #-1,RMDA(R0)          ;LOAD RMDA
3444 033624  012760  177777  000034  MOV     #-1,RMDC(R0)          ;LOAD RMDC
3445 033632  012760  000000  000032  MOV     #0,RMOF(R0)           ;LOAD RMOF
3446
3447                        ;ENABLE DEBUG CLOCK AND LOAD FUNCTION CODE IN RMCS1 WITH GO ON
3448 033640  012760  041001  000024  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3449 033646  010203               MOV     R2,R3                         ;ASSEMBLE CODE AND GO
3450 033650  052703  000001       BIS     #GO,R3
```

```
3451 033654  010360  000000                    MOV     R3,RMCS1(R0)    ;LOAD RMCS1
3452
3453                                    ;CLOCK THE COMMAND SEQUENCER TO SET PULSE
3454 033660  012704  000002                    MOV     #2,R4
3455 033664                             30$:
     033664  012760  141001  000024            MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3456 033672  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3457 033700  005304                            DEC     R4
3458 033702  001370                            BNE     30$
3459
3460                                    ;VERIFY IAE ACCORDING TO FUNCTION CODE TABLE
3461 033704  016037  000014  001142            MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
3462 033712  042737  175777  001142            BIC     #^CIAE,$BDDAT
3463 033720  016237  063640  001140            MOV     FNCDTB(R2),$GDDAT       ;ASSEMBLE EXPECTED IAE
3464 033726  042737  175777  001140            BIC     #^CIAE,$GDDAT
3465 033734  023737  001140  001142            CMP     $GDDAT,$BDDAT
3466 033742  001411                            BEQ     40$                     ;BRANCH IF IAE OK
3467 033744  010037  001136                    MOV     R0,$BDADR               ;SET UP ERROR MSG
3468 033750  062737  000014  001136            ADD     #RMER1,$BDADR
3469 033756  010237  001174                    MOV     R2,$TMP0
3470 033762  104207                            EMT     207
3471 033764  000406                            BR      50$                     ;SKIP REST OF TEST
3472
3473                                    ;ADVANCE TO NEXT FUNCTION CODE - EXIT IF DONE
3474 033766                             40$:
3475 033766  062702  000002                    ADD     #2,R2
3476 033772  023702  000076                    CMP     ILF76,R2
3477 033776  103401                            BLO     50$
3478 034000  000701                            BR      10$
3479 034002                             50$:                                    ;END OF TEST
3480
3481                                    ;;*****************************************************************
                                        ;*TEST 70       INVALID TRACK/SECTOR TEST

                                        ;;*****************************************************************
     034002                             TST70:
     034002  000004                            SCOPE                   ;SCOPE CALL
     034004  000240                            NOP
     034006  012706  001100                    MOV     #STACK,SP       ;LOAD THE STACK POINTER
     034012  013700  001276                    MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     034016  013701  001466                    MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     034022  012737  000070  001226            MOV     #70,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3482
3483 034030  013737  001334  001420            MOV     LSTRK,RMDA0             ;LOAD LAST TRACK ADDRESS
3484 034036  105237  001421                    INCB    RMDA0+1                 ;SETUP FIRST INVALID ADDRESS
3485 034042                             10$:
3486 034042  004737  054732                    JSR     PC,SETVV        ;GO SET VOLUME VALID
     034046  000402                            BR      20$             ;BRANCH TO 20$ IF NO ERROR
     034050  104000                            EMT
3487 034052  000477                            BR      100$                    ;SKIP REST OF TEST
3488
3489                                    ;CLEAR DESIRED CYLINDER, LOAD INVALID ADDRESS AND SET
3490                                    ;18 BIT FORMAT
3491 034054                             20$:
3492 034054  012760  000000  000034            MOV     #0,RMDC(R0)     ;LOAD RMDC
3493 034062  013760  001420  000006            MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
3494 034070  012760  000000  000032            MOV     #0,RMOF(R0)     ;LOAD RMOF
```

```
3495
3496                                        ;EXECUTE A SEARCH COMMAND TO WHERE "SET PULSE" IS ACTIVE
3497 034076  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3498 034104  012760  000031  000000          MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1
3499 034112  012703  000002                  MOV     #2,R3
3500 034116                                 30$:
3501 034116  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3502 034124  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3503 034132  005303                          DEC     R3
3504 034134  001370                          BNE     30$                     ;ISSUE 2 CLOCKS
3505
3506                                        ;VERIFY IAE IS SET
3507 034136  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
3508 034144  042737  175777  001142          BIC     #^CIAE,$BDDAT
3509 034152  001015                          BNE     40$                     ;BRANCH IF IAE IS ON
3510 034154  012737  002000  001140          MOV     #IAE,$GDDAT             ;SETUP ERROR MESSAGE
3511 034162  010037  001136                  MOV     R0,$BDADR
3512 034166  062737  000014  001136          ADD     #RMER1,$BDADR
3513 034174  013737  001420  001174          MOV     RMDA0,$TMP0
3514 034202  104210                          EMT     210
3515 034204  000422                          BR      100$
3516
3517                                        ;ADVANCE TO NEXT ENTRY IN TABLE - EXIT IF DONE
3518 034206                                 40$:
3519 034206  105737  001421                  TSTB    RMDA0+1                 ;TESTING INVALID SECTORS ?
3520 034212  001411                          BEQ     50$                     ;YES !!
3521 034214  105237  001421                  INCB    RMDA0+1                 ;INCREMENT TRACK ADDRESS
3522 034220  123727  001421  000200          CMPB    RMDA0+1,#128.           ;DONE ?
3523 034226  101705                          BLOS    10$                     ;NO, TEST NEXT TRACK ADDRESS
3524 034230  012737  000035  001420          MOV     #29.,RMDA0              ;LOAD LAST SECTOR ADDRESS AND
3525                                                                         ;TRACK 0.
3526 034236  005237  001420                 50$:    INC     RMDA0           ;INCREMENT SECTOR ADDRESS
3527 034242  123727  001420  000200          CMPB    RMDA0,#128.             ;DONE ?
3528 034250  101674                          BLOS    10$                     ;NO, TEST NEXT SECTOR ADDRESS
3529
3530 034252                                 100$:
3531
3532                                        ;;*****************************************************************
                                            ;*TEST 71        INVALID CYLINDER TEST

                                            ;;*****************************************************************
     034252                                 TST71:
     034252  000004                          SCOPE                           ;SCOPE CALL
     034254  000240                          NOP
     034256  012706  001100                  MOV     #STACK,SP               ;LOAD THE STACK POINTER
     034262  013700  001276                  MOV     $BASE,R0                ;R0 = UNIBUS ADDRESS
     034266  013701  001466                  MOV     TSTQUE,R1               ;R1 = POINTER TO DEVICE
     034272  012737  000071  001226          MOV     #71,$TESTN              ;;SET TEST NUMBER IN APT MAIL BOX
3533
3534 034300  012737  001061  001446          MOV     #561.,RMDC0                     ;SET FIRST INVALID CYLINDER
3535 034306                                 10$:
3536 034306  004737  054732                  JSR     PC,SETVV                ;GO SET VOLUME VALID
     034312  000402                          BR      20$                     ;BRANCH TO 20$ IF NO ERROR
     034314  104000                          EMT
3537 034316  000460                          BR      50$                             ;SKIP IF ERROR
3538 034320                                 20$:
3539 034320  013760  001446  000034          MOV     RMDC0,RMDC(R0)          ;LOAD RMDC
```

```
3540 034326  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
3541
3542                                  ;ENABLE DEBUG CLOCK AND EXECUTE SEARCH COMMAND
3543 034334  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3544 034342  012760  000031  000000          MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1
3545 034350  012703  000002                  MOV     #2,R3
3546 034354                           30$:
     034354  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3547 034362  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3548 034370  005303                          DEC     R3
3549 034372  001370                          BNE     30$                     ;ISSUE 2 CLOCKS
3550
3551                                  ;VERIFY IAE IS SET
3552 034374  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
3553 034402  042737  175777  001142          BIC     #^CIAE,$BDDAT
3554 034410  001015                          BNE     40$                     ;BRANCH IF IAE IS SET
3555 034412  012737  002000  001140          MOV     #IAE,$GDDAT             ;SETUP ERROR MESSAGE
3556 034420  010037  001136                  MOV     R0,$BDADR
3557 034424  062737  000014  001136          ADD     #RMER1,$BDADR
3558 034432  013737  001446  001174          MOV     RMDC0,$TMP0
3559 034440  104211                          EMT     211
3560 034442  000406                          BR      50$
3561
3562                                  ;ADVANCE CYLINDER ADDRESS
3563 034444                           40$:
3564 034444  005237  001446                  INC     RMDC0           ;INCREMENT CYLINDER ADDRESS
3565 034450  023727  001446  002000          CMP     RMDC0,#1024.    ;DONE ?
3566 034456  103713                          BLO     10$             ;NO, TEST AGAIN
3567 034460                           50$:
3568
3569                                  ;;*****************************************************************
                                      ;*TEST 72        SET AOE TEST

                                      ;;*****************************************************************
     034460                           TST72:
     034460  000004                          SCOPE                   ;SCOPE CALL
     034462  000240                          NOP
     034464  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     034470  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     034474  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     034500  012737  000003  001206          MOV     #3,$TIMES       ;;DO 3 ITERATIONS
     034506  012737  000072  001226          MOV     #72.,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
3570
3571 034514  005037  001444                  CLR     RMOF0           ;18 BIT FORMAT MODE
3572 034520  013737  001334  001420          MOV     LSTRK,RMDA0     ;SET LAST TRACK AND
3573 034526  112737  000035  001420          MOVB    #29.,RMDA0      ;LAST SECTOR
3574
3575                                  ;ENABLE DEBUG CLOCK AND LOAD LAST SECTOR ADDRESS, MEMORY ADDRESS AND
3576                                  ;WORD COUNT, THEN LOAD WRITE DATA COMMAND WITH GO SET
3577 034534                           10$:
3578 034534  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     034540  000402                          BR      15$             ;BRANCH TO 15$ IF NO ERROR
     034542  104000                          EMT
3579 034544  000517                          BR      40$             ;SKIP TEST IF ERROR
3580 034546                           15$:
3581 034546  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3582 034554  013760  001444  000032          MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
```

```
3583 034562  016037  000032  001174          MOV     RMOF(R0),$TMP0  ;STORE RMOF AT $TMP0
3584 034570  012760  001060  000034          MOV     #560.,RMDC(R0)  ;LOAD RMDC
3585 034576  013760  001420  000006          MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
3586 034604  012760  177000  000002          MOV     #-512.,RMWC(R0) ;LOAD RMWC
3587 034612  012760  104536  000004          MOV     #BUFFER,RMBA(R0)        ;LOAD RMBA
3588 034620  012760  000061  000000          MOV     #WD!GO,RMCS1(R0)        ;LOAD RMCS1
3589 034626  012702  000014                  MOV     #14,R2          ;R2 = CLOCK COUNT
3590                                                                 ;CLOCK COUNT 2-05 3-04 14-60...
3591                                 ;CLOCK THE COMMAND SEQUENCER TO GENERATE SET PULSE
3592 034632                          20$:
3593 034632  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
3594 034640  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3595 034646  005302                          DEC     R2
3596 034650  001370                          BNE     20$             ;ISSUE 2 CLOCKS
3597
3598                                 ;FORCE EBL TO GET TO OVERFLOW ADDRESS
3599 034652  012760  061001  000024          MOV     #DMD!MUR!DBEN!DEBL,RMMR1(R0)    ;LOAD RMMR1
3600 034660  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3601
3602                                 ;VERIFY THAT ADDRESS OVERFLOW ERROR IS SET
3603 034666  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
3604 034674  042737  176777  001142          BIC     #^CAOE,$BDDAT
3605 034702  001012                          BNE     30$             ;BRANCH IF AOE IS SET
3606 034704  010037  001136                  MOV     R0,$BDADR       ;SETUP ERROR MESSAGE
3607 034710  062737  000014  001136          ADD     #RMER1,$BDADR
3608 034716  012737  001000  001140          MOV     #AOE,$GDDAT
3609 034724  104212                          EMT     212
3610 034726  000426                          BR      40$
3611 034730                          30$:                            ;END OF TEST
3612 034730  032737  010000  001444          BIT     #FMT16,RMOFO    ;DONE 16 BIT FORMAT TEST ?
3613 034736  001007                          BNE     35$             ;YES !!
3614 034740  012737  010000  001444          MOV     #FMT16,RMOFO    ;SET 16 BIT FORMAT MODE AND
3615 034746  112737  000036  001420          MOVB    #30.,RMDA0      ;LAST SECTOR
3616 034754  000667                          BR      10$
3617 034756                          35$:
3618 034756  032737  001000  001444          BIT     #SSEI,RMOFO     ;DONE 16 BIT TEST W/ SSEI SET ?
3619 034764  001007                          BNE     40$             ;YES !!
3620 034766  052737  001000  001444          BIS     #SSEI,RMOFO     ;SET SSEI W/ 16 BIT MODE AND
3621 034774  112737  000037  001420          MOVB    #31.,RMDA0      ;LAST SECTOR
3622 035002  000654                          BR      10$
3623 035004                          40$:
3624
3625                                 ;;*****************************************************************************
                                     ;*TEST 73        SET RMR TEST

                                     ;;*****************************************************************************
     035004                          TST73:
     035004  000004                          SCOPE                   ;SCOPE CALL
     035006  000240                          NOP
     035010  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     035014  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     035020  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     035024  012737  000073  001226          MOV     #73,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
3626
3627 035032  010037  001136                  MOV     R0,$BDADR       ;SETUP REGISTER ADDRESS FOR MSG
3628 035036  062737  000014  001136          ADD     #RMER1,$BDADR
3629 035044  012702  035212                  MOV     #100$,R2        ;INITIALIZE TABLE POINTER
```

```
3630
3631                                    ;CLEAR THE DEVICE AND ENABLE DEBUG CLOCK
3632 035050                             10$:
3633 035050  004737  055156                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
3634 035054  012760  000001  000024                MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
3635 035062  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
3636 035070  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
3637 035076  012760  000000  000042                MOV     #0,RMER2(R0)    ;LOAD RMER2
3638
3639                                    ;SET GO THEN WRITE THE REGISTER SPECIFIED BY THE TABLE
3640 035104  012760  000001  000000                MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
3641 035112  011203                                MOV     (R2),R3                 ;GENERATE REGISTER ADDRESS
3642 035114  060003                                ADD     R0,R3
3643 035116  012713  041001                        MOV     #DMD!MUR!DBEN,(R3)      ;WRITE THE REGISTER
3644
3645                                    ;VERIFY RMR ACCORDING TO TABLE
3646 035122  016037  000014  001142                MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
3647 035130  042737  177773  001142                BIC     #^CRMR,$BDDAT
3648 035136  016237  000002  001140                MOV     2(R2),$GDDAT            ;GET EXPECTED RESULT FROM TABLE
3649 035144  023737  001140  001142                CMP     $GDDAT,$BDDAT
3650 035152  001411                                BEQ     30$                     ;BRANCH IF RMR IS OK
3651 035154  011237  001174                        MOV     (R2),$TMP0              ;SAVE TEST REGISTER
3652 035160  032762  000004  000002                BIT     #RMR,2(R2)
3653 035166  001002                                BNE     20$                     ;BRANCH IF ERROR SHOULD BE ONE
3654 035170  104213                                EMT     213
3655 035172  000401                                BR      30$
3656 035174                             20$:
     035174  104214                                EMT     214
3657
3658                                    ;ADVANCE TABLE POINTER, EXIT IF DONE
3659 035176                             30$:
3660 035176  062702  000004                        ADD     #4,R2
3661 035202  005712                                TST     (R2)
3662 035204  100401                                BMI     40$                     ;EXIT IF ENTRY NEGATIVE
3663 035206  000720                                BR      10$
3664 035210  000410                     40$:       BR      200$                    ;JUMP OVER TABLE
3665
3666                                    ;TABLE OF REGISTER ADDRESSES AND RMR VALUES
3667 035212                             100$:
3668 035212  000016                               .WORD   RMAS                    ;ATTENTION SUMMARY REG
3669 035214  000000                               .WORD   0                       ;RMR = 0
3670
3671 035216  000024                               .WORD   RMMR1                   ;MAINTENANCE REG
3672 035220  000000                               .WORD   0                       ;RMR = 0
3673
3674 035222  000006                               .WORD   RMDA                    ;DISK ADDRESS REG
3675 035224  000004                               .WORD   RMR                     ;RMR = 1
3676
3677 035226  177777                               .WORD   -1                      ;END OF TABLE
3678 035230  000000                               .WORD   0
3679
3680 035232                             200$:                                   ;END OF TEST
3681
3682                                    ;;*****************************************************************
                                        ;*TEST 74        PGM STATUS CHECK

                                        ;;*****************************************************************
```

T74 PGM STATUS CHECK

```
                035232                          TST74:
                035232  000004                          SCOPE                   ;SCOPE CALL
                035234  000240                          NOP
                035236  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
                035242  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                035246  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                035252  012737  000074  001226          MOV     #74,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
     3683
     3684                                       ;CLEAR AND READ DRIVE TYPE AND DRIVE STATUS
     3685 035260  004737  055156                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
     3686 035264  016037  000026  001174                MOV     RMDT(R0),$TMP0  ;STORE RMDT AT $TMP0
     3687 035272  016037  000012  001142                MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
     3688
     3689                                       ;OMIT TEST IF DRQ IS ON - ELSE VERIFY THAT PGM IS OFF
     3690 035300  032737  004000  001174                BIT     #DRQ,$TMP0
     3691 035306  001014                                BNE     10$                     ;BRANCH IF DRQ IS ON
     3692 035310  042737  176777  001142                BIC     #^CPGM,$BDDAT
     3693 035316  001410                                BEQ     10$                     ;BRANCH IF PGM IS OFF
     3694 035320  005037  001140                        CLR     $GDDAT
     3695 035324  010037  001136                        MOV     R0,$BDADR
     3696 035330  062737  000012  001134                ADD     #RMDS,$GDADR
     3697 035336  104215                                EMT     215
     3698 035340                                10$:                                    ;END OF TEST
     3699
     3700                                       ;;*****************************************************************************
                                                ;*TEST 75        DVA/DPR STATUS CHECK
                                                ;;*****************************************************************************
                035340                          TST75:
                035340  000004                          SCOPE                   ;SCOPE CALL
                035342  000240                          NOP
                035344  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
                035350  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
                035354  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                035360  012737  000075  001226          MOV     #75,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
     3701
     3702                                       ;CLEAR AND VERIFY THAT DVA IS SET
     3703 035366  004737  055156                        JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
     3704 035372  016037  000000  001142                MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
     3705 035400  042737  173777  001142                BIC     #^CDVA,$BDDAT
     3706 035406  001006                                BNE     10$                     ;BRANCH IF DVA IS ON
     3707 035410  012737  004000  001140                MOV     #DVA,$GDDAT
     3708 035416  010037  001136                        MOV     R0,$BDADR
     3709 035422  104216                                EMT     216
     3710
     3711                                       ;VERIFY THAT DPR IS SET
     3712 035424                                10$:
     3713 035424  016037  000012  001142                MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
     3714 035432  042737  177377  001142                BIC     #^CDPR,$BDDAT
     3715 035440  001011                                BNE     20$
     3716 035442  012737  000400  001140                MOV     #DPR,$GDDAT
     3717 035450  010037  001136                        MOV     R0,$BDADR
     3718 035454  062737  000012  001136                ADD     #RMDS,$BDADR
     3719 035462  104217                                EMT     217
     3720
     3721 035464                                20$:                                    ;END OF TEST
     3722
```

```
T76     PORT REQUEST TEST, PART 1

 3723                                   ;;*****************************************************************************
                                        ;*TEST 76       PORT REQUEST TEST, PART 1
                                        ;;*****************************************************************************
        035464                          TST76:
        035464  000004                          SCOPE                   ;SCOPE CALL
        035466  000240                          NOP
        035470  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        035474  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        035500  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        035504  012737  000076  001226          MOV     #76,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
 3724
 3725   035512  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
        035516  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
        035520  104000                          EMT
 3726   035522  000434                          BR      20$
 3727
 3728                                   ;EXECUTE A RELEASE TO RESET REQUEST FLOP
 3729   035524                          10$:
 3730   035524  012760  000013  000000          MOV     #RLEASE!GO,RMCS1(R0)    ;LOAD RMCS1
 3731
 3732                                   ;READ RMMR2 AND SKIP TEST IF REQUEST FLOPS ARENT RESET
 3733   035532  016002  000040                  MOV     RMMR2(R0),R2    ;STORE RMMR2 AT R2
 3734   035536  042702  037777                  BIC     #^C<RQA!RQB>,R2
 3735   035542  001024                          BNE     20$
 3736
 3737                                   ;READ RMCS1 TO SET REQUEST FLOP
 3738   035544  016002  000000                  MOV     RMCS1(R0),R2    ;STORE RMCS1 AT R2
 3739
 3740                                   ;VERIFY THAT REQUEST FLOP IS SET IF PGM IS SET
 3741   035550  016005  000012                  MOV     RMDS(R0),R5     ;STORE RMDS AT R5
 3742   035554  032705  001000                  BIT     #PGM,R5         ;SEE IF PGM IS SET
 3743   035560  001415                          BEQ     20$             ;DONT TEST REQUEST IF PGM IS ZERO
 3744   035562  016037  000040  001142          MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
 3745   035570  042737  037777  001142          BIC     #^C<RQA!RQB>,$BDDAT
 3746   035576  001006                          BNE     20$                     ;BRANCH IF REQUEST IS SET
 3747   035600  010037  001136                  MOV     R0,$BDADR
 3748   035604  062737  000040  001136          ADD     #RMMR2,$BDADR
 3749   035612  104220                          EMT     220
 3750   035614                          20$:
 3751
 3752                                   ;;*****************************************************************************
                                        ;*TEST 77       PORT REQUEST TEST, PART 2
                                        ;;*****************************************************************************
        035614                          TST77:
        035614  000004                          SCOPE                   ;SCOPE CALL
        035616  000240                          NOP
        035620  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        035624  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        035630  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        035634  012737  000077  001226          MOV     #77,$TESTN      ;;SET TEST NUMBER IN APT MAIL BOX
 3753
 3754   035642  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
        035646  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
        035650  104000                          EMT
 3755   035652  000435                          BR      20$
```

```
                                        ;EXECUTE A RELEASE TO RESET REQUEST FLOP
035654                                  10$:
035654  012760  000013  000000                MOV     #RLEASE!GO,RMCS1(R0)    ;LOAD RMCS1

                                        ;READ RMMR2 AND SKIP TEST IF REQUEST FLOPS ARENT RESET
035662  016002  000040                        MOV     RMMR2(R0),R2    ;STORE RMMR2 AT R2
035666  042702  037777                        BIC     #^C<RQA!RQB>,R2
035672  001025                              BNE     20$

                                        ;WRITE THE ATTENTION SUMMARY REGISTER TO SET REQUEST FLOP
035674  012760  177777  000016                MOV     #-1,RMAS(R0)    ;LOAD RMAS

                                        ;VERIFY THAT REQUEST FLOP IS SET IF PGM IS SET
035702  016005  000012                        MOV     RMDS(R0),R5     ;STORE RMDS AT R5
035706  032705  001000                        BIT     #PGM,R5         ;SEE IF PGM IS SET
035712  001415                              BEQ     20$             ;DONT TEST REQUEST IF PGM IS ZERO
035714  016037  000040  001142              MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
035722  042737  037777  001142              BIC     #^C<RQA!RQB>,$BDDAT
035730  001006                              BNE     20$
035732  010037  001136                      MOV     R0,$BDADR
035736  062737  000040  001136              ADD     #RMMR2,$BDADR
035744  104221                              EMT     221
035746                                  20$:

                                        ;;**********************************************************************
                                        ;*TEST 100      PORT REQUEST TEST, PART 3

                                        ;;**********************************************************************
035746                                  ;;
035746  000004                          TST100:
035750  000240                                SCOPE                   ;SCOPE CALL
035752  012706  001100                        NOP
035756  013700  001276                        MOV     #STACK,SP       ;LOAD THE STACK POINTER
035762  013701  001466                        MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
035766  012737  000100  001226                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
                                              MOV     #100,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX

035774  004737  054732                        JSR     PC,SETVV        ;GO SET VOLUME VALID
036000  000402                              BR      10$             ;BRANCH TO 10$ IF NO ERROR
036002  104000                              EMT
036004  000435                              BR      20$

                                        ;EXECUTE A RELEASE COMMAND TO RESET REQUEST FLOP
036006                                  10$:
036006  012760  000013  000000                MOV     #RLEASE!GO,RMCS1(R0)    ;LOAD RMCS1

                                        ;READ RMMR2 AND SKIP TEST IF REQUEST FLOPS ARENT RESET
036014  016002  000040                        MOV     RMMR2(R0),R2    ;STORE RMMR2 AT R2
036020  042702  037777                        BIC     #^C<RQA!RQB>,R2
036024  001025                              BNE     20$

                                        ;WRITE RMDA TO SET REQUEST FLOP
036026  012760  000000  000006                MOV     #0,RMDA(R0)     ;LOAD RMDA

                                        ;VERIFY THAT REQUEST FLOP IS SET IF PGM IS SET
036034  016005  000012                        MOV     RMDS(R0),R5     ;STORE RMDS AT R5
036040  032705  001000                        BIT     #PGM,R5         ;SEE IF PGM IS SET
```

```
3801 036044  001415                          BEQ     20$             ;DONT TEST REQUEST IF PGM IS ZERO
3802 036046  016037  000040  001142          MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
3803 036054  042737  037777  001142          BIC     #^C<RQA!RQB>,$BDDAT
3804 036062  001006                          BNE     20$
3805 036064  010037  001136                  MOV     R0,$BDADR
3806 036070  062737  000040  001136          ADD     #RMMR2,$BDADR
3807 036076  104222                          EMT     222
3808
3809 036100                          20$:
3810
3811                                 ;;*********************************************************************
                                     ;*TEST 101       RELEASE TEST

                                     ;;*********************************************************************
     036100                          TST101:
     036100  000004                          SCOPE                   ;SCOPE CALL
     036102  000240                          NOP
     036104  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     036110  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     036114  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     036120  012737  000101  001226          MOV     #101,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
3812
3813                                 ;REQUEST FLOP SHOULD SET WHEN WRITTING RMCS1
3814
3815 036126  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     036132  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
     036134  104000                          EMT
3816 036136  000454                          BR      40$
3817
3818                                 ;EXECUTE A RELEASE COMMAND
3819 036140                          10$:
3820 036140  012760  041001  000024          MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
3821 036146  012760  000013  000000          MOV     #RLEASE!GO,RMCS1(R0)    ;LOAD RMCS1
3822 036154  012702  000002                  MOV     #2,R2
3823 036160                          20$:
     036160  012760  141001  000024          MOV     #DMD!DBEN!MUR!DBCK,RMMR1(R0)    ;LOAD RMMR1
3824 036166  012760  041001  000024          MOV     #DMD!DBEN!MUR,RMMR1(R0) ;LOAD RMMR1
3825 036174  005302                          DEC     R2
3826 036176  001370                          BNE     20$                     ;ISSUE 2 CLOCKS
3827
3828                                 ;VERIFY REQUEST FLOPS ARE RESET
3829 036200  016037  000026  001174          MOV     RMDT(R0),$TMP0  ;STORE RMDT AT $TMP0
3830 036206  016037  000040  001142          MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
3831 036214  042737  037777  001142          BIC     #^C<RQA!RQB>,$BDDAT
3832 036222  001422                          BEQ     40$                     ;BRANCH IF REQUESTS ARE RESET
3833 036224  032737  004000  001174          BIT     #DRQ,$TMP0
3834 036232  001410                          BEQ     30$                     ;BRANCH IF SINGLE PORT DEVICE
3835 036234  032737  100000  001142          BIT     #RQA,$BDDAT
3836 036242  001412                          BEQ     40$                     ;BRANCH IF RQA IS RESET
3837 036244  032737  040000  001142          BIT     #RQB,$BDDAT
3838 036252  001406                          BEQ     40$                     ;BRANCH IF RQB IS RESET
3839
3840                                 ;DRQ IS ZERO AND A REQUEST FLOP IS ON, OR, DRQ IS ONE AND
3841                                 ;BOTH REQUEST FLOPS ARE ON
3842 036254                          30$:
3843 036254  010037  001136                  MOV     R0,$BDADR
3844 036260  062737  000040  001136          ADD     #RMMR2,$BDADR
```

```
     036266  104223                          EMT     223
     036270                          40$:                               ;END OF TEST


                                     ;;*******************************************************************
                                     ;*TEST 102      WRITE ATA TEST

                                     ;;*******************************************************************
     036270                          TST102:
     036270  000004                          SCOPE                      ;SCOPE CALL
     036272  000240                          NOP
     036274  012706  001100                  MOV     #STACK,SP          ;LOAD THE STACK POINTER
     036300  013700  001276                  MOV     $BASE,R0           ;R0 = UNIBUS ADDRESS
     036304  013701  001466                  MOV     TS!QUE,R1          ;R1 = POINTER TO DEVICE
     036310  012737  000102  001226          MOV     #102,$TESTN        ;;SET TEST NUMBER IN APT MAIL BOX

                                     ;CLEAR THE DEVICE, SET DIAGNOSTIC MODE THEN SET UNIT READY
     036316  004737  055156                  JSR     PC,CNTCLR          ;GO CLEAR CONTROLLER
     036322  012760  000001  000024          MOV     #DMD,RMMR1(R0)     ;LOAD RMMR1
     036330  012760  000000  000014          MOV     #0,RMER1(R0)       ;LOAD RMER1
     036336  012760  000000  000042          MOV     #0,RMER2(R0)       ;LOAD RMER2
     036344  012760  001001  000024          MOV     #DMD!MUR,RMMR1(R0)         ;LOAD RMMR1

                                     ;WRITE THE ATTENTION SUMMARY REGISTER
     036352  111102                          MOVB    (R1),R2                    ;ASSEMBLE THE ATA BIT IN R3
     036354  042702  177770                  BIC     #^CUNTMSK,R2
     036360  116203  063740                  MOVB    ATNTBL(R2),R3
     036364  042703  177400                  BIC     #^CATNMSK,R3
     036370  010360  000016                  MOV     R3,RMAS(R0)        ;LOAD RMAS

                                     ,READ RMDS AND VERIFY THAT ATA IS RESET
     036374  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
     036402  042737  077777  001142          BIC     #^CATA,$BDDAT
     036410  001411                          BEQ     10$                        ;BRANCH IF ATA IS RESET
     036412  010037  001136                  MOV     R0,$BDADR
     036416  062737  000012  001136          ADD     #RMDS,$BDADR
     036424  005037  001140                  CLR     $GDDAT
     036430  104224                          EMT     224
     036432  000417                          BR      20$

                                     ;READ RMAS AND VERIFY ATA IS RESET
     036434                          10$:
     036434  016037  000016  001142          MOV     RMAS(R0),$BDDAT ;STORE RMAS AT $BDDAT
     036442  005103                          COM     R3
     036444  040337  001142                  BIC     R3,$BDDAT
     036450  001410                          BEQ     20$                        ;BRANCH IF ATA IS RESET
     036452  005037  001140                  CLR     $GDDAT
     036456  010037  001136                  MOV     R0,$BDADR
     036462  062737  000016  001136          ADD     #RMAS,$BDADR
     036470  104225                          EMT     225
     036472                          20$:                               ;END OF TEST


                                     ;;*******************************************************************
                                     ;*TEST 103      RESET ATA BY GO TEST

                                     ;;*******************************************************************
     036472                          TST103:
     036472  000004                          SCOPE                      ;SCOPE CALL
```

```
T103    RESET ATA BY GO TEST

        036474  000240                          NOP
        036476  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        036502  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        036506  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        036512  012737  000103  001226          MOV     #103,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
   3887
   3888 036520  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
   3889 036524  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
   3890 036532  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
   3891 036540  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
   3892 036546  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
   3893
   3894                                 ;WITH DEBUG CLOCK ENABLED, SET GO AND VERIFY THAT ATA IS RESET
   3895 036554  012760  000001  000000          MOV     #GO,RMCS1(R0)   ;LOAD RMCS1
   3896 036562  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
   3897 036570  042737  077777  001142          BIC     #^CATA,$BDDAT
   3898 036576  001410                          BEQ     10$                     ;BRANCH IF ATA IS RESET
   3899 036600  005037  001140                  CLR     $GDDAT
   3900 036604  010037  001136                  MOV     R0,$BDADR
   3901 036610  062737  000012  001136          ADD     #RMDS,$BDADR
   3902 036616  104226                          EMT     226
   3903
   3904 036620                          10$:                                    ;END OF TEST
   3905
   3906                                 ;;**********************************************************************
                                        ;*TEST 104       UNIT READY ATA TEST
                                        ;;**********************************************************************
        036620
        036620  000004                  TST104:
                                                SCOPE                   ;SCOPE CALL
        036622  000240                          NOP
        036624  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
        036630  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        036634  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        036640  012737  000104  001226          MOV     #104,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
   3907
   3908                                 ;SET DIAGNOSTIC MODE AND CLEAR ATA
   3909 036646  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
   3910 036652  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
   3911 036660  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
   3912 036666  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
   3913 036674  012760  177777  000016          MOV     #-1,RMAS(R0)    ;LOAD RMAS
   3914
   3915                                 ;SET UNIT READY AND VERIFY ATA IS SET
   3916 036702  012760  001001  000024          MOV     #DMD!MUR,RMMR1(R0)      ;LOAD RMMR1
   3917 036710  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
   3918 036716  042737  077777  001142          BIC     #^CATA,$BDDAT
   3919 036724  001011                          BNE     10$                     ;BRANCH IF ATA IS SET
   3920 036726  010037  001136                  MOV     R0,$BDADR
   3921 036732  062737  000012  001136          ADD     #RMDS,$BDADR
   3922 036740  012737  100000  001140          MOV     #ATA,$GDDAT
   3923 036746  104227                          EMT     227
   3924
   3925                                 ;CLEAR ATA, RESET UNIT READY, AND VERIFY ATA IS SET
   3926 036750                          10$:
   3927 036750  012760  177777  000016          MOV     #-1,RMAS(R0)    ;LOAD RMAS
   3928 036756  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
```

```
3929 036764 016037 000012 001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
3930 036772 042737 077777 001142          BIC     #^CATA,$BDDAT
3931 037000 001011                        BNE     20$
3932 037002 010037 001136                 MOV     R0,$BDADR
3933 037006 062737 000012 001136          ADD     #RMDS,$BDADR
3934 037014 012737 100000 001140          MOV     #ATA,$GDDAT
3935 037022 104230                        EMT     230
3936
3937 037024                          20$:                                ;END OF TEST
3938
3939                                 ;;*****************************************************************
                                     ;*TEST 105      ERROR ATA TEST

                                     ;;*****************************************************************
     037024                          TST105:
     037024 000004                          SCOPE                       ;SCOPE CALL
     037026 000240                          NOP
     037030 012706 001100                   MOV     #STACK,SP           ;LOAD THE STACK POINTER
     037034 013700 001276                   MOV     $BASE,R0            ;R0 = UNIBUS ADDRESS
     037040 013701 001466                   MOV     TSTQUE,R1           ;R1 = POINTER TO DEVICE
     037044 012737 000105 001226            MOV     #105,$TESTN         ;;SET TEST NUMBER IN APT MAIL BOX
3940
3941                                 ;CLEAR THE DEVICE AND RESET ATTENTION
3942 037052 004737 055156                   JSR     PC,CNTCLR           ;GO CLEAR CONTROLLER
3943 037056 012760 000001 000024            MOV     #DMD,RMMR1(R0)      ;LOAD RMMR1
3944 037064 012760 000000 000014            MOV     #0,RMER1(R0)        ;LOAD RMER1
3945 037072 012760 000000 000042            MOV     #0,RMER2(R0)        ;LOAD RMER2
3946 037100 012760 177777 000016            MOV     #-1,RMAS(R0)        ;LOAD RMAS
3947
3948                                 ;WRITE ONES IN ERROR REGISTER 1 AND VERIFY ATA IS SET
3949 037106 012760 177777 000014            MOV     #-1,RMER1(R0)       ;LOAD RMER1
3950 037114 016037 000012 001142            MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
3951 037122 042737 077777 001142            BIC     #^CATA,$BDDAT
3952 037130 001011                          BNE     10$
3953 037132 012737 100000 001140            MOV     #ATA,$GDDAT
3954 037140 010037 001136                   MOV     R0,$BDADR
3955 037144 062737 000012 001136            ADD     #RMDS,$BDADR
3956 037152 104231                          EMT     231
3957
3958 037154                          10$:                                ;END OF TEST
3959
3960                                 ;;*****************************************************************
                                     ;*TEST 106      REGISTER TRANSFER ATA TEST

                                     ;;*****************************************************************
     037154                          TST106:
     037154 000004                          SCOPE                       ;SCOPE CALL
     037156 000240                          NOP
     037160 012706 001100                   MOV     #STACK,SP           ;LOAD THE STACK POINTER
     037164 013700 001276                   MOV     $BASE,R0            ;R0 = UNIBUS ADDRESS
     037170 013701 001466                   MOV     TSTQUE,R1           ;R1 = POINTER TO DEVICE
     037174 012737 000106 001226            MOV     #106,$TESTN         ;;SET TEST NUMBER IN APT MAIL BOX
3961
3962 037202 012702 037330                   MOV     #100$,R2                    ;INITIALIZE TABLE ADDRESS
3963
3964                                 ;FORCE COMPOSITE ERROR AND RESET ATA
3965 037206                          5$:
```

```
3966 037206  004737  055156                  JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
3967 037212  012760  000001  000024          MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
3968 037220  012760  177777  000014          MOV     #-1,RMER1(R0)   ;LOAD RMER1
3969 037226  012760  177777  000016          MOV     #-1,RMAS(R0)    ;LOAD RMAS
3970
3971                                 ;WRITE THE TEST REGISTER AND VERIFY ATA
3972 037234  011203                          MOV     (R2),R3                 ;GENERATE REGISTER ADDRESS
3973 037236  060003                          ADD     R0,R3
3974 037240  005013                          CLR     (R3)
3975 037242  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
3976 037250  042737  077777  001142          BIC     #^CATA,$BDDAT
3977 037256  016237  000002  001140          MOV     2(R2),$GDDAT
3978 037264  023737  001140  001142          CMP     $GDDAT,$BDDAT
3979 037272  001410                          BEQ     10$                     ;BRANCH IF ATA IS OK
3980 037274  010337  001174                  MOV     R3,$TMP0
3981 037300  010037  001136                  MOV     R0,$BDADR
3982 037304  062737  000012  001136          ADD     #RMDS,$BDADR
3983 037312  104232                          EMT     232
3984
3985                                 ;MOVE TABLE POINTER - EXIT IF DONE
3986 037314                          10$:
3987 037314  062702  000004                  ADD     #4,R2
3988 037320  005712                          TST     (R2)
3989 037322  100401                          BMI     20$                     ;EXIT IF ENTRY MINUS
3990 037324  000730                          BR      5$
3991 037326  000410                  20$:    BR      200$                    ;JUMP OVER TABLE
3992
3993                                 ;TABLE OF REGISTER ADDRESSES AND ATA BITS
3994 037330                          100$:
3995 037330  000016                          .WORD   RMAS
3996 037332  000000                          .WORD
3997
3998 037334  000006                          .WORD   RMDA
3999 037336  100000                          .WORD   ATA
4000
4001 037340  000000                          .WORD   RMCS1
4002 037342  000000                          .WORD
4003
4004 037344  177777                          .WORD   -1                      ;END OF TABLE
4005 037346  000000                          .WORD
4006
4007 037350                          200$:                                   ;END OF TEST
4008
4009                                 ;;*****************************************************************
                                     ;*TEST 107       P SET ATA TEST
                                     ;;*****************************************************************
     037350                          TST107:
     037350  000004                          SCOPE                   ;SCOPE CALL
     037352  000240                          NOP
     037354  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     037360  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     037364  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     037370  012737  000107  001226          MOV     #107,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
4010
4011 037376  012702  037540                  MOV     #100$,R2        ;INITIALIZE TABLE POINTER
4012 037402                          10$:
```

```
4013 037402  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     037406  000402                        BR      20$             ;BRANCH TO 20$ IF NO ERROR
     037410  104000                        EMT
4014 037412  000451                        BR      50$
4015
4016                                  ;EXECUTE THE COMMAND FROM THE TABLE
4017 037414                           20$:
4018 037414  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4019 037422  011203                        MOV     (R2),R3         ;GET FUNCTION CODE
4020 037424  052703  000001                BIS     #GO,R3
4021 037430  010360  000000                MOV     R3,RMCS1(R0)    ;LOAD RMCS1
4022 037434  012703  000003                MOV     #3,R3
4023 037440                           30$:
4024 037440  012760  141001  000024        MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4025 037446  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4026 037454  005303                        DEC     R3
4027 037456  001370                        BNE     30$
4028
4029                                  ;VERIFY THAT ATA IS SET
4030 037460  016037  000012  001142        MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
4031 037466  042737  077777  001142        BIC     #^CATA,$BDDAT
4032 037474  001013                        BNE     40$
4033 037476  010037  001136                MOV     R0,$BDADR
4034 037502  062737  000012  001136        ADD     #RMDS,$BDADR
4035 037510  012737  000000  001140        MOV     #ATA,$GDDAT
4036 037516  011237  001174                MOV     (R2),$TMP0
4037 037522  104233                        EMT     233
4038
4039                                  ;ADVANCE TABLE POINTER-EXIT IF DONE
4040 037524                           40$:
4041 037524  062702  000002                ADD     #2,R2
4042 037530  005712                        TST     (R2)
4043 037532  100401                        BMI     50$
4044 037534  000722                        BR      10$
4045 037536  000403                  50$:  BR      200$            ;JUMP OVER TABLE
4046
4047                                  ;TABLE OF FUNCTION CODES
4048 037540                           100$:
4049 037540  000014                        .WORD   OFFSET
4050 037542  000016                        .WORD   RTC
4051 037544  177777                        .WORD   -1              ;END OF TABLE
4052 037546                           200$:
4053
4054                                  ;;*****************************************************************
                                      ;*TEST 110       SET WLE TEST

                                      ;;*****************************************************************
     037546                           TST110:
     037546  000004                        SCOPE                   ;SCOPE CALL
     037550  000240                        NOP
     037552  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
     037556  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     037562  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     037566  012737  000110  001226        MOV     #110,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
4055
4056 037574  012702  037770                MOV     #100$,R2        ;INITIALIZE TABLE POINTER
4057 037600                           10$:
```

```
4058 037600  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     037604  000402                        BR      20$             ;BRANCH TO 20$ IF NO ERROR
     037606  104000                        EMT
4059 037610  000466                        BR      50$
4060
4061                                ;ENABLE DEBUG CLOCK AND SET WRITE PROTECT ACCORDING TO TABLE
4062 037612                         20$:
4063 037612  016203  000002                MOV     2(R2),R3        ;GET WRITE PROTECT FROM TABLE
4064 037616  052703  041001                BIS     #DMD!MUR!DBEN,R3        ;SET OTHER MAINT BITS
4065 037622  010360  000024                MOV     R3,RMMR1(R0)    ;LOAD RMMR1
4066
4067                                ;LOAD AND EXECUTE THE COMMAND FROM THE TABLE
4068 037626  011204                        MOV     (R2),R4         ;GET FUNCTION CODE FROM TABLE
4069 037630  052704  000001                BIS     #GO,R4          ;SET GO
4070 037634  010460  000000                MOV     R4,RMCS1(R0)    ;LOAD RMCS1
4071 037640  012705  000002                MOV     #2,R5           ;R5-CLOCK COUNT
4072 037644  052703  100000         30$:   BIS     #DBCK,R3        ;SET CLOCK
4073 037650  010360  000024                MOV     R3,RMMR1(R0)    ;LOAD RMMR1
4074 037654  042703  100000                BIC     #DBCK,R3        ;RESET CLOCK
4075 037660  010360  000024                MOV     R3,RMMR1(R0)    ;LOAD RMMR1
4076 037664  005305                        DEC     R5
4077 037666  001366                        BNE     30$             ;ISSUE 2 CLOCKS
4078
4079                                ;VERIFY THAT WRITE LOCK ERROR IS ACCORDING TO TABLE
4080 037670  016037  000014  001142        MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
4081 037676  042737  173777  001142        BIC     #^CWLE,$BDDAT
4082 037704  026237  000004  001142        CMP     4(R2),$BDDAT
4083 037712  001417                        BEQ     40$             ;BRANCH IF WLE IS OK
4084 037714  016237  000004  001140        MOV     4(R2),$GDDAT    ;SAVE DATA FOR ERROR MSG
4085 037722  010037  001136                MOV     R0,$BDADR
4086 037726  062737  000014  001136        ADD     #RMER1,$BDADR
4087 037734  011237  001174                MOV     (R2),$TMP0      ;$TMP0=FUNCTION CODE
4088 037740  016237  000002  001176        MOV     2(R2),$TMP1     ;$TMP1=WRITE PROTECT
4089 037746  104234                        EMT     234
4090 037750  000406                        BR      50$
4091
4092                                ;ADVANCE TABLE POINTER TO NEXT FUNCTION CODE-EXIT IF DONE
4093 037752                         40$:
4094 037752  062702  000006                ADD     #6,R2
4095 037756  005762  000002                TST     2(R2)
4096 037762  100401                        BMI     50$
4097 037764  000705                        BR      10$             ;RFPEAT TEST
4098
4099 037766  000416                 50$:   BR      200$            ;JUMP OVER TABLE
4100
4101                                ;TABLE OF FUNCTION CODES, WRITE PROTECT AND WRITE LOCK ERRORS
4102 037770                         100$:
4103 037770  000060                        .WORD   WD              ;WRITE DATA COMMAND
4104 037772  000010                        .WORD   MWP             ;WRITE PROTECT ON
4105 037774  004000                        .WORD   WLE             ;WRITE LOCK ERROR ONE
4106
4107 037776  000060                        .WORD   WD              ;WRITE DATA COMMAND
4108 040000  000000                        .WORD                   ;MWP OFF
4109 040002  000000                        .WORD                   ;WLE OFF
4110
4111 040004  000070                        .WORD   RD              ;READ DATA COMMAND
4112 040006  000010                        .WORD   MWP             ;MWP ON
```

```
T110    SET WLE TEST

4113 040010  000000                        .WORD                   ;WLE OFF
4114
4115 040012  000020                        .WORD   RIP             ;READ IN PRESET COMMAND
4116 040014  000010                        .WORD   MWP             ;MWP ON
4117 040016  000000                        .WORD                   ;WLE OFF
4118
4119 040020  000000                        .WORD                   ;END OF TABLE
4120 040022  177777                        .WORD   -1
4121
4122 040024                          200$:                         ;END OF TEST
4123
4124                                 ;;*****************************************************************
                                     ;*TEST 111      EXCEPTION TEST
                                     ;;*****************************************************************
     040024                          TST111:
     040024  000004                         SCOPE                  ;SCOPE CALL
     040026  000240                         NOP
     040030  012706  001100                 MOV     #STACK,SP      ;LOAD THE STACK POINTER
     040034  013700  001276                 MOV     $BASE,R0       ;R0 = UNIBUS ADDRESS
     040040  013701  001466                 MOV     TSTQUE,R1      ;R1 = POINTER TO DEVICE
     040044  012737  000111  001226         MOV     #111,$TESTN    ;;SET TEST NUMBER IN APT MAIL BOX
4125
4126                                 ;WITH OCCUPIED SET, EACH OF THE FOLLOWING ERRORS SHOULD CAUSE AN
4127                                 ;EXCEPTION:
4128                                 ;
4129                                 ;       PAR, IF RUN AND GO IS SET
4130                                 ;       RMR, IF RUN AND GO IS SET
4131                                 ;       ILR, IF RUN AND GO IS SET
4132                                 ;       DCK
4133                                 ;       HCE
4134                                 ;       HCRC
4135                                 ;       FER
4136                                 ;       OPI
4137
4138 040052  012702  040324                MOV     #100$,R2        ;INITIALIZE TABLE POINTER
4139
4140                                 ;INITIALIZE AND VERIFY THAT EXCEPTION IS RESET
4141 040056                          10$:
4142 040056  004737  055156                JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
4143 040062  016037  000024  001142         MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
4144 040070  042737  167777  001142         BIC     #^CREX,$BDDAT
4145 040076  001410                        BEQ     20$             ;BRANCH IF EXCEPTION IS 0
4146 040100  010037  001136                MOV     R0,$BDADR
4147 040104  062737  000024  001136         ADD     #RMMR1,$BDADR
4148 040112  005037  001140                CLR     $GDDAT
4149 040116  104235                        EMT     235
4150 040120                          20$:
4151 040120  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     040124  000402                        BR      30$             ;BRANCH TO 30$ IF NO ERROR
     040126  104000                        EMT
4152 040130  000474                        BR      60$
4153
4154                                 ;EXECUTE A WRITE DATA COMMAND TO SET OCCUPIED, RUN AND GO
4155 040132                          30$:
4156 040132  012760  000000  000006         MOV     #0,RMDA(R0)     ;LOAD RMDA
4157 040140  012760  000000  000034         MOV     #0,RMDC(R0)     ;LOAD RMDC
```

```
4158 040146  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4159 040154  012760  000061  000000          MOV     #WD!GO,RMCS1(R0)        ;LOAD RMCS1
4160 040162  012703  000002                  MOV     #2,R3
4161 040166                          40$:
     040166  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,PMMR1(R0)    ;LOAD RMMR1
4162 040174  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4163 040202  005303                          DEC     R3
4164 040204  001370                          BNE     40$             ;ISSUE 2 CLOCKS
4165
4166                                 ;LOAD ERROR REGISTER WITH ENTRY FROM TABLE AND VERIFY THAT EXCEPTION IS SET
4167 040206  011260  000014                  MOV     (R2),RMER1(R0)  ;LOAD RMER1
4168 040212  012737  000200  001534          MOV     #200,WATCH      ;SET WATCHDOG TIMER VALUE
     040220  004777  141312                  JSR     PC,@CLOCK       ;START THE CLOCK
4169 040224                          45$:
     040224  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
4170 040232  042737  167777  001142          BIC     #^CREX,$BDDAT
4171 040240  001021                          BNE     50$
4172 040242  005737  001534                  TST     WATCH           ;HAS CLOCK EXPIRED ??
4173 040246  001366                          BNE     45$             ;NO - TAKE ANOTHER SAMPLE
4174 040250  004777  141264                  JSR     PC,@STOPCL      ;STOP THE CLOCK
4175 040254  012737  010000  001140          MOV     #REX,$GDDAT
4176 040262  010037  001136                  MOV     R0,$BDADR
4177 040266  062737  000024  001136          ADD     #RMMR1,$BDADR
4178 040274  011237  001174                  MOV     (R2),$TMP0
4179 040300  104236                          EMT     236
4180 040302  000407                          BR      60$
4181
4182                                 ;ADVANCE TABLE POINTER-EXIT IF DONE
4183 040304                          50$:
4184 040304  004777  141230                  JSR     PC,@STOPCL      ;STOP THE CLOCK
4185 040310  062702  000002                  ADD     #2,R2
4186 040314  005712                          TST     (R2)
4187 040316  001401                          BEQ     60$
4188 040320  000656                          BR      10$
4189 040322  000402                  60$:    BR      200$            ;JUMP OVER TABLE
4190
4191                                 ;PRESENTLY, THE TABLE HAS ONLY ONE ENTRY, THE TEST USING RMR.  THE
4192                                 ;TABLE SHOULD BE EXPANDED TO TEST ALL THE CONDITIONS LISTED ABOVE IF
4193                                 ;A HARDWARE CHANGE IS MADE SUCH THAT IT IS POSSIBLE TO WRITE ERROR
4194                                 ;REGISTER 1 WITH GO SET.
4195 040324                          100$:
4196 040324  000004                          .WORD   RMR             ;RMR IS CAUSED BY HARDWARE
4197
4198 040326  000000                          .WORD                   ;END OF TABLE
4199 040330                          200$:                           ;END OF TEST
4200
4201                                 ;;*****************************************************************
                                     ;*TEST 112       RECALIBRATE TEST

                                     ;;*****************************************************************
     040330                          TST112:
     040330  000004                          SCOPE                   ;SCOPE CALL
     040332  000240                          NOP
     040334  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     040340  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     040344  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     040350  012737  000112  001226          MOV     #112,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
```

```
4202
4203
4204                                    ;VERIFY THAT OPI SETS IF UNIT READY DROPS AFTER DECODE
4205
4206 040356  004737  054732                    JSR     PC,SETVV        ;GO SET VOLUME VALID
     040362  000403                            BR      10$             ;BRANCH TO 10$ IF NO ERROR
     040364  104000                            EMT
4207 040366  000137  041664                    JMP     330$
4208
4209                                    ;ENABLE DEBUG CLOCK AND LOAD RECALIBRATE COMMAND
4210 040372                             10$:
4211 040372  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4212 040400  012760  000000  000014            MOV     #0,RMER1(R0)    ;LOAD RMER1
4213 040406  012760  000000  000042            MOV     #0,RMER2(R0)    ;LOAD RMER2
4214 040414  012760  000007  000000            MOV     #RECAL!GO,RMCS1(R0)     ;LOAD RMCS1
4215
4216                                    ;STEP COMMAND SEQUENCER TO RECAL COM (2 CLOCKS)
4217 040422  012702  000002                    MOV     #2,R2
4218 040426                             20$:
     040426  012760  141001  000024            MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4219 040434  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4220 040442  005302                            DEC     R2
4221 040444  001370                            BNE     20$
4222
4223                                    ;DROP UNIT READY AND STEP COMMAND SEQUENCER (2 CLOCKS)
4224 040446  012760  040001  000024            MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
4225 040454  012702  000002                    MOV     #2,R2
4226 040460                             30$:
     040460  012760  140001  000024            MOV     #DMD!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
4227 040466  012760  040001  000024            MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
4228 040474  005302                            DEC     R2
4229 040476  001370                            BNE     30$
4230
4231                                    ;VERIFY THAT OPI IS SET
4232 040500  016037  000014  001142            MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
4233 040506  042737  157777  001142            BIC     #^COPI,$BDDAT
4234 040514  001011                            BNE     40$
4235 040516  012737  020000  001140            MOV     #OPI,$GDDAT
4236 040524  010037  001136                    MOV     R0,$BDADR
4237 040530  062737  000014  001136            ADD     #RMER1,$BDADR
4238 040536  104241                            EMT     241
4239
4240 040540  012737  040546  001124  40$:      MOV     #50$,$LPERR     ;CHANGE LOOP ON ERROR ADDRESS
4241
4242                                    ;VERIFY THAT RECALIBRATE ABORTS DURING EXECUTION
4243 040546                             50$:
4244 040546  004737  054732                    JSR     PC,SETVV        ;GO SET VOLUME VALID
     040552  000403                            BR      60$             ;BRANCH TO 60$ IF NO ERROR
     040554  104000                            EMT
4245 040556  000137  041664                    JMP     330$
4246
4247                                    ;ENABLE DEBUG CLOCK AND LOAD RECALIBRATE COMMAND
4248 040562                             60$:
4249 040562  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4250 040570  012760  000000  000014            MOV     #0,RMER1(R0)    ;LOAD RMER1
4251 040576  012760  000000  000042            MOV     #0,RMER2(R0)    ;LOAD RMER2
4252 040604  012760  000007  000000            MOV     #RECAL!GO,RMCS1(R0)     ;LOAD RMCS1
```

```
                                        ;STEP THE COMMAND SEQUENCER TO FIRST TEST FOR ABORT (3 CLOCKS)
040612  012702  000003                          MOV     #3,R2
040616                                  70$:
040616  012760  141001  000024                  MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
040624  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
040632  005302                                  DEC     R2
040634  001370                                  BNE     70$

                                        ;SET DRIVE FAULT TO CAUSE ABORT CON^ITION
040636  012760  041101  000024                  MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1

                                        ;STEP 2 CLOCKS AND VERIFY GO IS RESET
040644  012702  000002                          MOV     #2,R2
040650                                  80$:
040650  012760  141101  000024                  MOV     #DMD!MUR!DBEN!MDF!DBCK,RMMR1(R0)        ;LOAD RMMR1
040656  012760  041101  000024                  MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
040664  005302                                  DEC     R2
040666  001370                                  BNE     80$
040670  016037  000000  001142                  MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
040676  042737  177776  001142                  BIC     #^CGO,$BDDAT
040704  001405                                  BEQ     90$
040706  010037  001136                          MOV     R0,$BDADR
040712  005037  001140                          CLR     $GDDAT
040716  104242                                  EMT     242

040720  012737  040726  001124  90$:    MOV     #100$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS

                                        ;VERIFY OPI SETS IF ON CYLINDER LATCH DOESNT CLEAR
040726                                  100$:
040726  004737  054732                          JSR     PC,SETVV        ;GO SET VOLUME VALID
040732  000403                                  BR      110$            ;BRANCH TO 110$ IF NO ERROR
040734  104000                                  EMT
040736  000137  041664                          JMP     330$

                                        ;ENABLE DEBUG CLOCK AND LOAD RECALIBRATE COMMAND
040742                                  110$:
040742  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
040750  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
040756  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
040764  012760  000007  000000                  MOV     #RECAL!GO,RMCS1(R0)     ;LOAD RMCS1

                                        ;STEP THE COMMAND SEQUENCER
040772  012702  000017                          MOV     #15.,R2
040776                                  120$:
040776  012760  141001  000024                  MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
041004  012760  041C01  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
041012  005302                                  DEC     R2
041014  001370                                  BNE     120$

                                        ;VERIFY THAT OPI IS SET
041016  016037  000014  001142                  MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
041024  042737  157777  001142                  BIC     #^COPI,$BDDAT
041032  001011                                  BNE     130$
041034  010037  001136                          MOV     R0,$BDADR
041040  062737  000014  001136                  ADD     #RMER1,$BDADR
041046  012737  020000  001140                  MOV     #OPI,$GDDAT
```

```
                                        EMT     243
                                        
041056  012737  041064  001124  130$:   MOV     #150$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
                                        
                                ;VERIFY ATA SETS IF DRIVE COMPLETES RECALIBRATE (ON CYLINDER SETS)
                                150$:
                                        JSR     PC,SETVV        ;GO SET VOLUME VALID
                                        BR      160$            ;BRANCH TO 160$ IF NO ERROR
                                        EMT
041074  000137  041664                  JMP     330$
                                        
                                ;ENABLE DEBUG CLOCK AND LOAD RECALIBRATE COMMAND
                                160$:
041100  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
041106  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
041114  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
041122  012760  000007  000000          MOV     #RECAL!GO,RMCS1(R0)     ;LOAD RMCS1
                                        
                                ;STEP COMMAND SEQUENCER TO FIRST ON LATCH TEST (13 CLOCKS)
041130  012702  000015                  MOV     #13.,R2
                                170$:
041134  012760  141401  000024          MOV     #DMD!MUR!DBEN!DBCK!MOC,RMMR1(R0)        ;LOAD RMMR1
041142  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
041150  005302                          DEC     R2
041152  001370                          BNE     170$
                                        
                                ;DROP ON CYLINDER TO RESET LATCH, THEN SET ON CYLINDER
041154  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
041162  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
                                        
                                ;STEP COMMAND SEQUENCER TO SET ATTENTION (3 CLOCKS)
041170  012702  000003                  MOV     #3,R2
                                180$:
041174  012760  141401  000024          MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
041202  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
041210  005302                          DEC     R2
041212  001370                          BNE     180$
                                        
                                ;VERIFY ATA IS SET
041214  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
041222  042737  077777  001142          BIC     #^CATA,$BDDAT
041230  001011                          BNE     190$
041232  012737  100000  001140          MOV     #ATA,$GDDAT
041240  010037  001136                  MOV     R0,$BDADR
041244  062737  000012  001136          ADD     #RMDS,$BDADR
041252  104244                          EMT     244
                                        
041254  012737  041262  001124  190$:   MOV     #200$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
                                        
                                ;VERIFY THAT RECALIBRATE ABORTS AFTER EXECUTION DURING WAIT LOOP
                                200$:
                                        JSR     PC,SETVV        ;GO SET VOLUME VALID
                                        BR      210$            ;BRANCH TO 210$ IF NO ERROR
                                        EMT
041272  000574                          BR      330$
                                        
                                ;ENABLE DEBUG CLOCK AND LOAD RECALIBRATE COMMAND
```

```
                                        210$:
041274                                          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
041274  012760  041401  000024                MOV     #0,RMER1(R0)    ;LOAD RMER1
041302  012760  000000  000014                MOV     #0,RMER2(R0)    ;LOAD RMER2
041310  012760  000000  000042                MOV     #RECAL!GO,RMCS1(R0)     ;LOAD RMCS1
041316  012760  000007  000000
                                        ;STEP COMMAND SEQUENCER TO FIRST ON LATCH TEST (13 CLOCKS)
041324  012702  000015                        MOV     #13.,R2
041330                                  220$:
041330  012760  141401  000024                MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
041336  012760  041401  000024                MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
041344  005302                                DEC     R2
041346  001370                                BNE     220$
                                        ;DROP ON CYLINDER TO RESET LATCH, LEAVE ON CYLINDER 0
041350  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
                                        ;STEP COMMAND SEQUENCER THROUGH WAIT LOOP (7 CLOCKS)
041356  012702  000007                        MOV     #7,R2
041362                                  230$:
041362  012760  141001  000024                MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
041370  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
041376  005302                                DEC     R2
041400  001370                                BNE     230$
                                        ;VERIFY THAT GO IS STILL SET
041402  016037  000000  001142                MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
041410  042737  177776  001142                BIC     #^CGO,$BDDAT
041416  001006                                BNE     240$
041420  012737  000001  001140                MOV     #GO,$GDDAT
041426  010037  001136                        MOV     R0,$BDADR
041432  104245                                EMT     24$
                                        ;SET SEEK INCOMPLETE ERROR
041434                                  240$:
041434  012760  041201  000024                MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
                                        ;STEP COMMAND SEQUENCER AND VERIFY GO RESETS (3 CLOCKS)
041442  012702  000003                        MOV     #3,R2
041446                                  250$:
041446  012760  141201  000024                MOV     #DMD!MUR!DBEN!MSER!DBCK,RMMR1(R0)       ;LOAD RMMR1
041454  012760  041201  000024                MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
041462  005302                                DEC     R2
041464  001370                                BNE     250$
041466  016037  000000  001142                MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
041474  042737  177776  001142                BIC     #^CGO,$BDDAT
041502  001405                                BEQ     260$
041504  010037  001136                        MOV     R0,$BDADR
041510  005037  001140                        CLR     $GDDAT
041514  104246                                EMT     246
041516  012737  041524  001124  260$:         MOV     #300$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
                                        ;VERIFY THE TAG BUS DURING RECALIBRATE
041524                                  300$:
041524  004737  054732                        JSR     PC,SETVV        ;GO SET VOLUME VALID
041530  000402                                BR      310$            ;BRANCH TO 310$ IF NO ERROR
```

```
041532  104000                          EMT
4413 041534  000453                     BR      330$
4414
4415                                ;ENABLE DEBUG CLOCK AND LOAD RECALIBRATE COMMAND
4416 041536                         310$:
4417 041536  012760  041401  000024     MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4418 041544  012760  000000  000014     MOV     #0,RMER1(R0)    ;LOAD RMER1
4419 041552  012760  000000  000042     MOV     #0,RMER2(R0)    ;LOAD RMER2
4420 041560  012760  000007  000000     MOV     #RECAL!GO,RMCS1(R0)     ;LOAD RMCS1
4421 041566  012702  041666             MOV     #400$,R2        ;INITIALIZE TABLE POINTER
4422
4423                                ;VERIFY TAG BUS ACCORDING TO TABLE
4424 041572                         315$:
041572  016037  000040  001142         MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
4425 041600  042737  150000  001142     BIC     #RQA!RQB!TST,$BDDAT
4426 041606  021237  001142             CMP     (R2),$BDDAT
4427 041612  001411                     BEQ     320$
4428 041614  011237  001140             MOV     (R2),$GDDAT
4429 041620  010037  001136             MOV     R0,$BDADR
4430 041624  062737  000040  001136     ADD     #RMMR2,$BDADR
4431 041632  104247                     EMT     247
4432 041634  000413                     BR      330$
4433
4434                                ;ADVANCE TO NEXT ENTRY IN TABLE-EXIT IF DONE
4435 041636                         320$:
4436 041636  062702  000002             ADD     #2,R2
4437 041642  005712                     TST     (R2)
4438 041644  100407                     BMI     330$            ;EXIT IF ENTRY NEGATIVE
4439
4440                                ;STEP THE COMMAND SEQUENCER AND REPEAT VERIFICATION
4441 041646  012760  151001  000024     MOV     #DMD!DBEN!MUR!MOV!DBCK,RMMR1(R0)        ;LOAD RMMR1
4442 041654  012760  C:1401  000024     MOV     #DMD!DBEN!MUR!MOC,RMMR1(R0)     ;LOAD RMMR1
4443 041662  000743                     BR      315$
4444 041664  000416                 330$:  BR      500$            ;JUMP OVER TABLE
4445
4446                                ;TABLE OF TAG BUS CONTROL AND BIT VALUES
4447 041666                         400$:
4448 041666  001777                     .WORD   1777            ;BUS BITS AT HIGH IMPEDANCE STATE
4449 041670  001777                     .WORD   1777
4450 041672  006100                     .WORD   CC!CH!BB06      ;CONTROL BITS ENABLED, BIT 6 ON
4451 041674  006100                     .WORD   CC!CH!BB06
4452 041676  026100                     .WORD   TAG!CC!CH!BB06  ;TAG COMES ON
4453 041700  026100                     .WORD   TAG!CC!CH!BB06
4454 041702  026100                     .WORD   TAG!CC!CH!BB06
4455 041704  026100                     .WORD   TAG!CC!CH!BB06
4456 041706  026100                     .WORD   TAG!CC!CH!BB06
4457 041710  026100                     .WORD   TAG!CC!CH!BB06
4458 041712  006100                     .WORD   CC!CH!BB06      ;TAG GOES OFF
4459 041714  006100                     .WORD   CC!CH!BB06
4460 041716  001777                     .WORD   1777            ;CONTROL BITS DISABLED
4461
4462 041720  177777                     .WORD   -1              ;END OF TABLE
4463
4464 041722                         500$:                       ;END OF TEST
4465
4466                                ;;*****************************************************************
                                    ;*TEST 113       SEEK TEST
```

```
                                        ;;*****************************************************************
                                        ;TST113:
041722                                          SCOPE                   ;SCOPE CALL
041722  000004                                    NOP
041724  000240                                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
041726  012706  001100                          MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
041732  013700  001276                          MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
041736  013701  001466                          MOV     #113,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
041742  012737  000113  001226
4467
4468
4469                                    ;VERIFY THAT OPI SETS IF UNIT READY DROPS DURING COMMAND EXECUTION
4470
4471 041750  004737  054732                      JSR     PC,SETVV        ;GO SET VOLUME VALID
041754  000403                                  BR      10$             ;BRANCH TO 10$ IF NO ERROR
041756  104000                                  EMT
4472 041760  000137  043400                      JMP     330$
4473
4474                                    ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
4475                                    ;ADDRESS,  AND LOAD SEEK COMMAND
4476 041764                             10$:
4477 041764  012760  041001  000024              MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4478 041772  012760  000000  000006              MOV     #0,RMDA(R0)     ;LOAD RMDA
4479 042000  012760  000000  000034              MOV     #0,RMDC(R0)     ;LOAD RMDC
4480 042006  012760  000000  000014              MOV     #0,RMER1(R0)    ;LOAD RMER1
4481 042014  012760  000000  000042              MOV     #0,RMER2(R0)    ;LOAD RMER2
4482 042022  012760  000005  000000              MOV     #SEEK!GO,RMCS1(R0)      ;LOAD RMCS1
4483
4484                                    ;STEP COMMAND SEQUENCER TO SEEK COM (2 CLOCKS)
4485 042030  012702  000002                      MOV     #2,R2
4486 042034                             20$:
042034  012760  141001  000024                  MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4487 042042  012760  041001  000024              MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4488 042050  005302                              DEC     R2
4489 042052  001370                              BNE     20$
4490
4491                                    ;DROP UNIT READY AND STEP COMMAND SEQUENCER (2 CLOCKS)
4492 042054  012760  040001  000024              MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
4493 042062  012702  000002                      MOV     #2,R2
4494 042066                             30$:
042066  012760  140001  000024                  MOV     #DMD!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
4495 042074  012760  040001  000024              MOV     #DMD!DBEN,RMMR1(R0)     ;LOAD RMMR1
4496 042102  005302                              DEC     R2
4497 042104  001370                              BNE     30$
4498
4499                                    ;VERIFY THAT OPI IS SET
4500 042106  016037  000014  001142              MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
4501 042114  042737  157777  001142              BIC     #^COPI,$BDDAT
4502 042122  001011                              BNE     40$
4503 042124  012737  020000  001140              MOV     #OPI,$GDDAT
4504 042132  010037  001136                      MOV     R0,$BDADR
4505 042136  062737  000014  001136              ADD     #RMER1,$BDADR
4506 042144  104250                              EMT     250
4507
4508 042146  012737  042154  001124  40$:        MOV     #50$,$LPERR     ;CHANGE LOOP ON ERROR ADDRESS
4509
4510                                    ;VERIFY THAT SEEK ABORTS DURING EXECUTION
```

```
4511 042154                                    50$:
4512 042154  004737  054732                          JSR     PC,SETVV        ;GO SET VOLUME VALID
     042160  000403                                  BR      60$             ;BRANCH TO 60$ IF NO ERROR
     042162  104000                                  EMT
4513 042164  000137  043400                          JMP     330$
4514
4515                                           ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
4516                                           ;ADDRESS,  AND LOAD SEEK COMMAND
4517 042170                                    60$:
4518 042170  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4519 042176  012760  000000  000006                MOV     #0,RMDA(R0)     ;LOAD RMDA
4520 042204  012760  000000  000034                MOV     #0,RMDC(R0)     ;LOAD RMDC
4521 042212  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
4522 042220  012760  000000  000042                MOV     #0,RMER2(R0)    ;LOAD RMER2
4523 042226  012760  000005  000000                MOV     #SEEK!GO,RMCS1(R0)      ;LOAD RMCS1
4524
4525                                           ;STEP THE COMMAND SEQUENCER TO FIRST TEST FOR ABORT (3 CLOCKS)
4526 042234  012702  000003                          MOV     #3,R2
4527 042240                                    70$:
4528 042240  012760  141001  000024                MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4529 042246  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4530 042254  005302                                DEC     R2
4531 042256  001370                                BNE     70$
4532
4533                                           ;SET DRIVE FAULT TO CAUSE ABORT CONDITION
4534 042260  012760  041101  000024                MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
4535
4536                                           ;STEP 2 CLOCKS AND VERIFY GO IS RESET
4537 042266  012702  000002                          MOV     #2,R2
4538 042272                                    80$:
     042272  012760  141101  000024                MOV     #DMD!MUR!DBEN!MDF!DBCK,RMMR1(R0)        ;LOAD RMMR1
4539 042300  012760  041101  000024                MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
4540 042306  005302                                DEC     R2
4541 042310  001370                                BNE     80$
4542 042312  016037  000000  001142                MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
4543 042320  042737  177776  001142                BIC     #^CGO,$BDDAT
4544 042326  001405                                BEQ     90$
4545 042330  010037  001136                        MOV     R0,$BDADR
4546 042334  005037  001140                        CLR     $GDDAT
4547 042340  104251                                EMT     251
4548
4549 042342  012737  042350  001124  90$:    MOV     #100$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
4550
4551                                           ;VERIFY OPI SETS IF ON CYLINDER LATCH DOESNT CLEAR
4552 042350                                    100$:
4553 042350  004737  054732                          JSR     PC,SETVV        ;GO SET VOLUME VALID
     042354  000403                                  BR      110$            ;BRANCH TO 110$ IF NO ERROR
     042356  104000                                  EMT
4554 042360  000137  043400                          JMP     330$
4555
4556                                           ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
4557                                           ;ADDRESS,  AND LOAD SEEK COMMAND
4558 042364                                    110$:
4559 042364  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4560 042372  012760  000000  000006                MOV     #0,RMDA(R0)     ;LOAD RMDA
4561 042400  012760  000000  000034                MOV     #0,RMDC(R0)     ;LOAD RMDC
4562 042406  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
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```
4563 042414  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
4564 042422  012760  000005  000000          MOV     #SEEK!GO,RMCS1(R0)      ;LOAD RMCS1
4565
4566                                 ;STEP THE COMMAND SEQUENCER
4567 042430  012702  000017                  MOV     #15.,R2
4568 042434                          120$:
4569 042434  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4570 042442  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4571 042450  005302                          DEC     R2
4572 042452  001370                          BNE     120$
4573
4574                                 ;VERIFY THAT OPI IS SET
4575 042454  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
4576 042462  042737  157777  001142          BIC     #^COPI,$BDDAT
4577 042470  001011                          BNE     130$
4578 042472  010037  001136                  MOV     R0,$BDADR
4579 042476  062737  000014  001136          ADD     #RMER1,$BDADR
4580 042504  012737  020000  001140          MOV     #OPI,$GDDAT
4581 042512  104252                          EMT     252
4582
4583 042514  012737  042522  001124  130$:   MOV     #150$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
4584
4585                                 ;VERIFY ATA SETS IF DRIVE COMPLETES SEEK (ON CYLINDER SETS)
4586 042522                          150$:
4587 042522  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     042526  000403                          BR      160$            ;BRANCH TO 160$ IF NO ERROR
     042530  104000                          EMT
4588 042532  000137  043400                  JMP     330$
4589
4590                                 ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
4591                                 ;ADDRESS,  AND LOAD SEEK COMMAND
4592 042536                          160$:
4593 042536  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4594 042544  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
4595 042552  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
4596 042560  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
4597 042566  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
4598 042574  012760  000005  000000          MOV     #SEEK!GO,RMCS1(R0)      ;LOAD RMCS1
4599
4600                                 ;STEP COMMAND SEQUENCER TO FIRST ON LATCH TEST (13 CLOCKS)
4601 042602  012702  000015                  MOV     #13.,R2
4602 042606                          170$:
     042606  012760  141401  000024          MOV     #DMD!MUR!DBEN!DBCK!MOC,RMMR1(R0)        ;LOAD RMMR1
4603 042614  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4604 042622  005302                          DEC     R2
4605 042624  001370                          BNE     170$
4606
4607                                 ;DROP ON CYLINDER TO RESET LATCH, THEN SET ON CYLINDER
4608 042626  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4609 042634  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4610
4611                                 ;STEP COMMAND SEQUENCER TO SET ATTENTION (3 CLOCKS)
4612 042642  012702  000003                  MOV     #3,R2
4613 042646                          180$:
4614 042646  012760  141401  000024          MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
4615 042654  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4616 042662  005302                          DEC     R2
```

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4617 042664  001370                          BNE     180$
4618
4619                                 ;VERIFY ATA IS SET
4620 042666  016037  000012  001142          MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
4621 042674  042737  077777  001142          BIC     #^CATA,$BDDAT
4622 042702  001011                          BNE     190$
4623 042704  012737  100000  001140          MOV     #ATA,$GDDAT
4624 042712  010037  001136                  MOV     R0,$BDADR
4625 042716  062737  000012  001136          ADD     #RMDS,$BDADR
4626 042724  104253                          EMT     253
4627
4628 042726  012737  042734  001124  190$:   MOV     #200$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
4629
4630                                 ;VERIFY THAT SEEK ABORTS AFTER EXECUTION DURING WAIT LOOP
4631 042734                          200$:
4632 042734  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     042740  000403                          BR      210$            ;BRANCH TO 210$ IF NO ERROR
     042742  104000                          EMT
4633 042744  000137  043400                  JMP     330$
4634
4635                                 ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
4636                                 ;ADDRESS  AND LOAD SEEK COMMAND
4637 042750                          210$:
4638 042750  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4639 042756  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
4640 042764  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
4641 042772  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
4642 043000  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
4643 043006  012760  000005  000000          MOV     #SEEK!GO,RMCS1(R0)      ;LOAD RMCS1
4644
4645                                 ;STEP COMMAND SEQUENCER TO FIRST ON LATCH TEST (13 CLOCKS)
4646 043014  012702  000015                  MOV     #13.,R2
4647 043020                          220$:
4648 043020  012760  141401  000024          MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
4649 043026  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
4650 043034  005302                          DEC     R2
4651 043036  001370                          BNE     220$
4652
4653                                 ;DROP ON CYLINDER TO RESET LATCH, LEAVE ON CYLINDER 0
4654 043040  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4655
4656                                 ;STEP COMMAND SEQUENCER THROUGH WAIT LOOP (7 CLOCKS)
4657 043046  012702  000007                  MOV     #7,R2
4658 043052                          230$:
4659 043052  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4660 043060  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4661 043066  005302                          DEC     R2
4662 043070  001370                          BNE     230$
4663
4664                                 ;VERIFY THAT GO IS STILL SET
4665 043072  016037  000000  001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
4666 043100  042737  177776  001142          BIC     #^CGO,$BDDAT
4667 043106  001006                          BNE     240$
4668 043110  012737  000001  001140          MOV     #GO,$GDDAT
4669 043116  010037  001136                  MOV     R0,$BDADR
4670 043122  104254                          EMT     254
4671
```

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                                        ;SET SEEK INCOMPLETE ERROR
043124                                  240$:
043124  012760  041201  000024                MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1

                                        ;STEP COMMAND SEQUENCER AND VERIFY GO RESETS (3 CLOCKS)
043132  012702  000003                        MOV     #3,R2
043136                                  250$:
043136  012760  141201  000024                MOV     #DMD!MUR!DBEN!MSER!DBCK,RMMR1(R0)       ;LOAD RMMR1
043144  012760  041201  000024                MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
043152  005302                                DEC     R2
043154  001370                                BNE     250$
043156  016037  000000  001142                MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
043164  042737  177776  001142                BIC     #^CGO,$BDDAT
043172  001405                                BEQ     260$
043174  010037  001136                        MOV     R0,$BDADR
043200  005037  001140                        CLR     $GDDAT
043204  104255                                EMT     255

043206  012737  043220  001124  260$:        MOV     #300$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
043214  012703  000001                        MOV     #1,R3           ;INITIALIZE CYLINDER ADDRESS

                                        ;VERIFY THE TAG BUS DURING SEEK
043220                                  300$:
043220  004737  054732                        JSR     PC,SETVV        ;GO SET VOLUME VALID
043224  000402                                BR      310$            ;BRANCH TO 310$ IF NO ERROR
043226  104000                                EMT
043230  000463                                BR      330$

                                        ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
                                        ;ADDRESS  AND LOAD SEEK COMMAND
043232                                  310$:
043232  012760  041401  000024                MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
043240  012760  000000  000006                MOV     #0,RMDA(R0)     ;LOAD RMDA
043246  010360  000034                        MOV     R3,RMDC(R0)     ;LOAD RMDC
043252  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
043260  012760  000000  000042                MOV     #0,RMER2(R0)    ;LOAD RMER2
043266  012760  000005  000000                MOV     #SEEK!GO,RMCS1(R0)      ;LOAD RMCS1
043274  012702  043414                        MOV     #400$,R2        ;INITIALIZE TABLE POINTER

                                        ;VERIFY TAG BUS ACCORDING TO TABLE AND CYLINDER IN R3
043300                                  315$:
043300  016037  000040  001142                MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
043306  042737  150000  001142                BIC     #RQA!RQB!TST,$BDDAT
043314  011237  001140                        MOV     (R2),$GDDAT
043320  050337  001140                        BIS     R3,$GDDAT       ;OR CYLINDER ADDRESS IN
043324  023737  001140  001142                CMP     $GDDAT,$BDDAT   ;COMPARE EXPECTED AND RECEIVED
043332  001407                                BEQ     320$            ;BRANCH IF TAG BUS OK
043334  010037  001136                        MOV     R0,$BDADR
043340  062737  000040  001136                ADD     #RMMR2,$BDADR
043346  104256                                EMT     256
043350  000413                                BR      330$

                                        ;ADVANCE TO NEXT ENTRY IN TABLE-EXIT IF DONE
043352                                  320$:
043352  062702  000002                        ADD     #2,R2
043356  005712                                TST     (R2)
043360  100407                                BMI     330$            ;EXIT IF ENTRY NEGATIVE
```

```
                                        ;STEP THE COMMAND SEQUENCER AND REPEAT VERIFICATION
043362  012760  151001  000024            MOV     #DMD!DBEN!MUR!MOV!DBCK,RMMR1(R0)        ;LOAD RMMR1
043370  012760  041401  000024            MOV     #DMD!DBEN!MUR!MOC,RMMR1(R0)     ;LOAD RMMR1
043376  000740                            BR      315$

                                        ;REPEAT TAG BUS TEST FOR EACH PRIME CYLINDER, I.E., 1,2,4,...
043400                                  330$:
043400  006303                          ASL     R3              ;SHIFT TO NEXT CYLINDER
043402  020327  002000                    CMP     R3,#1024.
043406  103001                          BHIS    340$            ;EXIT IF WAS DONE
043410  000703                          BR      300$            ;TEST NEXT CYLINDER
043412  000416                  340$:   BR      500$            ;JUMP OVER TABLE

                                        ;TABLE OF TAG BUS CONTROL AND BIT VALUES
043414                                  400$:
043414  001777                          .WORD   1777            ;BUS BITS AT HIGH IMPEDANCE STATE
043416  001777                          .WORD   1777
043420  004000                          .WORD   CC      ;CONTROL BITS ENABLED, BIT 6 ON
043422  004000                          .WORD   CC
043424  024000                          .WORD   TAG!CC  ;TAG COMES ON
043426  024000                          .WORD   TAG!CC
043430  024000                          .WORD   TAG!CC
043432  024000                          .WORD   TAG!CC
043434  024000                          .WORD   TAG!CC
043436  024000                          .WORD   TAG!CC
043440  004000                          .WORD   CC      ;TAG GOES OFF
043442  004000                          .WORD   CC
043444  001777                          .WORD   1777            ;CONTROL BITS DISABLED

043446  177777                          .WORD   -1              ;END OF TABLE

043450                                  500$:                   ;END OF TEST

                                        ;;*****************************************************************
                                        ;*TEST 114       SEARCH TEST
                                        ;;*****************************************************************
043450                                  TST114:
043450  000004                          SCOPE                   ;SCOPE CALL
043452  000240                          NOP
043454  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
043460  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
043464  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
043470  012737  000114  001226          MOV     #114,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX

                                        ;VERIFY THAT OPI SETS IF UNIT READY DROPS DURING COMMAND EXECUTION

043476  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
043502  000403                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
043504  104000                          EMT
043506  000137  045544                  JMP     330$

                                        ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
                                        ;ADDRESS,  AND LOAD SEARCH COMMAND
043512                                  10$:
```

```
 4769 043512  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 4770 043520  012760  000000  000006          MOV     #0,RMDA(R0)      ;LOAD RMDA
 4771 043526  012760  000000  000034          MOV     #0,RMDC(R0)      ;LOAD RMDC
 4772 043534  012760  000000  000014          MOV     #0,RMER1(R0)     ;LOAD RMER1
 4773 043542  012760  000000  000042          MOV     #0,RMER2(R0)     ;LOAD RMER2
 4774 043550  012760  000031  000000          MOV     #SEARCH!GO,RMCS1(R0)     ;LOAD RMCS1
 4775
 4776                                 ;STEP COMMAND SEQUENCER TO SEARCH COM (2 CLOCKS)
 4777 043556  012702  000002                  MOV     #2,R2
 4778 043562                          20$:
      043562  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)     ;LOAD RMMR1
 4779 043570  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 4780 043576  005302                          DEC     R2
 4781 043600  001370                          BNE     20$
 4782
 4783                                 ;DROP UNIT READY AND STEP COMMAND SEQUENCER (2 CLOCKS)
 4784 043602  012760  040000  000024          MOV     #DMD!DBEN,RMMR1(R0)      ;LOAD RMMR1
 4785 043610  012702  000002                  MOV     #2,R2
 4786 043614                          30$:
      043614  012760  140001  000024          MOV     #DMD!DBEN!DBCK,RMMR1(R0)         ;LOAD RMMR1
 4787 043622  012760  040001  000024          MOV     #DMD!DBEN,RMMR1(R0)      ;LOAD RMMR1
 4788 043630  005302                          DEC     R2
 4789 043632  001370                          BNE     30$
 4790
 4791                                 ;VERIFY THAT OPI IS SET
 4792 043634  016037  000014  001142          MOV     RMER1(R0),$BDDAT         ;STORE RMER1 AT $BDDAT
 4793 043642  042737  157777  001142          BIC     #^COPI,$BDDAT
 4794 043650  001011                          BNE     40$
 4795 043652  012737  020000  001140          MOV     #OPI,$GDDAT
 4796 043660  010037  001136                  MOV     R0,$BDADR
 4797 043664  062737  000014  001136          ADD     #RMER1,$BDADR
 4798 043672  104257                          EMT     257
 4799
 4800 043674  012737  043702  001124  40$:    MOV     #50$,$LPERR      ;CHANGE LOOP ON ERROR ADDRESS
 4801
 4802                                 ;VERIFY THAT SEARCH ABORTS DURING EXECUTION
 4803 043702                          50$:
 4804 043702  004737  054732                  JSR     PC,SETVV         ;GO SET VOLUME VALID
      043706  000403                          BR      60$              ;BRANCH TO 60$ IF NO ERROR
      043710  104000                          EMT
 4805 043712  000137  045544                  JMP     330$
 4806
 4807                                 ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
 4808                                 ;ADDRESS,  AND LOAD SEARCH COMMAND
 4809 043716                          60$:
 4810 043716  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 4811 043724  012760  000000  000006          MOV     #0,RMDA(R0)      ;LOAD RMDA
 4812 043732  012760  000000  000034          MOV     #0,RMDC(R0)      ;LOAD RMDC
 4813 043740  012760  000000  000014          MOV     #0,RMER1(R0)     ;LOAD RMER1
 4814 043746  012760  000000  000042          MOV     #0,RMER2(R0)     ;LOAD RMER2
 4815 043754  012760  000031  000000          MOV     #SEARCH!GO,RMCS1(R0)     ;LOAD RMCS1
 4816
 4817                                 ;STEP THE COMMAND SEQUENCER TO FIRST TEST FOR ABORT (3 CLOCKS)
 4818 043762  012702  000003                  MOV     #3,R2
 4819 043766                          70$:
 4820 043766  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)     ;LOAD RMMR1
 4821 043774  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
```

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4822 044002  005302                          DEC     R2
4823 044004  001370                          BNE     70$
4824
4825                                 ;SET DRIVE FAULT TO CAUSE ABORT CONDITION
4826 044006  012760  041101  000024          MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
4827
4828                                 ;STEP 2 CLOCKS AND VERIFY GO IS RESET
4829 044014  012702  000002                  MOV     #2,R2
4830 044020                          80$:
     044020  012760  141101  000024          MOV     #DMD!MUR!DBEN!MDF!DBCK,RMMR1(R0)        ;LOAD RMMR1
4831 044026  012760  041101  000024          MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
4832 044034  005302                          DEC     R2
4833 044036  001370                          BNE     80$
4834 044040  016037  000000  001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
4835 044046  042737  177776  001142          BIC     #^CGO,$BDDAT
4836 044054  001405                          BEQ     90$
4837 044056  010037  001136                  MOV     R0,$BDADR
4838 044062  005037  001140                  CLR     $GDDAT
4839 044066  104260                          EMT     260
4840
4841                                 ;(THE OTHER TWO ABORT TESTS IN THE COMMAND SEQUENCER ARE TESTED
4842                                 ;DURING DATA COMMAND TESTS)
4843
4844 044070  012737  044076  001124  90$:    MOV     #100$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
4845
4846                                 ;VERIFY OPI SETS IF ON CYLINDER LATCH DOESNT CLEAR
4847 044076                          100$:
4848 044076  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     044102  000403                          BR      110$            ;BRANCH TO 110$ IF NO ERROR
     044104  104000                          EMT
4849 044106  000137  045544                  JMP     330$
4850
4851                                 ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
4852                                 ;ADDRESS,  AND LOAD SEARCH COMMAND
4853 044112                          110$:
4854 044112  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4855 044120  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
4856 044126  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
4857 044134  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
4858 044142  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
4859 044150  012760  000031  000000          MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1
4860
4861                                 ;STEP THE COMMAND SEQUENCER
4862 044156  012702  000023                  MOV     #19.,R2
4863 044162                          120$:
4864 044162  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
4865 044170  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
4866 044176  005302                          DEC     R2
4867 044200  001370                          BNE     120$
4868
4869                                 ;VERIFY THAT OPI IS SET
4870 044202  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
4871 044210  042737  157777  001142          BIC     #^COPI,$BDDAT
4872 044216  001011                          BNE     130$
4873 044220  010037  001136                  MOV     R0,$BDADR
4874 044224  062737  000014  001136          ADD     #RMER1,$BDADR
4875 044232  012737  020000  001140          MOV     #OPI,$GDDAT
```

```
                                        EMT     261

044242  012737  044250  001124  130$:   MOV     #150$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS

                                ;VERIFY ATA SETS IF DRIVE COMPLETES SEARCH (ON CYLINDER AND
                                ;SECTOR COMPARE SETS)
044250                          150$:
044250  004737  054732                 JSR     PC,SETVV        ;GO SET VOLUME VALID
044254  000403                         BR      160$            ;BRANCH TO 160$ IF NO ERROR
044256  104000                         EMT
044260  000137  045544                 JMP     330$

                                ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
                                ;ADDRESS,  AND LOAD SEARCH COMMAND
044264                          160$:
044264  012760  041401  000024         MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
044272  012760  000000  000006         MOV     #0,RMDA(R0)     ;LOAD RMDA
044300  012760  000000  000034         MOV     #0,RMDC(R0)     ;LOAD RMDC
044306  012760  000000  000014         MOV     #0,RMER1(R0)    ;LOAD RMER1
044314  012760  000000  000042         MOV     #0,RMER2(R0)    ;LOAD RMER2
044322  012760  000031  000000         MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1

                                ;STEP COMMAND SEQUENCER TC FIRST ON LATCH TEST (17 CLOCKS)
044330  012702  000021                 MOV     #17.,R2
044334                          170$:
044334  012760  141401  000024         MOV     #DMD!MUR!DBEN!DBCK!MOC,RMMR1(R0)        ;LOAD RMMR1
044342  012760  041401  000024         MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
044350  005302                         DEC     R2
044352  001370                         BNE     170$

                                ;DROP ON CYLINDER TO RESET LATCH,AND RAISE INDEX PULSE
                                ;TO SET FORMAT CHANGE FLOP
044354  012760  041005  000024         MOV     #DMD!MUR!DBEN!MI,RMMR1(R0)      ;LOAD RMMR1

                                ;RAISE ON CYLINDER AND INHIBIT SEARCH TIMEOUT
044362  012760  051401  000024         MOV     #DMD!MUR!DBEN!MOC!MSEN,RMMR1(R0)        ;LOAD RMMR1

                                ;STEP COMMAND SEQUENCER TO SEARCH ENABLE (2 CLOCKS)
044370  012702  000002                 MOV     #2,R2
044374                          180$:
044374  012760  151401  000024         MOV     #DMD!MUR!DBEN!MOC!MSEN!DBCK,RMMR1(R0)   ;LOAD RMMR1
044402  012760  051401  000024         MOV     #DMD!MUR!DBEN!MOC!MSEN,RMMR1(R0)        ;LOAD RMMR1
044410  005302                         DEC     R2
044412  001370                         BNE     180$

                                ;FORCE SECTOR COMPARE BY CLOCKING SECTOR PULSE WITH SECTOR COMPARE
                                ;ACTIVE
044414  012760  051403  000024         MOV     #DMD!MUR!MOC!DBEN!MSEN!MSC,RMMR1(R0)    ;LOAD RMMR1
044422  012760  051443  000024         MOV     #DMD!MUR!MOC!DBEN!MSEN!MSC!MS,RMMR1(R0) ;LOAD RMMR1
044430  012760  051403  000024         MOV     #DMD!MUR!MOC!DBEN!MSEN!MSC,RMMR1(R0)    ;LOAD RMMR1

                                ;CLOCK SEQUENCER TO SET ATA (3 CLOCKS)
044436  012702  000003                 MOV     #3,R2           ;R2 = CLOCK COUNT
044442                          185$:
044442  012760  151401  000024         MOV     #DMD!MUR!MOC!DBEN!MSEN!DBCK,RMMR1(R0)   ;LOAD RMMR1
044450  012760  051401  000024         MOV     #DMD!MUR!MOC!DBEN!MSEN,RMMR1(R0)        ;LOAD RMMR1
044456  005302                         DEC     R2
```

```
                                        BNE     185$

                                ;VERIFY ATA IS SET
044462  016037  000012  001142            MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
044470  042737  077777  001142            BIC     #^CATA,$BDDAT
044476  001011                            BNE     190$
044500  012737  100000  001140            MOV     #ATA,$GDDAT
044506  010037  001136                    MOV     R0,$BDADR
044512  062737  000012  001136            ADD     #RMDS,$BDADR
044520  104262                            EMT     262

044522  012737  044530  001124  190$:     MOV     #200$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS

                                ;VERIFY THAT SEARCH ABORTS AFTER EXECUTION DURING SEARCH SEEK LOOP
044530                          200$:
044530  004737  054732                    JSR     PC,SETVV        ;GO SET VOLUME VALID
044534  000403                            BR      210$            ;BRANCH TO 210$ IF NO ERROR
044536  104000                            EMT
044540  000137  045544                    JMP     330$

                                ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
                                ;ADDRESS  AND LOAD SEARCH COMMAND
044544                          210$:
044544  012760  041401  000024            MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
044552  012760  000000  000006            MOV     #0,RMDA(R0)     ;LOAD RMDA
044560  012760  000000  000034            MOV     #0,RMDC(R0)     ;LOAD RMDC
044566  012760  000000  000014            MOV     #0,RMER1(R0)    ;LOAD RMER1
044574  012760  000000  000042            MOV     #0,RMER2(R0)    ;LOAD RMER2
044602  012760  000031  000000            MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1

                                ;STEP COMMAND SEQUENCER TO FIRST ON LATCH TEST (17 CLOCKS)
044610  012702  000021                    MOV     #17.,R2
044614                          220$:
044614  012760  141401  000024            MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
044622  012760  041401  000024            MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
044630  005302                            DEC     R2
044632  001370                            BNE     220$

                                ;DROP ON CYLINDER TO RESET LATCH, LEAVE ON CYLINDER 0
044634  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1

                                ;STEP COMMAND SEQUENCER THROUGH WAIT LOOP (7 CLOCKS)
044642  012702  000007                    MOV     #7,R2
044646                          230$:
044646  012760  141001  000024            MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
044654  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
044662  005302                            DEC     R2
044664  001370                            BNE     230$

                                ;VERIFY THAT GO IS STILL SET
044666  016037  000000  001142            MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
044674  042737  177776  001142            BIC     #^CGO,$BDDAT
044702  001006                            BNE     240$
044704  012737  000001  001140            MOV     #GO,$GDDAT
044712  010037  001136                    MOV     R0,$BDADR
044716  104263                            EMT     263
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                                        ;SET SEEK INCOMPLETE ERROR
                                        240$:
044720                                          MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
044720  012760  041201  000024
                                        ;STEP COMMAND SEQUENCER AND VERIFY GO RESETS (3 CLOCKS)
044726  012702  000003                          MOV     #3,R2
044732                                  250$:
044732  012760  141201  000024                   MOV     #DMD!MUR!DBEN!MSER!DBCK,RMMR1(R0)       ;LOAD RMMR1
044740  012760  041201  000024                   MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
044746  005302                                  DEC     R2
044750  001370                                  BNE     250$
044752  016037  000000  001142                   MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
044760  042737  177776  001142                   BIC     #^CGO,$BDDAT
044766  001405                                  BEQ     260$
044770  010037  001136                          MOV     R0,$BDADR
044774  005037  001140                          CLR     $GDDAT
045000  104264                                  EMT     264

045002  012737  045010  001124  260$:   MOV     #265$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS

                                        ;VERIFY THAT SEARCH ABORTS DURING SECTOR COMPARE LOOP
045010                                  265$:
045010  004737  054732                          JSR     PC,SETVV        ;GO SET VOLUME VALID
045014  000403                                  BR      270$            ;BRANCH TO 270$ IF NO ERROR
045016  104000                                  EMT
045020  000137  045544                          JMP     330$

                                        ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
                                        ;ADDRESS,  AND LOAD SEARCH COMMAND
045024                                  270$:
045024  012760  041401  000024                   MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
045032  012760  000000  000006                   MOV     #0,RMDA(R0)     ;LOAD RMDA
045040  012760  000000  000034                   MOV     #0,RMDC(R0)     ;LOAD RMDC
045046  012760  000000  000032                   MOV     #0,RMER1(R0)    ;LOAD RMER1
045054  012760  000000  000042                   MOV     #0,RMER2(R0)    ;LOAD RMER2
045062  012760  000031  000000                   MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1

                                        ;STEP COMMAND SEQUENCER TO FIRST ON LATCH TEST (17 CLOCKS)
045070  012702  000021                          MOV     #17.,R2
045074                                  275$:
045074  012760  141401  000024                   MOV     #DMD!MUR!DBEN!DBCK!MOC,RMMR1(R0)        ;LOAD RMMR1
045102  012760  041401  000024                   MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
045110  005302                                  DEC     R2
045112  001370                                  BNE     275$

                                        ;DROP ON CYLINDER TO RESET LATCH, AND RAISE INDEX PULSE
                                        ;TO SET FORMAT CHANGE FLOP
045114  012760  041005  000024                   MOV     #DMD!MUR!DBEN!MI,RMMR1(R0)      ;LOAD RMMR1

                                        ;RAISE ON CYLINDER AND INHIBIT SEARCH TIMEOUT
045122  012760  051401  000024                   MOV     #DMD!MUR!DBEN!MOC!MSEN,RMMR1(R0)        ;LOAD RMMR1

                                        ;STEP COMMAND SEQUENCER TO SEARCH ENABLE (2 CLOCKS)
045130  012702  000002                          MOV     #2,R2
045134                                  280$:
045134  012760  151401  000024                   MOV     #DMD!MUR!DBEN!MOC!MSEN!DBCK,RMMR1(R0)   ;LOAD RMMR1
045142  012760  051401  000024                   MOV     #DMD!MUR!DBEN!MOC!MSEN,RMMR1(R0)        ;LOAD RMMR1
```

```
5036 045150  005302                          DEC     R2
5037 045152  001370                          BNE     280$
5038
5039                                 ;VERIFY THAT SEARCH ENABLE IS ON DURING SECTOR COMPARE LOOP
5040 045154  012702  000004                  MOV     #4,R2           ;R2 = CLOCK COUNT
5041 045160                          281$:
5042 045160  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
5043 045166  042737  173777  001142          BIC     #^CESRC,$BDDAT
5044 045174  001411                          BEQ     282$            ;BRANCH IF SEARCH NOT ENABLED
5045 045176  012760  151401  000024          MOV     #DMD!MUR!MOC!DBEN!MSEN!DBCK,RMMR1(R0)   ;LOAD RMMR1
5046 045204  012760  051401  000024          MOV     #DMD!MUR!MOC!DBEN!MSEN,RMMR1(R0)        ;LOAD RMMR1
5047 045212  005302                          DEC     R2
5048 045214  001361                          BNE     281$
5049 045216  000411                          BR      283$
5050 045220  012737  004000  001140  282$:   MOV     #ESRC,$GDDAT
5051 045226  010037  001136                  MOV     R0,$BDADR
5052 045232  062737  000024  001136          ADD     #RMMR1,$BDADR
5053 045240  104265                          EMT     265
5054
5055                                 ;SET DRIVE FAULT TO CAUSE ABORT CONDITION
5056 045242                          283$:
     045242  012760  051501  000024          MOV     #DMD!MUR!DBEN!MOC!MSEN!MDF,RMMR1(R0)    ;LOAD RMMR1
5057
5058                                 ;STEP 2 CLOCKS AND VERIFY GO IS RESET
5059 045250  012702  000002                  MOV     #2,R2           ;R2 = CLOCK COUNT
5060 045254                          285$:
     045254  012760  151501  000024          MOV     #DMD!MUR!DBEN!MOC!MSEN!MDF!DBCK,RMMR1(R0)       ;LOAD RMMR1
5061 045262  012760  051501  000024          MOV     #DMD!MUR!DBEN!MOC!MSEN!MDF,RMMR1(R0)    ;LOAD RMMR1
5062 045270  005302                          DEC     R2
5063 045272  001370                          BNE     285$
5064 045274  016037  000000  001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
5065 045302  042737  177776  001142          BIC     #^CGO,$BDDAT
5066 045310  001406                          BEQ     290$
5067 045312  012737  000000  001140          MOV     #0,$GDDAT
5068 045320  010037  001136                  MOV     R0,$BDADR
5069 045324  104260                          EMT     260
5070
5071 045326  012737  045340  001124  290$:   MOV     #300$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
5072 045334  012703  000001                  MOV     #1,R3           ;INITIALIZE CYLINDER ADDRESS
5073
5074                                 ;VERIFY THE TAG BUS DURING SEARCH
5075 045340                          300$:
5076 045340  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     045344  000402                          BR      310$            ;BRANCH TO 310$ IF NO ERROR
     045346  104000                          EMT
5077 045350  000475                          BR      330$
5078
5079                                 ;ENABLE DEBUG CLOCK, LOAD CYLINDER, TRACK AND SECTOR
5080                                 ;ADDRESS  AND LOAD SEARCH COMMAND
5081 045352                          310$:
5082 045352  012760  041401  000024          MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)      ;LOAD RMMR1
5083 045360  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
5084 045366  010360  000034                  MOV     R3,RMDC(R0)     ;LOAD RMDC
5085 045372  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
5086 045400  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
5087 045406  012760  000031  000000          MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1
5088
```

```
                                ;;*****************************************************************
                                ;       MOV     #400$,R2        ;INITIALIZE TABLE POINTER

                                                                ;HARDWARE ECO CHANGE TO THE PLA OF THE
                                                                ;CS BOARD.
045414  012702  000011          MOV     #9.,R2          ;CLOCK THE SEQUENCER THRU THE FIRST
                                                        ;9. COMMAND SEQUENCES TO ALLOW THE PROGRAM
                                                        ;TO RUN WITH OR WITHOUT THE ECO.
045420                          312$:
045420  012760  141401  000024  MOV     #DMD!DBEN!MUR!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
045426  012760  041401  000024  MOV     #DMD!DBEN!MUR!MOC,RMMR1(R0)     ;LOAD RMMR1
045434  005302                  DEC     R2              ;DONE 9. CLOCKS ?
045436  001370                  BNE     312$            ;NO !!
045440  012702  045602          MOV     #450$,R2        ;INITIALIZE NEW TABLE POINTER
                                ;;*****************************************************************

                                ;VERIFY TAG BUS ACCORDING TO TABLE AND CYLINDER IN R3
045444                          315$:
045444  016037  000040  001142  MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
045452  042737  150000  001142  BIC     #RQA!RQB!TST,$BDDAT
045460  011237  001140          MOV     (R2),$GDDAT
045464  050337  001140          BIS     R3,$GDDAT       ;OR CYLINDER ADDRESS IN
045470  023737  001140  001142  CMP     $GDDAT,$BDDAT   ;COMPARE EXPECTED AND RECEIVED
045476  001407                  BEQ     320$            ;BRANCH IF TAG BUS OK
045500  010037  001136          MOV     R0,$BDADR
045504  062737  000040  001136  ADD     #RMMR2,$BDADR
045512  104266                  EMT     266
045514  000420                  BR      340$

                                ;ADVANCE TO NEXT ENTRY IN TABLE-EXIT IF DONE
045516                          320$:
045516  062702  000002          ADD     #2,R2
045522  005712                  TST     (R2)
045524  100407                  BMI     330$            ;EXIT IF ENTRY NEGATIVE

                                ;STEP THE COMMAND SEQUENCER AND REPEAT VERIFICATION
045526  012760  141401  000024  MOV     #DMD!DBEN!MUR!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
045534  012760  041401  000024  MOV     #DMD!DBEN!MUR!MOC,RMMR1(R0)     ;LOAD RMMR1
045542  000740                  BR      315$

                                ;REPEAT TAG BUS TEST FOR EACH PRIME CYLINDER, I.E., 1,2,4,...
045544                          330$:
045544  006303                  ASL     R3              ;SHIFT TO NEXT CYLINDER
045546  020327  002000          CMP     R3,#1024.
045552  103001                  BHIS    340$            ;EXIT IF WAS DONE
045554  000671                  BR      300$            ;TEST NEXT CYLINDER
045556  000424          340$:   BR      500$            ;JUMP OVER TABLE

                                ;TABLE OF TAG BUS CONTROL AND BIT VALUES
045560                          400$:
045560  001777                  .WORD   1777            ;BUS BITS AT HIGH IMPEDANCE STATE
045562  001777                  .WORD   1777
045564  001777                  .WORD   1777
045566  001777                  .WORD   1777
045570  001777                  .WORD   1777
045572  004000                  .WORD   CC              ;CONTROL BITS ENABLED, BIT 6 ON
045574  004000                  .WORD   CC
```

```
5145 045576  024000                        .WORD   TAG!CC          ;TAG COMES ON
5146 045600  024000                        .WORD   TAG!CC
5147 045602                          450$:                         ;START TABLE HERE FOR HARDWARE ECO CHANGE
5148 045602  024000                        .WORD   TAG!CC
5149 045604  024000                        .WORD   TAG!CC
5150 045606  024000                        .WORD   TAG!CC
5151 045610  024000                        .WORD   TAG!CC
5152 045612  177777                        .WORD   -1              ;END TABLE HERE FOR HARDWARE ECO CHANGE
5153
5154                                 ;      .WORD   CC              ;TAG GOES OFF
5155 045614  004000                        .WORD   CC
5156 045616  001777                        .WORD   1777            ;CONTROL BITS DISABLED
5157 045620  001777                        .WORD   1777
5158 045622  001777                        .WORD   1777
5159 045624  001777                        .WORD   1777
5160
5161 045626  177777                        .WORD   -1              ;END OF TABLE
5162
5163 045630                          500$:                         ;END OF TEST
5164
5165                                 ;;*****************************************************************
                                     ;*TEST 115      SEARCH TIMEOUT TEST
                                     ;;*****************************************************************
     045630                          TST115:
     045630  000004                        SCOPE                   ;SCOPE CALL
     045632  000240                        NOP
     045634  012706  001100                MOV     #STACK,SP       ;LOAD THE STACK POINTER
     045640  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     045644  013701  001466                MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     045650  012737  000115  001226        MOV     #115,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
5166
5167 045656  004737  054732                JSR     PC,SETVV        ;GO SET VOLUME VALID
     045662  000402                        BR      10$             ;BRANCH TO 10$ IF NO ERROR
     045664  104000                        EMT
5168 045666  000550                        BR      90$
5169
5170                                 ;ENABLE DEBUG CLOCK AND LOAD SEARCH COMMAND
5171 045670                          10$:
5172 045670  012760  041401  000024        MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
5173 045676  012760  000000  000014        MOV     #0,RMER1(R0)    ;LOAD RMER1
5174 045704  012760  000000  000042        MOV     #0,RMER2(R0)    ;LOAD RMER2
5175 045712  012760  000000  000034        MOV     #0,RMDC(R0)     ;LOAD RMDC
5176 045720  012760  000000  000006        MOV     #0,RMDA(R0)     ;LOAD RMDA
5177 045726  012760  000031  000000        MOV     #SEARCH!GO,RMCS1(R0)    ;LOAD RMCS1
5178
5179                                 ;EXECUTE SEARCH TO TEST FOR ON LATCH RESET (17 CLOCKS)
5180 045734  012702  000021                MOV     #17.,R2
5181 045740                          20$:
     045740  012760  141401  000024        MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
5182 045746  012760  041401  000024        MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
5183 045754  005302                        DEC     R2
5184 045756  001370                        BNE     20$
5185
5186                                 ;DROP ON CYLINDER TO RESET LATCH, RAISE ON CYLINDER
5187 045760  012760  041001  000024        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
5188 045766  012760  041401  000024        MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
```

```
                                        ;STEP COMMAND SEQUENCER TO SECTOR COMPARE LOOP (2 CLOCKS)
046774  012702  000002                          MOV     #2,R2
046000                                  30$:
046000  012760  151401  000024                  MOV     #DMD!DBEN!MUR!MOC!DBCK!MSEN,RMMR1(R0)   ;LOAD RMMR1
046006  012760  051401  000024                  MOV     #DMD!DBEN!MUR!MOC!MSEN,RMMR1(R0)        ;LOAD RMMR1
046014  005302                                  DEC     R2
046016  001370                                  BNE     30$

                                        ;THE COMMAND SEQUENCER IS NOW IN THE SECTOR COMPARE LOOP.  STEP
                                        ;THROUGH THE LOOP AND VERIFY SEARCH IS ENABLED.
046020  012702  000005                          MOV     #5,R2
046024                                  40$:
046024  012760  151401  000024                  MOV     #DMD!DBEN!MUR!MOC!DBCK!MSEN,RMMR1(R0)   ;LOAD RMMR1
046032  012760  051401  000024                  MOV     #DMD!DBEN!MUR!MOC!MSEN,RMMR1(R0)        ;LOAD RMMR1
046040  016037  000024  001142                  MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
046046  042737  173777  001142                  BIC     #^CESRC,$BDDAT
046054  001403                                  BEQ     50$             ;BRANCH IF SEARCH NOT ENABLED
046056  005302                                  DEC     R2
046060  001361                                  BNE     40$
046062  000412                                  BR      60$
046064  012737  004000  001140  50$:            MOV     #ESRC,$GDDAT    ;SETUP ERROR MSG
046072  010037  001136                          MOV     R0,$BDADR
046076  062737  000024  001136                  ADD     #RMMR1,$BDADR
046104  104265                                  EMT     265
046106  000440                                  BR      90$

                                        ;DROP 'MSEN' TO ENABLE SEARCH TIMEOUT AND WAIT FOR OPI TO SET.
046110                                  60$:
046110  012760  041401  000024                  MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
046116  012737  070000  001534                  MOV     #70000,WATCH    ;SET WATCHDOG TIMER VALUE
046124  004777  133406                          JSR     PC,@CLOCK       ;START THE CLOCK
046130                                  70$:
046130  016037  000014  001142                  MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
046136  042737  157777  001142                  BIC     #^COPI,$BDDAT
046144  001017                                  BNE     80$
046146  005737  001534                          TST     WATCH
046152  001366                                  BNE     70$
046154  004777  133360                          JSR     PC,@STOPCL      ;STOP THE CLOCK
046160  012737  020000  001140                  MOV     #OPI,$GDDAT     ;SETUP ERROR MSG
046166  010037  001136                          MOV     R0,$BDADR
046172  062737  000014  001136                  ADD     #RMER1,$BDADR
046200  104267                                  EMT     267
046202  000402                                  BR      90$
046204                                  80$:
046204  004777  133330                          JSR     PC,@STOPCL      ;STOP THE CLOCK

046210                                  90$:                            ;END OF TEST

                                        ;;*******************************************************************
                                        ;*TEST 116      DATA COMMAND TESTS (1)

                                        ;;*******************************************************************
046210                                  TST116:
046210  000004                                  SCOPE                   ;SCOPE CALL
046212  000240                                  NOP
046214  012706  001100                          MOV     #STACK,SP       ;LOAD THE STACK POINTER
```

```
        046220  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
        046224  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
        046230  012737  000116  001226          MOV     #116,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
  5234
  5235                                  ;VERIFY DATA COMMAND SETS OPI IF DRIVE NOT READY
  5236
  5237  046236  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
        046242  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
        046244  104000                          EMT
  5238  046246  000471                          BR      40$
  5239
  5240                                  ;ENABLE DEBUG CLOCK AND LOAD READ COMMAND
  5241  046250                          10$:
  5242  046250  012760  041401  000024          MOV     #DMD!MUR!MOC.DBEN,RMMR1(R0)     ;LOAD RMMR1
  5243  046256  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
  5244  046264  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
  5245  046272  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
  5246  046300  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
  5247  046306  012760  000071  000000          MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
  5248
  5249                                  ;STEP COMMAND SEQUENCER TO UNIT READY TEST (3 CLOCKS)
  5250  046314  012702  000003                  MOV     #3,R2
  5251  046320                          20$:
        046320  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
  5252  046326  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
  5253  046334  005302                          DEC     R2
  5254  046336  001370                          BNE     20$
  5255
  5256                                  ;DROP UNIT READY
  5257  046340  012760  040401  000024          MOV     #DMD!MOC!DBEN,RMMR1(R0) ;LOAD RMMR1
  5258
  5259                                  ;STEP SEQUENCER AND VERIFY OPI SETS (2 CLOCKS)
  5260  046346  012702  000002                  MOV     #2,R2
  5261  046352                          30$:
        046352  012760  140401  000024          MOV     #DMD!MOC!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
  5262  046360  012760  040401  000024          MOV     #DMD!MOC!DBEN,RMMR1(R0) ;LOAD RMMR1
  5263  046366  005302                          DEC     R2
  5264  046370  001370                          BNE     30$
  5265  046372  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
  5266  046400  042737  157777  001142          BIC     #^COPI,$BDDAT
  5267  046406  001011                          BNE     40$
  5268  046410  012737  020000  001140          MOV     #OPI,$GDDAT
  5269  046416  010037  001136                  MOV     R0,$BDADR
  5270  046422  062737  000014  001136          ADD     #RMER1,$BDADR
  5271  046430  104270                          EMT     270
  5272
  5273  046432  012737  046440  001124  40$:    MOV     #50$,$LPERR     ;CHANGE LOOP ON ERROR TEST
  5274
  5275                                  ;VERIFY DATA COMMAND ABORTS AT LOCATION 129
  5276  046440                          50$:
  5277  046440  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
        046444  000402                          BR      60$             ;BRANCH TO 60$ IF NO ERROR
        046446  104000                          EMT
  5278  046450  000576                          BR      150$
  5279
  5280                                  ;ENABLE DEBUG CLOCK AND LOAD READ COMMAND
  5281  046452                          60$:
```

```
5282 046452  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5283 046460  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
5284 046466  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
5285 046474  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
5286 046502  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
5287 046510  012760  000071  000000          MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
5288
5289                                 ;STEP COMMAND SEQUENCER TO ABORT TEST AT LOCATION 129 (4 CLOCKS)
5290 046516  012702  00000(                  MOV     #4,R2
5291 046522                          70$:
     046522  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
5292 046530  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5293 046536  005302                          DEC     R2
5294 046540  001370                          BNE     70$
5295
5296                                 ;SET DEVICE FAULT TO CAUSE ABORT CONDITION
5297 046542  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5298
5299                                 ;STEP THE SEQUENCER THROUGH THE TEST FOR ABORT (1 CLOCK)
5300 046550  012702  000001                  MOV     #1,R2
5301 046554                          80$:
     046554  012760  141501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!DBCK,RMMR1(R0)    ;LOAD RMMR1
5302 046562  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5303 046570  005302                          DEC     R2
5304 046572  001370                          BNE     80$
5305
5306                                 ;ABORT EBL SHOULD NOW BE ACTIVE - USE THE MAINTENANCE REGISTER TO
5307                                 ;FORCE BIT CLOCKS AND VERIFY THAT EBL SETS WITHIN 16 BIT CLOCKS
5308 046574  012702  000020                  MOV     #16.,R2         ;MAXIMUM NUMBER OF BIT CLOCKS
5309 046600                          85$:
     046600  012760  045501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!MCLK,RMMR1(R0)    ;LOAD RMMR1
5310 046606  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5311 046614  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
5312 046622  042737  157777  001142          BIC     #^CEBL,$BDDAT
5313 046630  001014                          BNE     90$             ;BRANCH IF EBL IS SET
5314
5315 046632  005302                          DEC     R2
5316 046634  001361                          BNE     85$             ;CONTINUE BIT CLOCKS IF COUNT NOT 0
5317 046636  012737  020000  001140          MOV     #EBL,$GDDAT
5318 046644  010037  001136                  MOV     R0,$BDADR
5319 046650  062737  000024  001136          ADD     #RMMR1,$BDADR
5320 046656  104271                          EMT     271
5321 046660  000472                          BR      150$
5322
5323                                 ;STEP THE SEQUENCER THROUGH ITS TEST FOR EBL (2 CLOCKS)
5324 046662                          90$:
5325 046662  012702  000002                  MOV     #2,R2
5326 046666                          100$:
5327 046666  012760  141501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!DBCK,RMMR1(R0)    ;LOAD RMMR1
5328 046674  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5329 046702  005302                          DEC     R2
5330 046704  001370                          BNE     100$
5331
5332                                 ;ABORT EBL SHOULD NOW BE INACTIVE - FORCE BIT CLOCK USING THE
5333                                 ;MAINTENANCE REGISTER TO RESET EBL (16 BIT CLOCKS)
5334 046706  012702  000020                  MOV     #16.,R2         ;MAXIMUM NUMBER OF BIT CLOCKS
5335 046712                          110$:
```

```
        046712  012760  045501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!MCLK,RMMR1(R0)    ;LOAD RMMR1
 5336   046720  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
 5337   046726  005302                          DEC     R2
 5338   046730  001370                          BNE     110$            ;ISSUE 16 BIT CLOCKS THEN TEST
 5339
 5340                                   ;VERIFY EBL IS NOW RESET
 5341   046732                         120$:
 5342   046732  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 5343   046740  042737  157777  001142          BIC     #^CEBL,$BDDAT
 5344   046746  001411                          BEQ     130$            ;BRANCH IF EBL IS RESET
 5345   046750  005037  001140                  CLR     $GDDAT
 5346   046754  010037  001136                  MOV     R0,$BDADR
 5347   046760  062737  000024  001136          ADD     #RMMR1,$BDADR
 5348   046766  104273                          EMT     273
 5349   046770  000426                          BR      150$
 5350
 5351                                   ;VERIFY GO RESETS WITHIN 4 CLOCK CYCLES
 5352   046772                         130$:
 5353   046772  012702  000004                  MOV     #4,R2
 5354   046776                         140$:
        046776  012760  141501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!DBCK,RMMR1(R0)    ;LOAD RMMR1
 5355   047004  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
 5356   047012  005302                          DEC     R2
 5357   047014  001370                          BNE     140$
 5358   047016  016037  000000  001142          MOV     RMCS1(R0),$BDDAT        ;STORE RMCS1 AT $BDDAT
 5359   047024  042737  177776  001142          BIC     #^CGO,$BDDAT
 5360   047032  001405                          BEQ     150$
 5361   047034  005037  001140                  CLR     $GDDAT
 5362   047040  010037  001136                  MOV     R0,$BDADR
 5363   047044  104274                          EMT     274
 5364
 5365   047046  012737  047054  001124  150$:   MOV     #200$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
 5366
 5367                                   ;VERIFY SEQUENCER BRANCHES TO SEEK WHEN RUN AND CO FLOP SETS
 5368   047054                         200$:
 5369   047054  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
        047060  000402                          BR      210$            ;BRANCH TO 210$ IF NO ERROR
        047062  104000                          EMT
 5370   047064  000512                          BR      250$
 5371
 5372                                   ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
 5373   047066                         210$:
 5374   047066  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5375   047074  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
 5376   047102  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
 5377   047110  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
 5378   047116  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
 5379   047124  012760  000071  000000          MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
 5380
 5381                                   ;MOVE SEQUENCER TO TEST FOR RUN AND GO AT LOCATION 130 (5 CLOCKS)
 5382   047132  012702  000005                  MOV     #5,R2
 5383   047136                         220$:
        047136  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5384   047144  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5385   047152  005302                          DEC     R2
 5386   047154  001370                          BNE     220$
 5387
```

```
5388                                            ;VERIFY RUN AND GO IS SET
5389 047156  016037  000024  001142             MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
5390 047164  042737  137777  001142             BIC     #^CRG,$BDDAT
5391 047172  001012                             BNE     230$
5392 047174  012737  040000  001140             MOV     #RG,$GDDAT
5393 047202  010037  001136                     MOV     R0,$BDADR
5394 047206  062737  000024  001136             ADD     #RMMR1,$BDADR
5395 047214  104275                             EMT     275
5396 047216  000435                             BR      250$
5397
5398                                            ;VERIFY THAT CYLINDER TAG COMES UP IN ONE CLOCK CYCLE
5399 047220                                     230$:
5400 047220  012702  000001                     MOV     #1,R2
5401 047224                                     240$:
     047224  012760  141401  000024             MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
5402 047232  012760  041401  000024             MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5403 047240  005302                             DEC     R2
5404 047242  001370                             BNE     240$
5405 047244  016037  000040  001142             MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
5406
5407                                            ;;*****************************************************************
5408                                            ;       BIC     #RQA!RQB!TAG,$BDDAT
5409                                                                            ;THE FOLLOWING CODE WAS ADDED
5410                                                                            ;TO ALLOW THE PROGRAM TO RUN WITH
5411                                                                            ;OR WITHOUT THE ECO TO THE CS BOARD.
5412
5413 047252  042737  162000  001142             BIC     #RQA!RQB!TAG!CH,$BDDAT  ;HARDWARE ECO CHANGE CAUSES CC AND
5414                                                                            ;CH TO SET AT THE SAME TIME
5415                                            ;;*****************************************************************
5416
5417 047260  012737  004000  001140             MOV     #CC,$GDDAT
5418 047266  023737  001140  001142             CMP     $GDDAT,$BDDAT
5419 047274  001406                             BEQ     250$
5420 047276  010037  001136                     MOV     R0,$BDADR
5421 047302  062737  000040  001136             ADD     #RMMR2,$BDADR
5422 047310  104276                             EMT     276
5423
5424 047312  012737  047324  001124  250$:     MOV     #260$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
5425
5426                                            ;VERIFY DATA COMMAND ABORTS AT COMMAND SEQUENCER LOCATIONS 144, 145
5427 047320  012702  000144                     MOV     #144,R2         ;INITIALIZE TEST LOCATION
5428 047324                                     260$:
5429 047324  004737  054732                     JSR     PC,SETVV        ;GO SET VOLUME VALID
     047330  000402                             BR      270$            ;BRANCH TO 270$ IF NO ERROR
     047332  104000                             EMT
5430 047334  000553                             BR      320$
5431
5432                                            ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
5433 047336                                     270$:
5434 047336  012760  041401  000024             MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5435 047344  012760  000000  000014             MOV     #0,RMER1(R0)    ;LOAD RMER1
5436 047352  012760  000000  000042             MOV     #0,RMER2(R0)    ;LOAD RMER2
5437 047360  012760  000000  000006             MOV     #0,RMDA(R0)     ;LOAD RMDA
5438 047366  012760  000000  000034             MOV     #0,RMDC(R0)     ;LOAD RMDC
5439 047374  012760  000071  000000             MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
5440
5441                                            ;WAIT FOR RUN AND GO TO SET
```

```
5442 047402  012737  000310  001534          MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
     047410  004777  132122                  JSR     PC,@CLOCK       ;START THE CLOCK
5443 047414                          280$:
     047414  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
5444 047422  042737  137777  001142          BIC     #^CRG,$BDDAT
5445 047430  001017                          BNE     290$
5446 047432  005737  001534                  TST     WATCH
5447 047436  001366                          BNE     280$
5448 047440  004777  132074                  JSR     PC,@STOPCL      ;STOP THE CLOCK
5449 047444  012737  040000  001140          MOV     #RG,$GDDAT
5450 047452  010037  001136                  MOV     R0,$BDADR
5451 047456  062737  000024  001136          ADD     #RMMR1,$BDADR
5452 047464  104275                          EMT     275
5453 047466  000476                          BR      320$
5454 047470                          290$:
     047470  004777  132044                  JSR     PC,@STOPCL      ;STOP THE CLOCK
5455
5456                                 ;MOVE COMMAND SEQUENCER TO ABORT TEST (LOCATION 144 OR 145)
5457 047474  012703  000006                  MOV     #6,R3           ;SETUP CLOCK COUNT
5458 047500  022702  000144                  CMP     #144,R2
5459 047504  001402                          BEQ     300$
5460 047506  012703  000007                  MOV     #7,R3
5461 047512                          300$:
     047512  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
5462 047520  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5463 047526  005303                          DEC     R3
5464 047530  001370                          BNE     300$
5465
5466                                 ;SET DRIVE FAULT TO FORCE ABORT CONDITION
5467 047532  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5468
5469                                 ;CLOCK SEQUENCER THROUGH ITS TEST FOR ABORT (1 CLOCK)
5470 047540  012703  000001                  MOV     #1,R3
5471 047544                          305$:
     047544  012760  141501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!DBCK,RMMR1(R0)    ;LOAD RMMR1
5472 047552  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5473 047560  005303                          DEC     R3
5474 047562  001370                          BNE     305$            ;ISSUE 2 CLOCKS
5475
5476                                 ;ABORT EBL SHOULD NOW BE ACTIVE - USE THE MAINTENANCE REGISTER TO
5477                                 ;FORCE BIT CLOCKS AND VERIFY THAT EBL SETS WITHIN 16 BIT CLOCKS
5478 047564  012702  000020                  MOV     #16.,R2         ;MAXIMUM NUMBER OF BIT CLOCKS
5479 047570                          306$:
     047570  012760  045501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!MCLK,RMMR1(R0)    ;LOAD RMMR1
5480 047576  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
5481 047604  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
5482 047612  042737  157777  001142          BIC     #^CEBL,$BDDAT
5483 047620  001013                          BNE     310$            ;BRANCH IF EBL IS SET
5484
5485 047622  005302                          DEC     R2
5486 047624  001361                          BNE     306$            ;CONTINUE BIT CLOCKS IF COUNT NOT 0
5487 047626  012737  020000  001140          MOV     #EBL,$GDDAT
5488 047634  010037  001136                  MOV     R0,$BDADR
5489 047640  062737  000024  001136          ADD     #RMMR1,$BDADR
5490 047646  104271                          EMT     271
5491 047650  022702  000144          310$:   CMP     #144,R2
5492 047654  001003                          BNE     320$
```

```
 5493 047656  012702  000145                    MOV     #145,R2
 5494 047662  000620                            BR      260$
 5495
 5496 047664  012737  047674  001124  320$:    MOV     #330$,$LPERR            ;CHANGE LOOP ON ERROR ADDRESS
 5497
 5498                                 ;VERIFY HEAD TAG DURING DATA COMMAND
 5499 047672  005002                            CLR     R2                      ;INITIALIZE TRACK ADDRESS = 0
 5500 047674                          330$:
 5501 047674  004737  054732                    JSR     PC,SETVV                ;GO SET VOLUME VALID
      047700  000402                            BR      340$                    ;BRANCH TO 340$ IF NO ERROR
      047702  104000                            EMT
 5502 047704  000561                            BR      400$
 5503
 5504                                 ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
 5505 047706                          340$:
 5506 047706  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5507 047714  012760  000000  000014            MOV     #0,RMER1(R0)            ;LOAD RMER1
 5508 047722  012760  000000  000042            MOV     #0,RMER2(R0)            ;LOAD RMER2
 5509 047730  010260  000006                    MOV     R2,RMDA(R0)             ;LOAD RMDA
 5510 047734  012760  000000  000034            MOV     #0,RMDC(R0)             ;LOAD RMDC
 5511 047742  012760  000071  000000            MOV     #RD!GO,RMCS1(R0)                ;LOAD RMCS1
 5512
 5513                                 ;WAIT FOR RUN AND GO TO SET
 5514 047750  012737  000310  001534            MOV     #200.,WATCH             ;SET WATCHDOG TIMER VALUE
      047756  004777  131554                    JSR     PC,@CLOCK               ;START THE CLOCK
 5515 047762                          350$:
      047762  016037  000024  001142            MOV     RMMR1(R0),$BDDAT                ;STORE RMMR1 AT $BDDAT
 5516 047770  042737  137777  001142            BIC     #^CRG,$BDDAT
 5517 047776  001017                            BNE     360$
 5518 050000  005737  001534                    TST     WATCH
 5519 050004  001366                            BNE     350$
 5520 050006  004777  131526                    JSR     PC,@STOPCL              ;STOP THE CLOCK
 5521 050012  012737  040000  001140            MOV     #RG,$GDDAT
 5522 050020  010037  001136                    MOV     R0,$BDADR
 5523 050024  062737  000024  001136            ADD     #RMMR1,$BDADR
 5524 050032  104275                            EMT     275
 5525 050034  000505                            BR      400$
 5526 050036                          360$:
      050036  004777  131476                    JSR     PC,@STOPCL              ;STOP THE CLOCK
 5527
 5528                                 ;STEP COMMAND SEQUENCER TO HEAD SEQUENCE, LOCATION 156 (17 CLOCKS)
 5529 050042  012703  000021                    MOV     #17.,R3
 5530 050046                          370$:
      050046  012760  141401  000024            MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5531 050054  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5532 050062  005303                            DEC     R3
 5533 050064  001370                            BNE     370$
 5534
 5535                                 ;DROP AND RAISE ON CYLINDER TO RESET ON LATCH
 5536 050066  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5537 050074  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5538
 5539                                 ;;*****************************************************************
 5540                                 ;       MOV     #450$,R3                ;INITIALIZE TABLE POINTER
 5541
 5542                                                                         ;HARDWARE ECO CHANGE TO THE PLA ON THE
 5543                                                                         ;CS BOARD.
```

```
5544 050102  012703  000004                    MOV     #4,R3           ;CLOCK THE SEQUENCER THRU THE FIRST
5545                                                                   ;4 COMMAND SEQUENCES TO ALLOW THE PROGRAM
5546                                                                   ;TO RUN WITH OR WITHOUT THE ECO.
5547 050106                                372$:
5548 050106  012760  141401  000024          MOV     #DMD!DBEN!MUR!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
5549 050114  012760  041401  000024          MOV     #DMD!DBEN!MUR!MOC,RMMR1(R0)     ;LOAD RMMR1
5550 050122  005303                          DEC     R3              ;DONE 4 CLOCKS ?
5551 050124  001370                          BNE     372$            ;NO !!
5552 050126  012703  050262                  MOV     #475$,R3        ;INITIALIZE NEW TABLE POINTER
5553                                        ;;*****************************************************************
5554
5555                                        ;VERIFY TAG BUS ACCORDING TO TABLE AND TRACK ADDRESS IN R2
5556 050132                                375$:
5557 050132  016037  000040  001142          MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
5558 050140  042737  150000  001142          BIC     #RQA!RQB!TST,$BDDAT
5559 050146  011337  001140                  MOV     (R3),$GDDAT
5560 050152  010204                          MOV     R2,R4           ;GENERATE EXPECTED TAG BUS
5561 050154  000304                          SWAB    R4
5562 050156  050437  001140                  BIS     R4,$GDDAT
5563
5564                                        ;COMPARE EXPECTED AND RECEIVED TAG BUS DATA
5565 050162  023737  001140  001142          CMP     $GDDAT,$BDDAT
5566 050170  001021                          BNE     390$
5567 050172  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
5568 050200  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5569
5570                                        ;ADVANCE TO NEXT TABLE ENTRY
5571 050206  062703  000002                  ADD     #2,R3
5572 050212  005713                          TST     (R3)
5573 050214  100401                          BMI     380$
5574 050216  000745                          BR      375$
5575
5576                                        ;SHIFT TO NEXT TRACK ADDRESS-EXIT LOOP IF DONE
5577 050220                                380$:
5578 050220  062702  000400                  ADD     #TA1,R2         ;ADVANCE TRACK ADDRESS
5579 050224  020237  001334                  CMP     R2,LSTRK        ;DONE ALL TRACKS ?
5580 050230  101007                          BHI     400$            ;YES, EXIT
5581 050232  000620                          BR      330$
5582
5583                                        ;ERROR ON TAG BUS DURING HEAD SEQUENCE
5584 050234                                390$:
5585 050234  010037  001136                  MOV     R0,$BDADR
5586 050240  062737  000040  001136          ADD     #RMMR2,$BDADR
5587 050246  104276                          EMT     276
5588
5589 050250  000440                400$:     BR      500$            ;JUMP OVER TABLE
5590
5591                                        ;TABLE OF TAG BUS DURING HEAD SEQUENCE
5592 050252                                450$:
5593 050252  002000                          .WORD   CH
5594 050254  002000                          .WORD   CH
5595 050256  022000                          .WORD   CH!TAG
5596 050260  022000                          .WORD   CH!TAG
5597 050262                                475$:                   ;START TABLE HERE FOR HARDWARE ECO CHANGE
5598 050262  022000                          .WORD   CH!TAG
5599 050264  022000                          .WORD   CH!TAG
5600 050266  022000                          .WORD   CH!TAG
```

```
5601 050270  022000                          .WORD   CH!TAG
5602 050272  177777                          .WORD   -1              ;END TABLE HERE FOR HARDWARE ECO CHANGE
5603
5604                                 ;        .WORD   CH
5605 050274  002000                          .WORD   CH
5606 050276  001777                          .WORD   1777
5607 050300  001777                          .WORD   1777
5608 050302  001777                          .WORD   1777
5609 050304  001777                          .WORD   1777
5610 050306  001777                          .WORD   1777
5611 050310  001777                          .WORD   1777
5612 050312  001777                          .WORD   1777
5613 050314  001777                          .WORD   1777
5614 050316  001777                          .WORD   1777
5615 050320  001777                          .WORD   1777
5616 050322  001777                          .WORD   1777
5617 050324  001777                          .WORD   1777
5618 050326  001777                          .WORD   1777
5619 050330  001777                          .WORD   1777
5620 050332  001777                          .WORD   1777
5621 050334  001777                          .WORD   1777
5622 050336  001777                          .WORD   1777
5623 050340  001777                          .WORD   1777
5624 050342  001777                          .WORD   1777
5625 050344  001777                          .WORD   1777
5626 050346  001777                          .WORD   1777
5627
5628 050350  177777                          .WORD   -1              ;END OF TABLE
5629
5630 050352                          500$:                           ;END OF TEST
5631
5632                                 ;;*****************************************************************
                                     ;*TEST 117      DATA COMMAND TESTS (2)
                                     ;;*****************************************************************
     050352                          TST117:
     050352  000004                          SCOPE                   ;SCOPE CALL
     050354  000240                          NOP
     050356  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
     050362  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
     050366  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
     050372  012737  000117  001226          MOV     #117,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
5633
5634                                 ;VERIFY OPI SETS IF ON CYLINDER LATCH DOESN'T RESET
5635
5636 050400  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     050404  000402                          BR      10$             ;BRANCH TO 10$ IF NO ERROR
     050406  104000                          EMT
5637 050410  000514                          BR      60$
5638
5639                                 ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND DURING CYLINDER SEQUENCE
5640 050412                          10$:
5641 050412  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5642 050420  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
5643 050426  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
5644 050434  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
5645 050442  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
```

```
5646 050450  012760  000071  000000          MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
5647
5648                                 ;WAIT FOR RUN AND GO TO SET
5649 050456  012737  000310  001534          MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
     050464  004777  131046                  JSR     PC,@CLOCK       ;START THE CLOCK
5650 050470                          20$:
     050470  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
5651 050476  042737  137777  001142          BIC     #^CRG,$BDDAT
5652 050504  001017                          BNE     30$
5653 050506  005737  001534                  TST     WATCH
5654 050512  001366                          BNE     20$
5655 050514  004777  131020                  JSR     PC,@STOPCL      ;STOP THE CLOCK
5656 050[illegible] 012737  040000  001140          MOV     #RG,$GDDAT
5657 050[illegible] 010037  001136                  MOV     R0,$BDADR
5658 050552  062737  000024  001136          ADD     #RMMR1,$BDADR
5659 050540  104275                          EMT     275
5660 050542  000437                          BR      60$
5661 050544                          30$:
     050544  004777  130770                  JSR     PC,@STOPCL      ;STOP THE CLOCK
5662
5663                                 ;STEP COMMAND SEQUENCER AND VERIFY OPI SETS (19 CLOCKS)
5664 050550  012702  000023                  MOV     #19.,R2
5665 050554                          40$:
     050554  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
5666 050562  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5667 050570  005302                          DEC     R2
5668 050572  001370                          BNE     40$
5669 050574  016037  000014  001142          MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
5670 050602  042737  157777  001142          BIC     #^COPI,$BDDAT
5671 050610  001011                          BNE     50$             ;BRANCH IF OPI SET
5672 050612  012737  020000  001140          MOV     #OPE,$GDDAT
5673 050620  010037  001136                  MOV     R0,$BDADR
5674 050624  062737  000014  001136          ADD     #RMER1,$BDADR
5675 050632  104277                          EMT     277
5676 050634  012737  050642  001124  50$:     MOV     #60$,$LPERR     ;CHANGE LOOP ON ERROR ADDRESS
5677
5678                                 ;VERIFY DATA COMMAND ABORTS DURING SEEK WAIT LOOP
5679 050642                          60$:
5680 050642  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
     050646  000402                          BR      70$             ;BRANCH TO 70$ IF NO ERROR
     050650  104000                          EMT
5681 050652  000567                          BR      140$
5682
5683                                 ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
5684 050654                          70$:
5685 050654  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
5686 050662  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
5687 050670  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
5688 050676  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
5689 050704  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
5690 050712  012760  000071  000000          MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
5691
5692                                 ;WAIT FOR RUN & GO TO SET
5693 050720  012737  000310  001534          MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
     050726  004777  130604                  JSR     PC,@CLOCK       ;START THE CLOCK
5694 050732                          80$:
     050732  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
```

```
 5695 050740  042737  137777  001142          BIC     #^CRG,$BDDAT
 5696 050746  001017                          BNE     90$
 5697 050750  005737  001534                  TST     WATCH
 5698 050754  001366                          BNE     80$
 5699 050756  004777  130556                  JSR     PC,@STOPCL      ;STOP THE CLOCK
 5700 050762  012737  040000  001140          MOV     #RG,$GDDAT
 5701 050770  010037  001136                  MOV     R0,$BDADR
 5702 050774  062737  000024  001136          ADD     #RMMR1,$BDADR
 5703 051002  104275                          EMT     275
 5704 051004  000512                          BR      140$
 5705 051006                          90$:
      051006  004777  130526                  JSR     PC,@STOPCL      ;STOP THE CLOCK
 5706
 5707                                 ;STEP COMMAND SEQUENCER TO ON LATCH TEST AT LOCATION 156 (17 CLOCKS)
 5708 051012  012702  000021                  MOV     #17.,R2
 5709 051016                          100$:
      051016  012760  141401  000024          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5710 051024  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5711 051032  005302                          DEC     R2
 5712 051034  001370                          BNE     100$
 5713
 5714                                 ;DROP ON CYLINDER TO RESET LATCH
 5715 051036  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5716
 5717                                 ;MOVE COMMAND SEQUENCER TO SEEK WAIT LOOP (31 CLOCKS)
 5718 051044  012702  000037                  MOV     #31.,R2
 5719 051050                          110$:
      051050  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
 5720 051056  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5721 051064  005302                          DEC     R2
 5722 051066  001370                          BNE     110$
 5723
 5724                                 ;STEP THROUGH SEEK WAIT LOOP (6 CLOCKS) 2 TIMES
 5725 051070  012702  000006                  MOV     #6.,R2
 5726 051074                          120$:
      051074  012760  141001  000024          MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
 5727 051102  012760  041001  000024          MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5728 051110  005302                          DEC     R2
 5729 051112  001370                          BNE     120$
 5730
 5731                                 ;SET SEEK INCOMPLETE ERROR TO CAUSE ABORT
 5732 051114  012760  041201  000024          MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
 5733
 5734                                 ;CLOCK THE SEQUENCER THROUGH ITS TEST FOR ABORT (2 CLOCKS)
 5735 051122  012702  000002                  MOV     #2,R2
 5736 051126                          130$:
      051126  012760  141201  000024          MOV     #DMD!MUR!DBEN!MSER!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5737 051134  012760  041201  000024          MOV     #DMD!MUR!DBEN!MSER,RMMR1(R0)    ;LOAD RMMR1
 5738 051142  005302                          DEC     R2
 5739 051144  001370                          BNE     130$
 5740
 5741                                 ;ABORT EBL SHOULD NOW BE ACTIVE - USE THE MAINTENANCE REGISTER TO
 5742                                 ;FORCE BIT CLOCKS AND VERIFY THAT EBL SETS WITHIN 16 BIT CLOCKS
 5743 051146  012702  000020                  MOV     #16.,R2         ;MAXIMUM NUMBER OF BIT CLOCKS
 5744 051152                          135$:
      051152  012760  045501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF!MCLK,RMMR1(R0)    ;LOAD RMMR1
 5745 051160  012760  041501  000024          MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
```

```
 5746 051166  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 5747 051174  042737  157777  001142          BIC     #^CEBL,$BDDAT
 5748 051202  001013                          BNE     140$
 5749
 5750 051204  005302                          DEC     R2
 5751 051206  001361                          BNE     135$            ;CONTINUE BIT CLOCKS IF COUNT NOT 0
 5752 051210  012737  020000  001140          MOV     #EBL,$GDDAT
 5753 051216  010037  001136                  MOV     R0,$BDADR
 5754 051222  062737  000024  001136          ADD     #RMMR1,$BDADR
 5755 051230  10430C                          EMT     300
 5756 051232  012737  051240  001124  140$:   MOV     #150$,$LPERR            ;CHANGE LOOP ON ERROR ADDRESS
 5757
 5758                                 ;VERIFY DATA COMMAND ABORTS DURING OFFSET IF ON CYLINDER LATCH
 5759                                 ;DOESNT RESET
 5760 051240                          150$:
 5761 051240  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
      051244  000402                          BR      160$            ;BRANCH TO 160$ IF NO ERROR
      051246  104000                          EMT
 5762 051250  000536                          BR      220$
 5763
 5764                                 ;LOAD TRACK, SECTOR AND CYLINDER ADDRESSES
 5765 051252                          160$:
 5766 051252  012760  000000  000006          MOV     #0,RMDA(R0)     ;LOAD RMDA
 5767 051260  012760  000000  000034          MOV     #0,RMDC(R0)     ;LOAD RMDC
 5768
 5769 051266  004737  055054                  JSR     PC,SETOM        ;GC SET OFFSET MODE
      051272  000402                          BR      170$            ;BRANCH TO 170$ IF NO ERROR
      051274  104000                          EMT
 5770 051276  000523                          BR      220$
 5771
 5772                                 ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
 5773 051300                          170$:
 5774 051300  012760  041401  000024          MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5775 051306  012760  000000  000014          MOV     #0,RMER1(R0)    ;LOAD RMER1
 5776 051314  012760  000000  000042          MOV     #0,RMER2(R0)    ;LOAD RMER2
 5777 051322  012760  000071  000000          MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
 5778
 5779                                 ;WAIT FOR RUN AND GO TO SET
 5780 051330  012737  000310  001534          MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
      051336  004777  130174                  JSR     PC,@CLOCK       ;START THE CLOCK
 5781 051342                          180$:
      051342  016037  000024  001142          MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 5782 051350  042737  137777  001142          BIC     #^CRG,$BDDAT
 5783 051356  001017                          BNE     190$
 5784 051360  005737  001534                  TST     WATCH
 5785 051364  001366                          BNE     180$
 5786 051366  004777  130146                  JSR     PC,@STOPCL      ;STOP THE CLOCK
 5787 051372  012737  040000  001140          MOV     #RG,$GDDAT
 5788 051400  010037  001140                  MOV     R0,$GDDAT
 5789 051404  062737  000024  001136          ADD     #RMMR1,$BDADR
 5790 051412  104275                          EMT     275
 5791 051414  000454                          BR      220$
 5792 051416                          190$:
      051416  004777  130116                  JSR     PC,@STOPCL      ;STOP THE CLOCK
 5793
 5794                                 ;STEP COMMAND SEQUENCER TO ON LATCH TEST AT LOCATION 156 (17 CLOCKS)
 5795 051422  012702  000021                  MOV     #17.,R2
```

```
 5796 051426                                200$:
      051426  012760  141401  000024              MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5797 051434  012760  041401  000024              MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5798 051442  005302                              DEC     R2
 5799 051444  001370                              BNE     200$
 5800
 5801                                       ;DROP ON CYLINDER TO RESET LATCH, SET ON CYLINDER TO PASS TEST
 5802                                       ;AT LOCATION 166
 5803 051446  012760  041001  000024              MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5804 051454  012760  041401  000024              MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
 5805
 5806                                       ;MOVE SEQUENCER TO SET OPI AND EBL (39 CLOCKS)
 5807 051462  012702  000047                      MOV     #39.,R2
 5808 051466                                210$:
      051466  012760  141401  000024              MOV     #DMD!MUR!DBEN!MOC!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5809 051474  012760  041401  000024              MOV     #DMD!MUR!DBEN!MOC,RMMR1(R0)     ;LOAD RMMR1
 5810 051502  005302                              DEC     R2
 5811 051504  001370                              BNE     210$
 5812
 5813                                       ;VERIFY OPI IS SET
 5814 051506  016037  000014  001142              MOV     RMER1(R0),$BDDAT        ;STORE RMER1 AT $BDDAT
 5815 051514  042737  157777  001142              BIC     #^COPI,$BDDAT
 5816 051522  001011                              BNE     220$
 5817 051524  012737  020000  001140              MOV     #OPI,$GDDAT
 5818 051532  010037  001136                      MOV     R0,$BDADR
 5819 051536  062737  000014  001136              ADD     #RMER1,$BDADR
 5820 051544  104277                              EMT     277
 5821 051546  012737  051554  001124  220$:       MOV     #230$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS
 5822
 5823                                       ;VERIFY DATA COMMAND ABORTS DURING OFFSET WAIT LOOP
 5824
 5825 051554                                230$:
      051554  004737  054732                      JSR     PC,SETVV        ;GO SET VOLUME VALID
      051560  000403                              BR      240$            ;BRANCH TO 240$ IF NO ERROR
      051562  104000                              EMT
 5826 051564  000137  052174                      JMP     310$
 5827
 5828                                       ;LOAD SECTOR,TRACK AND CYLINDER ADDRESS
 5829 051570                                240$:
 5830 051570  012760  000000  000006              MOV     #0,RMDA(R0)     ;LOAD RMDA
 5831 051576  012760  000000  000034              MOV     #0,RMDC(R0)     ;LOAD RMDC
 5832
 5833 051604  004737  055054                      JSR     PC,SETOM        ;GO SET OFFSET MODE
      051610  000402                              BR      245$            ;BRANCH TO 245$ IF NO ERROR
      051612  104000                              EMT
 5834 051614  000567                              BR      310$
 5835
 5836                                       ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
 5837 051616                                245$:
      051616  012760  041401  000024              MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5838 051624  012760  000000  000014              MOV     #0,RMER1(R0)    ;LOAD RMER1
 5839 051632  012760  000000  000042              MOV     #0,RMER2(R0)    ;LOAD RMER2
 5840 051640  012760  000071  000000              MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1
 5841
 5842                                       ;WAIT FOR RUN AND GO TO SET
 5843 051646  012737  000310  001534              MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
      051654  004777  127656                      JSR     PC,@CLOCK       ;START THE CLOCK
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 5844 051660                                    250$:
      051660  016037  000024  001142                MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 5845 051666  042737  137777  001142                BIC     #^CRG,$BDDAT
 5846 051674  001017                                BNE     260$
 5847 051676  005737  001534                        TST     WATCH
 5848 051702  001366                                BNE     250$
 5849 051704  004777  127630                        JSR     PC,@STOPCL      ;STOP THE CLOCK
 5850 051710  012737  040000  001140                MOV     #RG,$GDDAT
 5851 051716  010037  001136                        MOV     R0,$BDADR
 5852 051722  062737  000024  001136                ADD     #RMMR1,$BDADR
 5853 051730  104275                                EMT     275
 5854 051732  000520                                BR      310$
 5855 051734                                    260$:
      051734  004777  127600                        JSR     PC,@STOPCL      ;STOP THE CLOCK
 5856
 5857                                           ;STEP SEQUENCER TO LOCATION 156 (17 CLOCKS)
 5858 051740  012702  000021                        MOV     #17.,R2
 5859 051744                                    270$:
      051744  012760  141401  000024                MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5860 051752  012760  041401  000024                MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5861 051760  005302                                DEC     R2
 5862 051762  001370                                BNE     270$
 5863
 5864                                           ;DROP ON CYLINDER TO RESET LATCH, SET ON CYLINDER TO PASS TEST
 5865                                           ;AT LOCATION 166
 5866 051764  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5867 051772  012760  041401  000024                MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5868
 5869                                           ;MOVE SEQUENCER TO LOCATION  174 (37 CLOCKS)
 5870 052000  012702  000045                        MOV     #37.,R2
 5871 052004                                    280$:
      052004  012760  141401  000024                MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5872 052012  012760  041401  000024                MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5873 052020  005302                                DEC     R2
 5874 052022  001370                                BNE     280$
 5875
 5876                                           ;DROP ON CYLINDER TO RESET LATCH, LEAVE ON CYLINDER RESET
 5877 052024  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5878
 5879                                           ;STEP SEQUENCER THROUGH OFFSET WAIT LOOP TWICE (7 CLOCKS)
 5880 052032  012702  000007                        MOV     #7.,R2
 5881 052036                                    290$:
      052036  012760  141001  000024                MOV     #DMD!MUR!DBEN!DBCK,RMMR1(R0)    ;LOAD RMMR1
 5882 052044  012760  041001  000024                MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5883 052052  005302                                DEC     R2
 5884 052054  001370                                BNE     290$
 5885
 5886                                           ;SET DRIVE FAULT TO CAUSE ABORT CONDITION
 5887 052056  012760  041101  000024                MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
 5888
 5889                                           ;STEP SEQUENCER THROUGH ITS TEST FOR ABORT (2 CLOCKS)
 5890 052064  012702  000002                        MOV     #2,R2
 5891 052070                                    300$:
      052070  012760  141101  000024                MOV     #DMD!MUR!DBEN!MDF!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5892 052076  012760  041101  000024                MOV     #DMD!MUR!DBEN!MDF,RMMR1(R0)     ;LOAD RMMR1
 5893 052104  005302                                DEC     R2
 5894 052106  001370                                BNE     300$
```

```
                                        ;ABORT EBL SHOULD NOW BE ACTIVE - USE THE MAINTENANCE REGISTER TO
                                        ;FORCE BIT CLOCKS AND VERIFY THAT EBL SETS WITHIN 16 BIT CLOCKS
052110  012702  000020                        MOV     #16.,R2         ;MAXIMUM NUMBER OF BIT CLOCKS
052114                                  305$:
052114  012760  045501  000024                MOV     #DMD!MUR!MOC!DBEN!MDF!MCLK,RMMR1(R0)    ;LOAD RMMR1
052122  012760  041501  000024                MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
052130  016037  000024  001142                MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
052136  042737  157777  001142                BIC     #^CEBL,$BDDAT
052144  001013                                BNE     310$

052146  005302                                DEC     R2
052150  001361                                BNE     305$            ;CONTINUE BIT CLOCKS IF COUNT NOT 0
052152  012737  020000  001140                MOV     #EBL,$GDDAT
052160  010037  001136                        MOV     R0,$BDADR
052164  062737  000024  001136                ADD     #RMMR1,$BDADR
052172  104271                                EMT     271

052174  012737  052202  001124  310$:   MOV     #320$,$LPERR    ;CHANGE LOOP ON ERROR ADDRESS

                                        ;VERIFY THAT DATA COMMAND ABORTS DURING SECTOR WAIT LOOP AT LOCATION 179

052202                                  320$:
052202  004737  054732                        JSR     PC,SETVV        ;GO SET VOLUME VALID
052206  000403                                BR      330$            ;BRANCH TO 330$ IF NO ERROR
052210  104000                                EMT
052212  000137  052640                        JMP     420$

                                        ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
052216                                  330$:
052216  012760  041401  000024                MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
052224  012760  000000  000014                MOV     #0,RMER1(R0)    ;LOAD RMER1
052232  012760  000000  000042                MOV     #0,RMER2(R0)    ;LOAD RMER2
052240  012760  000000  000006                MOV     #0,RMDA(R0)     ;LOAD RMDA
052246  012760  000000  000034                MOV     #0,RMDC(R0)     ;LOAD RMDC
052254  012760  000071  000000                MOV     #RD!GO,RMCS1(R0)        ;LOAD RMCS1

                                        ;WAIT FOR RUN AND GO TO SET
052262  012737  000310  001534                MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
052270  004777  127242                        JSR     PC,@CLOCK       ;START THE CLOCK
052274                                  340$:
052274  016037  000024  001142                MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
052302  042737  137777  001142                BIC     #^CRG,$BDDAT
052310  001017                                BNE     350$
052312  005737  001534                        TST     WATCH
052316  001366                                BNE     340$
052320  004777  127214                        JSR     PC,@STOPCL      ;STOP THE CLOCK
052324  012737  040000  001140                MOV     #RG,$GDDAT
052332  010037  001136                        MOV     R0,$BDADR
052336  062737  000024  001136                ADD     #RMMR1,$BDADR
052344  104275                                EMT     275
052346  000534                                BR      420$
052350                                  350$:
052350  004777  127164                        JSR     PC,@STOPCL      ;STOP THE CLOCK

                                        ;STEP SEQUENCER TO LOCATION 156 (17 CLOCKS)
052354  012702  000021                        MOV     #17.,R2
```

```
                                        360$:
 5945 052360                                    MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
      052360  012760  141401  000024
 5946 052366  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5947 052374  005302                            DEC     R2
 5948 052376  001370                            BNE     360$
 5949
 5950                                   ;DROP ON CYLINDER TO RESET LATCH, SET ON CYLINDER TO PASS TEST
 5951                                   ;AT LOCATION 166
 5952 052400  012760  041001  000024            MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
 5953
 5954                                   ;MOVE SEQUENCER TO SECTOR WAIT (34 CLOCKS)
 5955 052406  012702  000042                    MOV     #34.,R2
 5956 052412                            370$:
      052412  012760  141401  000024            MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5957 052420  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5958 052426  005302                            DEC     R2
 5959 052430  001370                            BNE     370$
 5960
 5961                                   ;STEP THROUGH SECTOR WAIT LOOP TWICE AND VERIFY SEARCH IS ENABLED
 5962                                   ;DURING THE LOOP (6 CLOCKS)
 5963 052432  012702  000006                    MOV     #6.,R2
 5964 052436                            380$:
      052436  012760  141401  000024            MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
 5965 052444  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
 5966 052452  016037  000024  001142            MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
 5967 052460  042737  173777  001142            BIC     #^CESRC,$BDDAT
 5968 052466  001403                            BEQ     390$
 5969 052470  005302                            DEC     R2
 5970 052472  001361                            BNE     380$
 5971 052474  000412                            BR      400$
 5972 052476  012737  004000  001140  390$:     MOV     #ESRC,$GDDAT
 5973 052504  010037  001136                    MOV     R0,$BDADR
 5974 052510  062737  000024  001136            ADD     #RMMR1,$BDADR
 5975 052516  104301                            EMT     301
 5976 052520  000447                            BR      420$
 5977
 5978                                   ;SET DRIVE FAULT TO CAUSE ABORT CONDITION
 5979 052522                            400$:
      052522  012760  041001  000024            MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
 5980
 5981                                   ;STEP SEQUENCER THROUGH ITS TEST FOR ABORT (2 CLOCKS)
 5982 052530  012702  000002                    MOV     #2,R2
 5983 052534                            410$:
      052534  012760  141501  000024            MOV     #DMD!MUR!MOC!DBEN!MDF!DBCK,RMMR1(R0)    ;LOAD RMMR1
 5984 052542  012760  041501  000024            MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
 5985 052550  005302                            DEC     R2
 5986 052552  001370                            BNE     410$
 5987
 5988                                   ;ABORT EBL SHOULD NOW BE ACTIVE - USE THE MAINTENANCE REGISTER TO
 5989                                   ;FORCE BIT CLOCKS AND VERIFY THAT EBL SETS WITHIN 16 BIT CLOCKS
 5990 052554  012702  000020                    MOV     #16.,R2         ;MAXIMUM NUMBER OF BIT CLOCKS
 5991 052560                            415$:
      052560  012760  045501  000024            MOV     #DMD!MUR!MOC!DBEN!MDF!MCLK,RMMR1(R0)    ;LOAD RMMR1
 5992 052566  012760  041501  000024            MOV     #DMD!MUR!MOC!DBEN!MDF,RMMR1(R0) ;LOAD RMMR1
 5993
 5994                                   ;VERIFY EBL IS SET
 5995 052574  016037  000024  001142            MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
```

```
 5996 052602  042737  157777  001142          BIC     #^CEBL,$BDDAT
 5997 052610  001013                          BNE     420$
 5998
 5999 052612  005302                          DEC     R2
 6000 052614  001361                          BNE     415$            ;CONTINUE BIT CLOCKS IF COUNT NOT 0
 6001 052616  012737  020000  001140          MOV     #EBL,$GDDAT
 6002 052624  010037  001136                  MOV     R0,$BDADR
 6003 052630  062737  000024  001136          ADD     #RMMP1,$BDADR
 6004 052636  104271                          EMT     271
 6005
 6006 052640                          420$:                           ;END OF TEST
 6007
 6008                                 ;;*****************************************************************
                                      ;*TEST 120       DATA COMMAND TESTS (3)
                                      ;;*****************************************************************
      052640                          TST120:
      052640  000004                          SCOPE                   ;SCOPE CALL
      052642  000240                          NOP
      052644  012706  001100                  MOV     #STACK,SP       ;LOAD THE STACK POINTER
      052650  013700  001276                  MOV     $BASE,R0        ;R0 = UNIBUS ADDRESS
      052654  013701  001466                  MOV     TSTQUE,R1       ;R1 = POINTER TO DEVICE
      052660  012737  000120  001226          MOV     #120,$TESTN     ;;SET TEST NUMBER IN APT MAIL BOX
 6009
 6010                                 ;VERIFY THE TAG BUS DURING DATA COMMAND
 6011                                 ;FIRST PART USES OFFSET FORWARD
 6012
 6013                                 ;LOAD TEST PARAMETERS IN REGISTER OUTPUT BUFFER
 6014 052666  012737  001060  001446          MOV     #560.,RMDCO     ;LAST CYLINDER
 6015 052674  013737  001334  001420          MOV     LSTRK,RMDAO     ;SET LAST TRACK AND
 6016 052702  112737  000035  001420          MOVB    #29.,RMDAO      ;LAST SECTOR
 6017 052710  012737  000200  001444          MOV     #OFD,RMOFO      ;FORWARD OFFSET
 6018 052716  012737  000071  001412          MOV     #RD!GO,RMCS10   ;READ DATA
 6019 052724  012737  177400  001414          MOV     #-256.,RMWCO    ;WORD COUNT
 6020 052732  012737  104536  001416          MOV     #BUFFER,RMBAO   ;BUFFER ADDRESS
 6021
 6022                                 ;EXECUTE COMMAND AND VERIFY TAG BUS USING SUBROUTINE
 6023 052740  004737  052762                  JSR     PC,10$
 6024
 6025                                 ;SECOND PART USES OFFSET REVERSE
 6026                                 ;LOAD TEST PARAMETERS IN REGISTER OUTPUT BUFFER
 6027 052744  112737  000000  001444          MOVB    #0,RMOFO        ;REVERSE OFFSET
 6028
 6029                                 ;EXECUTE COMMAND AND VERIFY TAG BUS USING SUBROUTINE
 6030 052752  004737  052762                  JSR     PC,10$
 6031 052756  000137  054046                  JMP     300$
 6032
 6033                                 ;;*****************************************************************
 6034                                 ;SUBROUTINE USED DURING TEST
 6035                                 ;;*****************************************************************
 6036
 6037 052762                          10$:
 6038 052762  004737  054732                  JSR     PC,SETVV        ;GO SET VOLUME VALID
      052766  000403                          BR      20$             ;BRANCH TO 20$ IF NO ERROR
      052770  104000                          EMT
 6039 052772  000137  053664                  JMP     160$
 6040
```

```
6041                                    ;LOAD TRACK, SECTOR AND CYLINDER ADDRESS, LOAD OFFSET
6042 052776                             20$:
6043 052776  013760  001420  000006            MOV     RMDA0,RMDA(R0)  ;LOAD RMDA
6044 053004  013760  001446  000034            MOV     RMDC0,RMDC(R0)  ;LOAD RMDC
6045 053012  013760  001444  000032            MOV     RMOF0,RMOF(R0)  ;LOAD RMOF
6046
6047 053020  004737  055054                    JSR     PC,SETOM        ;GO SET OFFSET MODE
     053024  000403                            BR      30$             ;BRANCH TO 30$ IF NO ERROR
     053026  104000                            EMT
6048 053030  000137  053664                    JMP     160$
6049
6050                                    ;LOAD BUFFER ADDRESS AND WORD COUNT
6051 053034                             30$:
6052 053034  013760  001414  000002            MOV     RMWC0,RMWC(R0)  ;LOAD RMWC
6053 053042  013760  001416  000004            MOV     RMBA0,RMBA(R0)  ;LOAD RMBA
6054
6055                                    ;ENABLE DEBUG CLOCK AND LOAD DATA COMMAND
6056 053050  012760  041401  000024            MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
6057 053056  012760  000000  000014            MOV     #0,RMER1(R0)    ;LOAD RMER1
6058 053064  012760  000000  000042            MOV     #0,RMER2(R0)    ;LOAD RMER2
6059 053072  013760  001412  000000            MOV     RMCS10,RMCS1(R0)        ;LOAD RMCS1
6060
6061                                    ;WAIT FOR RUN AND GO TO SET
6062 053100  012737  000310  001534            MOV     #200.,WATCH     ;SET WATCHDOG TIMER VALUE
     053106  004777  126'24                    JSR     PC,@CLOCK       ;START THE CLOCK
6063 053112                             40$:
     053112  016037  000024  001142            MOV     RMMR1(R0),$BDDAT        ;STORE RMMR1 AT $BDDAT
6064 053120  042737  137777  001142            BIC     #^CRG,$BDDAT
6065 053126  001020                            BNE     50$
6066 053130  005737  001534                    TST     WATCH
6067 053134  001366                            BNE     40$
6068 053136  004777  126376                    JSR     PC,@STOPCL      ;STOP THE CLOCK
6069 053142  012737  040000  001140            MOV     #RG,$GDDAT
6070 053150  010037  001136                    MOV     R0,$BDADR
6071 053154  062737  000024  001136            ADD     #RMMR1,$BDADR
6072 053162  104275                            EMT     275
6073 053164  000137  053664                    JMP     160$
6074 053170                             50$:
     053170  004777  126344                    JSR     PC,@STOPCL      ;STOP THE CLOCK
6075 053174  012704  053666                    MOV     #200$,R4        ;R4 = TABLE POINTER
6076
6077                                    ;STEP SEQUENCER TO HEAD SEQUENCE AT LOCATION 156 (17 CLOCKS)
6078 053200  012705  000021                    MOV     #17.,R5         ;R5 = CLOCK COUNT
6079 053204                             60$:
     053204  016037  000040  001142            MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT
6080
6081                                    ;;*****************************************************************
6082 053212  013737  001142  001174            MOV     $BDDAT,$TMP0    ;IF CC AND CH ARE SET AT THE SAME TIME
6083                                            ;THE ECO TO THE CS BOARD IS IMPLEMENTED.
6084
6085 053220  042737  171777  001174            BIC     #^C<CC!CH>,$TMP0        ;SAVE CC AND CH BITS
6086 053226  022737  006000  001174            CMP     #CC!CH,$TMP0    ;ARE CC AND CH SET ?
6087 053234  001414                            BEQ     65$             ;YES, BRANCH TO NEW LOCATION
6088                                    ;;*****************************************************************
6089
6090 053236  042737  150000  001142            BIC     #RQA!RQB!TST,$BDDAT
6091 053244  012437  001140                    MOV     (R4)+,$GDDAT
```

```
                                        BIS     RMDCO,$GDDAT    ;OR CYLINDER ADDRESS
                                        CMP     $GDDAT,$BDDAT
                                        BNE     70$             ;BRANCH IF TAG BUS WRONG
                                65$:
                                        MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
                                        MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
                                        DEC     R5
                                        BNE     60$
                                        BR      80$
                                70$:    MOV     R0,$BDADR
                                        ADD     #RMMR2,$BDADR
                                        EMT     276
                                        BR      160$

                                ;DROP ON CYLINDER TO RESET LATCH, SET ON CYLINDER TO PASS TEST AT
                                ;LOCATION 166
                                80$:
                                        MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
                                        MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1

                                ;STEP SEQUENCER TO END OF OFFSET AT LOCATION 174 (37 CLOCKS)
                                        MOV     #37.,R5         ;RELOAD CLOCK COUNT
                                90$:
                                        MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT

                                ;;**********************************************************************
                                        MOV     $BDDAT,$TMP0    ;IF CC AND CH ARE SET AT SAME TIME
                                                                ;THE ECO TO THE CS BOARD IS IMPLEMENTED.

                                        BIC     #^C<CC!CH>,$TMP0        ;SAVE CC AND CH BITS
                                        CMP     #CC!CH,$TMP0    ;ARE CC AND CH SET ?
                                        BNE     92$             ;NO !!
                                        SUB     #2,R4           ;ADJUST THE TABLE ADDRESS
                                        BR      115$            ;TO OTHER LOCATION
                                92$:
                                ;;**********************************************************************

                                        BIC     #RQA!RQB!TST,$BDDAT
                                        MOV     (R4),$GDDAT
                                        BIT     #CH,(R4)
                                        BEQ     110$            ;BRANCH IF CONTROL/HEADER NOT ON
                                        BIT     #CC,(R4)
                                        BEQ     100$            ;BRANCH IF HEADER TAG

                                ;CONTROL TAG SHOULD BE ON-SETUP EXPECTED OFFSET
                                        BIS     #BB03,$GDDAT    ;ASSUME OFD IS NOT SET
                                        BIT     #OFD,RMOFO
                                        BEQ     95$
                                        BIC     #BB03,$GDDAT    ;RESET BUS BIT 3 - DIRECTION IS REV
                                        BIS     #BB02,$GDDAT
                                95$:    BR      110$

                                ;HEADER TAG SHOULD BE ON - SETUP EXPECTED TRACK ADDRESS
                                100$:
                                        MOVB    RMDAO+1,R3      ;GET TRACK
                                        BIS     R3,$GDDAT
```

```
                                        ;COMPARE EXPECTED AND RECEIVED TAG BUS DATA
                                        110$:
053500                                          CMP     $GDDAT,$BDDAT
053500  023737  001140  001142                  BNE     120$
053506  001013
                                        115$:
053510                                          MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
053510  012760  141401  000024                  MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
053516  012760  041401  000024                  ADD     #2,R4                   ;MOVE TABLE POINTER
053524  062704  000002                          DEC     R5                      ;DECREMENT CLOCK COUNT
053530  005305                                  BNE     90$
053532  001305                                  BR      130$
053534  000407
053536  010037  001136                  120$:   MOV     R0,$BDADR
053542  062737  000040  001136                  ADD     #RMMR2,$BDADR
053550  104276                                  EMT     276
053552  000444                                  BR      160$

                                        ;DROP ON CYLINDER TO RESET LATCH, RAISE ON CYLINDER TO PASS TEST AT
                                        ;SEQUENCER LOCATION 175
053554                                  150$:
053554  012760  041001  000024                  MOV     #DMD!MUR!DBEN,RMMR1(R0) ;LOAD RMMR1
053562  012760  041401  000024                  MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1

                                        ;STEP SEQUENCER TO SECTOR WAIT LOOP (8 CLOCKS)
053570  012705  000010                          MOV     #8.,R5
053574                                  140$:
053574  016037  000040  001142                  MOV     RMMR2(R0),$BDDAT        ;STORE RMMR2 AT $BDDAT

                                        ;;**********************************************************************
                                        ;       BIC     #RQA!RQB!TST,$BDDAT
                                                                        ;THE FOLLOWING CODE WAS ADDED
                                                                        ;TO ALLOW THE PROGRAM TO RUN WITH
                                                                        ;OR WITHOUT ECO TO THE CS BOARD.

053602  042737  171777  001142                  BIC     #^C<CC!CH>,$BDDAT       ;SAVE CC AND CH BITS
053610  012737  006000  001140                  MOV     #CC!CH,$GDDAT   ;GET EXPECTED DATA
                                        ;;**********************************************************************

053616  023737  001140  001142                  CMP     $GDDAT,$BDDAT   ;GOOD DATA SAME AS LAST CMP
053624  001011                                  BNE     150$            ;BRANCH IF ERROR
053626  012760  141401  000024                  MOV     #DMD!MUR!MOC!DBEN!DBCK,RMMR1(R0)        ;LOAD RMMR1
053634  012760  041401  000024                  MOV     #DMD!MUR!MOC!DBEN,RMMR1(R0)     ;LOAD RMMR1
053642  005305                                  DEC     R5
053644  001353                                  BNE     140$
053646  000406                                  BR      160$
053650  010037  001136                  150$:   MOV     R0,$BDADR
053654  062737  000040  001136                  ADD     #RMMR2,$BDADR
053662  104276                                  EMT     276

053664  000207                          160$:   RTS     PC

                                        ;TABLE OF TAG BUS CONTROL AND DATA VALUES
053666                                  200$:
053666  001777                                  .WORD   1777            ;LOCATION 0
053670  001777                                  .WORD   1777            ;LOCATION 25
053672  001777                                  .WORD   1777            ;LOCATION 26
053674  001777                                  .WORD   1777            ;LOCATION 128
053676  001777                                  .WORD   1777            ;LOCATION 129
```

```
6204 053700  001777                .WORD   1777            ;LOCATION 130
6205 053702  004000                .WORD   CC              ;LOCATION 144
6206 053704  004000                .WORD   CC              ;LOCATION 145
6207 053706  024000                .WORD   CC!TAG          ;LOCATION 146
6208 053710  024000                .WORD   CC!TAG          ;LOCATION 147
6209 053712  024000                .WORD   CC!TAG          ;LOCATION 148
6210 053714  024000                .WORD   CC!TAG          ;LOCATION 149
6211 053716  024000                .WORD   CC!TAG          ;LOCATION 150
6212 053720  024000                .WORD   CC!TAG          ;LOCATION 151
6213 053722  004000                .WORD   CC              ;LOCATION 152
6214 053724  004000                .WORD   CC              ;LOCATION 153
6215 053726  001777                .WORD   1777            ;LOCATION 154
6216 053730  002000                .WORD   CH              ;LOCATION 156
6217 053732  002000                .WORD   CH              ;LOCATION 157
6218 053734  022000                .WORD   CH!TAG          ;LOCATION 158
6219 053736  022000                .WORD   CH!TAG          ;LOCATION 159
6220 053740  022000                .WORD   CH!TAG          ;LOCATION 160
6221 053742  022000                .WORD   CH!TAG          ;LOCATION 161
6222 053744  022000                .WORD   CH!TAG          ;LOCATION 162
6223 053746  022000                .WORD   CH!TAG          ;LOCATION 163
6224 053750  002000                .WORD   CH              ;LOCATION 164
6225 053752  002000                .WORD   CH              ;LOCATION 165
6226 053754  001777                .WORD   1777            ;LOCATION 232
6227 053756  001777                .WORD   1777            ;LOCATION 233
6228 053760  001777                .WORD   1777            ;LOCATION 234
6229 053762  001777                .WORD   1777            ;LOCATION 235
6230 053764  001777                .WORD   1777            ;LOCATION 236
6231 053766  001777                .WORD   1777            ;LOCATION 237
6232 053770  001777                .WORD   1777            ;LOCATION 238
6233 053772  001777                .WORD   1777            ;LOCATION 239
6234 053774  001777                .WORD   1777            ;LOCATION 240
6235 053776  001777                .WORD   1777            ;LOCATION 241
6236 054000  001777                .WORD   1777            ;LOCATION 242
6237 054002  001777                .WORD   1777            ;LOCATION 243
6238 054004  001777                .WORD   1777            ;LOCATION 244
6239 054006  001777                .WORD   1777            ;LOCATION 245
6240 054010  001777                .WORD   1777            ;LOCATION 246
6241 054012  001777                .WORD   1777            ;LOCATION 247
6242 054014  001777                .WORD   1777            ;LOCATION 248
6243 054016  001777                .WORD   1777            ;LOCATION 249
6244 054020  001777                .WORD   1777            ;LOCATION 250
6245 054022  001777                .WORD   1777            ;LOCATION 251
6246 054024  001777                .WORD   1777            ;LOCATION 252
6247 054026  001777                .WORD   1777            ;LOCATION 166
6248 054030  006000                .WORD   CC!CH           ;LOCATION 169
6249 054032  006000                .WORD   CC!CH           ;LOCATION 170
6250 054034  026000                .WORD   CC!CH!TAG       ;LOCATION 171
6251 054036  026000                .WORD   CC!CH!TAG       ;LOCATION 172
6252 054040  026000                .WORD   CC!CH!TAG       ;LOCATION 173
6253 054042  026000                .WORD   CC!CH!TAG       ;LOCATION 174
6254 054044  026000                .WORD   CC!CH!TAG       ;LOCATION 175,ETC
6255
6256 054046                300$:                           ;END OF TEST
```

END OF SUB-PASS ROUTINE

```
                                .SBTTL  END OF SUB-PASS ROUTINE

                                ;THIS IS THE END OF SUB-PASS ROUTINE. THIS ROUTINE IS USED TO
                                ;TERMINATE THE OPERATION OF THE CURRENT DEVICE UNDER TEST AND
                                ;SELECT THE NEXT DEVICE FOR TEST. IF THERE ARE NO MORE DEVICES
                                ;TO TEST, EXIT IS MADE TO '$EOP' ROUTINE. OTHERWISE, RETURN
                                ;IS MADE TO 'READY' ROUTINE.

054046  000004                  $EOSP:  SCOPE
054050  000240                          NOP
054052  013700  001466                  MOV     TSTQUE,R0       ;GET POINTER TO TSTQUE
054056  062700  000002                  ADD     #2,R0           ;ADJUST POINTER TO NEXT DEVICE
054062  010037  001466                  MOV     R0,TSTQUE       ;SAVE POINTER TO TSTQUE
054066  005710                          TST     (R0)            ;ANY MORE DEVICES FOR TEST ?
054070  001402                          BEQ     1$              ;BR IF NO
054072  000137  007006                  JMP     READY           ;YES, JUMP TO 'READY' ROUTINE
054076  012737  001470  001466  1$:     MOV     #TSTQUL+2,TSTQUE        ;INITIALIZE POINTER TO FIRST DEVICE IN
                                                                ;TEST QUE TABLE

                                .SBTTL  END OF PASS ROUTINE

                                ;;**************************************************************************
                                ;*INCREMENT THE PASS NUMBER ($PASS)
                                ;*TYPE 'END PASS #XXXXX TOTAL NUMBER OF ERRORS SINCE LAST REPORT YYYYY''
                                ;*WHERE XXXXX AND YYYYY ARE DECIMAL NUMBERS
                                ;*IF THERES A MONITOR GO TO IT
                                ;*IF THERE ISN'T JUMP TO READY

054104                          $EOP:
054104  000240                          NOP
054106  005037  001116                  CLR     $TSTNM          ;;ZERO THE TEST NUMBER
054112  005037  001206                  CLR     $TIMES          ;;ZERO THE NUMBER OF ITERATIONS
054116  005237  001230                  INC     $PASS           ;;INCREMENT THE PASS NUMBER
054122  042737  100000  001230          BIC     #100000,$PASS   ;;DON'T ALLOW A NEG. NUMBER
054130  005327                          DEC     (PC)+           ;;LOOP?
054132  000001                  $EOPCT: .WORD   1
054134  003066                          BGT     $DOAGN          ;;YES
054136  012737                          MOV     (PC)+,@(PC)+    ;;RESTORE COUNTER
054140  000001                  $ENDCT: .WORD   1
054142  054132                          $EOPCT
054144  104401  054152                  TYPE    ,65$            ;;TYPE ASCIZ STRING
054150  000407                          BR      64$             ;;GET OVER THE ASCIZ
                                ;;65$:  .ASCIZ  <12><15>/END PASS #/
054170                          64$:
054170  013746  001230                  MOV     $PASS,-(SP)     ;;SAVE $PASS FOR TYPEOUT
                                                                ;;TYPE PASS NUMBER
054174  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
054176  005737  001126                  TST     $ERTTL          ;;SEE IF ANY ERRORS THIS PASS
054202  001431                          BEQ     $GT42P          ;;BR IF NO ERRORS TO REPORT
054204  104401  054212                  TYPE    ,67$            ;;TYPE ASCIZ STRING
054210  000421                          BR      66$             ;;GET OVER THE ASCIZ
                                ;;67$:  .ASCIZ  /  TOTAL ERRORS SINCE LAST REPORT /
054254                          66$:
054254  013746  001126                  MOV     $ERTTL,-(SP)    ;;SAVE $ERTTL FOR TYPEOUT
                                                                ;;TOTAL NUMBER OF ERRORS
054260  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
054262  005037  001126                  CLR     $ERTTL          ;;CLEAR ERROR TOTAL
```

END OF PASS ROUTINE

```
054266  104401  001217          $GT42P: TYPE    ,$CRLF          ;;TYPE CARRIAGE RETURN, LINE FEED
054272  013700  000042          $GET42: MOV     @#42,R0         ;;GET MONITOR ADDRESS
054276  001405                          BEQ     $DOAGN          ;;BRANCH IF !   MONITOR
054300  000005                          RESET                   ;;CLEAR THE !   .LD
054302  004710                  $ENDAD: JSR     PC,(R0)         ;;GO TO MONI.OR
054304  000240                          NOP                     ;;SAVE ROOM
054306  000240                          NOP                     ;;FOR
054310  000240                          NOP                     ;;ACT11
054312                          $DOAGN:
054312  000137                          JMP     @(PC)+          ;;RETURN
054314  007006                  $RTNAD: .WORD   READY
054316     377     377     000  $ENULL: .BYTE   -1,-1,0          ;;NULL CHARACTER STRING
                                        .EVEN
```

CLOCK SUBROUTINES

```
                                        .SBTTL  CLOCK SUBROUTINES

                                        ;ROUTINE TO SIZE FOR CLOCKS (KW11-L OR KW11-P)

054322  000240                  SIZCLK: NOP
054324  013746  000004                  MOV     ERRVEC,-(SP)    ;;PUSH ERRVEC ON STACK
054330  013746  000006                  MOV     ERRVEC+2,-(SP)          ;;PUSH ERRVEC+2 ON STACK
054334  012737  054420  000004          MOV     #10$,ERRVEC     ;LOAD 04 TRAP VECTORS
054342  012737  000300  000006          MOV     #PR6,ERRVEC+2

                                        ;SEE IF A KW11-P CLOCK IS PRESENT - GO TO 10$ IF NOT PRESENT
054350  005777  125136                  TST     @$LPCSR         ;TEST FOR P CLOCK
054354  012737  054562  001536          MOV     #PCLOCK,CLOCK   ;LOAD SUBROUTINE ADDRESS
054362  012737  054704  001540          MOV     #PSTOP,STOPCL   ;LOAD STOP ADDRESS
054370  012777  054650  125120          MOV     #PCOUNT,@$LPVEC ;LOAD P CLOCK INTERRUPT VECTOR
054376  012777  000300  125114          MOV     #PR6,@$LPVEC+2
054404  013777  001526  125112          MOV     $LLVEC+2,@$LLVEC        ;CLEAR L CLOCK INTERRUPT VECTOR
054412  005077  125110                  CLR     @$LLVEC+2
054416  000454                          BR      30$
054420  012716  054426          10$:    MOV     #15$,(SP)       ;DUMMY RTI ADDRESS
054424  000002                          RTI                     ;RESTORE PRIORITY

                                        ;NO P CLOCK-SEE IF L CLOCK IS PRESENT-GO TO 20$ IF NOT PRESET
054426                          15$:
054426  012737  054504  000004          MOV     #20$,ERRVEC     ;CHANGE 04 TRAP VECTOR
054434  005777  125062                  TST     @$LLCSR         ;TEST FOR L CLOCK
054440  012737  054600  001536          MOV     #LCLOCK,CLOCK   ;LOAD SUBROUTINE ADDRESS
054446  012737  054712  001540          MOV     #LSTOP,STOPCL   ;LOAD STOP ADDRESS
054454  012777  054650  125042          MOV     #LCOUNT,@$LLVEC ;LOAD L CLOCK INTERRUPT VECTOR
054462  012777  000300  125036          MOV     #PR6,@$LLVEC+2
054470  013777  001520  125020          MOV     $LPVEC+2,@$LPVEC;CLEAR P CLOCK INTERRUPT VECTOR
054476  005077  125016                  CLR     @$LPVEC+2
054502  000422                          BR      30$
054504  012716  054512          20$:    MOV     #25$,(SP)       ;DUMMY RTI ADDRESS
054510  000002                          RTI                     ;RESTORE PRIORITY

                                        ;NO CLOCK AVAILABLE - AUGMENT RETURN ADDRESS
054512                          25$:
054512  005037  001536                  CLR     CLOCK           ;CLEAR SUBROUTINE ADDRESS
054516  012737  001520  001516          MOV     #$LPVEC+2,$LPVEC;CLEAR P CLOCK INTERRUPT VECTOR
054524  005037  001520                  CLR     $LPVEC+2
054530  012737  001526  001524          MOV     #$LLVEC+2,$LLVEC;CLEAR L CLOCK INTERRUPT VECTOR
054536  005037  001526                  CLR     $LLVEC+2
054542  062766  000002  000004          ADD     #2,4(SP)        ;CHANGE RETURN ADDRESS
054550                          30$:
054550  012o37  000006                  MOV     (SP)+,ERRVEC+2          ;;POP STACK INTO ERRVEC+2
054554  012637  000004                  MOV     (SP)+,ERRVEC    ;;POP STACK INTO ERRVEC
054560  000207                          RTS     PC

                                        ;ROUTINES TO START THE CLOCK (KW11-L OR KW11-P)

054562  012777  177777  124724  PCLOCK: MOV     #-1,@$LPCSB     ;LOAD COUNT SET BUFFER
054570  012777  000135  124714          MOV     #135,@$LPCSR    ;LOAD CONTROL REGISTER
054576  000403                          BR      PLCLK           ;GO TO COMMON CODE

054600  012777  000100  124714  LCLOCK: MOV     #100,@$LLCSR    ;LOAD CONTROL REGISTER
```

CLOCK SUBROUTINES

```
     057 054606  005037  001532          PLCLK:  CLR     TIME            ;CLEAR TIMER COUNT
     058 054612  104400                          TRAP                    ;;PUSH OLD PSW AND PC ON STACK
         054614  012605                          MOV     (SP)+,R5        ;;SAVE THE PSW IN R5
     059 054616  010537  001530                  MOV     R5,$PSW         ;SAVE PRIORITY
     060 054622  042705  177437                  BIC     #^CPR7,R5       ;MASK X
     061 054626  022705  000300                  CMP     #PR6,R5         ;IS PRIGRITY TOO HIGH??
     062 054632  101005                          BHI     40$             ;NO!!
     063 054634  012746  000240                  MOV     #PR5,-(SP)      ;;PUT NEW PS ON STACK
         054640  012746  054646                  MOV     #30$,-(SP)      ;;PUT NEW PC ON  STACK
         054644  000002                          RTI                     ;;POP NEW PC AND PS
         054646                          30$:
     064 054646  000207                  40$:    RTS     PC
     065
     066                                 ;ROUTINES TO HANDLE CLOCK INTERRUPTS (KW11-L OR KW11-P)
     067
     068 054650                          PCOUNT:
     069 054650  062737  000021  001532  LCOUNT: ADD     #17.,TIME       ;ADD 17MS TO ELAPSED TIME
     070 054656  103003                          BCC     10$             ;BRANCH IF NO OVERFLOW
     071 054660  012737  177777  001532          MOV     #-1,TIME        ;RESTORE MAXIMUM COUNT
     072 054666  162737  000021  001534  10$:    SUB     #17.,WATCH      ;DECREMENT REMAINING TIME
     073 054674  100002                          BPL     20$             ;BRANCH IF POSITIVE
     074 054676  005037  001534                  CLR     WATCH           ;CLEAR REMAINING TIME
     075 054702                          20$:
     076
     077                                 ;RTI TO HANDLE DEVICE INTERRUPTS
     078
     079 054702  000002                  IRP:    RTI                     ;RETURN TO USER
     080
     081                                 ;ROUTINES TO STOP THE CLOCK (KW11-L OR KW11-P)
     082
     083 054704  005077  124602          PSTOP:  CLR     @$LPCSR         ;STOP P CLOCK
     084 054710  000402                          BR      PLSTP           ;GO TO COMMON STOP CODE
     085
     086 054712  005077  124604          LSTOP:  CLR     @$LLCSR         ;STOP L CLOCK
     087
     088 054716                          PLSTP:
     089 054716  013746  00'530                  MOV     $PSW,-(SP)      ;;PUT NEW PS ON STACK
         054722  012746  054730                  MOV     #10$,-(SP)      ;;PUT NEW PC ON  STACK
         054726  000002                          RTI                     ;;POP NEW PC AND PS
         054730                          10$:
     090 054730  000207                          RTS     PC
```

SET VOLUME VALID SUBROUTINE

```
                                        .SBTTL  SET VOLUME VALID SUBROUTINE
                                        ;
                                        ;THIS SUBROUTINE INITIALIZES THE SUBSYSTEM AND SETS VOLUME VALID,
                                        ;RETURNING WITH THE DRIVE STILL IN DIAGNOSTIC MODE.  THE SUBROUTINE
                                        ;RETURNS TO THE WORD FOLLOWING THE CALL, EXCEPT WHEN AN ERROR IS
                                        ;DETECTED, IN WHICH CASE IT RETURNS TO THE SECOND WORD FOLLOWING THE
                                        ;CALL.
                                        ;
                                        ;CALL:  JSR     PC,SETVV        JUMP TO SUBROUTINE
                                        ;       BR      ??              RETURN HERE IF NO ERROR
                                        ;       ERROR                   RETURN HERE IF ERROR
                                        ;
054732                                  SETVV:
054732  004737  055156                          JSR     PC,CNTCLR       ;GO CLEAR CONTROLLER
054736  012760  000001  000024                  MOV     #DMD,RMMR1(R0)  ;LOAD RMMR1
054744  012760  001001  000024                  MOV     #DMD!MUR,RMMR1(R0)      ;LOAD RMMR1
054752  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
054760  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
054766  012760  000023  000000                  MOV     #PACACK!GO,RMCS1(R0)    ;LOAD RMCS1
054774  016037  000012  001142                  MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
055002  042737  177677  001142                  BIC     #^CVV,$BDDAT
055010  001020                                  BNE     10$             ;BRANCH IF VOLUME VALID SET
055012  010037  001136                          MOV     R0,$BDADR       ;SETUP FOR ERROR MSG
055016  062737  000012  001136                  ADD     #RMDS,$BDADR
055024  012737  000100  001140                  MOV     #VV,$GDDAT
055032  062716  000002                          ADD     #2,(SP)         ;MOVE RETURN ADDRESS TO ERROR
055036  112776  000170  000000                  MOVB    #170,@(SP)      ;WRITE ERROR NUMBER
055044  012737  000022  001174                  MOV     #PACACK,$TMP0
055052  000207                          10$:    RTS     PC              ;RETURN
```

SET OFFSET MODE SUBROUTINE

```
                                        .SBTTL  SET OFFSET MODE SUBROUTINE
                                        ;
                                        ;THIS SUBROUTINE EXECUTES AN OFFSET COMMAND AND VERIFIES THAT OFFSET
                                        ;MODE SETS.  THE DRIVE SHOULD BE IN DIAGNOSTIC MODE WHEN CALLING THE
                                        ;SUBROUTINE, WHICH WILL LEAVE DMD ON.  THE SUBROUTINE RETURNS TO THE
                                        ;WORD FOLLOWING THE CALL UNLESS THERE IS AN ERROR, IN WHICH CASE IT
                                        ;RETURNS TO THE SECOND WORD FOLLOWING THE CALL
                                        ;
                                        ;CALL:  JSR     PC,SETOM        JUMP TO SUBROUTINE
                                        ;       BR      ??              RETURN HERE IF NO ERROR
                                        ;       ERROR                   RETURN HERE IF ERROR
                                        ;
055054                                  SETOM:
055054  012760  001001  000024                  MOV     #DMD!MUR,RMMR1(R0)      ;LOAD RMMR1
055062  012760  000000  000014                  MOV     #0,RMER1(R0)    ;LOAD RMER1
055070  012760  000000  000042                  MOV     #0,RMER2(R0)    ;LOAD RMER2
055076  012760  000015  000000                  MOV     #OFFSET!GO,RMCS1(R0)    ;LOAD RMCS1
055104  016037  00C012  001142                  MOV     RMDS(R0),$BDDAT ;STORE RMDS AT $BDDAT
055112  042737  177776  001142                  BIC     #^COM,$BDDAT
055120  001015                                  BNE     10$             ;BRANCH IF OFFSET ON
055122  012737  000001  001140                  MOV     #OM,$GDDAT
055130  010037  001136                          MOV     R0,$BDADR
055134  062737  000012  001136                  ADD     #RMDS,$BDADR
055142  062716  000002                          ADD     #2,(SP)         ;MOVE RETURN ADDRESS TO ERROR
055146  112776  000200  000000                  MOVB    #200,@(SP)      ;WRITE ERROR NUMBER
055154                                  10$:
055154  000207                                  RTS     PC              ;RETURN TO USER
```

CLEAR CONTROLLER SUBROUTINE

```
                                .SBTTL  CLEAR CONTROLLER SUBROUTINE
                                
                                ;THIS SUBROUTINE CLEARS THE MASSBUS CONTROLLER, MASSBUS ADAPTERS,
                                ;AND DRIVES, THEN SELECTS THE DRIVE.
                                ;CALL:
                                ;       JSR     PC,CNTCLR       ;CALL TO ROUTINE
                                
 055156                         CNTCLR:
 055156  010046                        MOV     R0,-(SP)        ;;PUSH R0 ON STACK
 055160  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
 055162  013700  001276                MOV     $BASE,R0        ;R0 = UNIBUS BASE ADDRESS
 055166  012760  000040  000010        MOV     #CLR,RMCS2(R0)  ;CLEAR MASSBUS
 055174  013701  001466                MOV     TSTQUE,R1       ;GET DEVICE UNDER TEST
 055200  111160  000010                MOVB    (R1),RMCS2(R0)  ;SELECT DEVICE
 055204  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
 055206  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
 055210  000207                        RTS     PC              ;RETURN
```

SAVE AND RESTORE R0-R5 ROUTINES

```
      1                               .SBTTL  SAVE AND RESTORE R0-R5 ROUTINES

                                      ;;*****************************************************************
                                      ;*SAVE R0-R5
                                      ;*CALL:
                                      ;*      SAVREG
                                      ;*UPON RETURN FROM $SAVREG THE STACK WILL LOOK LIKE:
                                      ;*
                                      ;*TOP---(+16)
                                      ;* +2---(+18)
                                      ;* +4---R5
                                      ;* +6---R4
                                      ;* +8---R3
                                      ;*+10---R2
                                      ;*+12---R1
                                      ;*+14---R0

 055212                               $SAVREG:
 055212  010046                               MOV     R0,-(SP)        ;;PUSH R0 ON STACK
 055214  010146                               MOV     R1,-(SP)        ;;PUSH R1 ON STACK
 055216  010246                               MOV     R2,-(SP)        ;;PUSH R2 ON STACK
 055220  010346                               MOV     R3,-(SP)        ;;PUSH R3 ON STACK
 055222  010446                               MOV     R4,-(SP)        ;;PUSH R4 ON STACK
 055224  010546                               MOV     R5,-(SP)        ;;PUSH R5 ON STACK
 055226  016646  000022                       MOV     22(SP),-(SP)    ;;SAVE PS OF MAIN FLOW
 055232  016646  000022                       MOV     22(SP),-(SP)    ;;SAVE PC OF MAIN FLOW
 055236  016646  000022                       MOV     22(SP),-(SP)    ;;SAVE PS OF CALL
 055242  016646  000022                       MOV     22(SP),-(SP)    ;;SAVE PC OF CALL
 055246  000002                               RTI

                                      ;*RESTORE R0-R5
                                      ;*CALL:
                                      ;*      RESREG
 055250                               $RESREG:
 055250  012666  000022                       MOV     (SP)+,22(SP)    ;;RESTORE PC OF CALL
 055254  012666  000022                       MOV     (SP)+,22(SP)    ;;RESTORE PS OF CALL
 055260  012666  000022                       MOV     (SP)+,22(SP)    ;;RESTORE PC OF MAIN FLOW
 055264  012666  000022                       MOV     (SP)+,22(SP)    ;;RESTORE PS OF MAIN FLOW
 055270  012605                               MOV     (SP)+,R5        ;;POP STACK INTO R5
 055272  012604                               MOV     (SP)+,R4        ;;POP STACK INTO R4
 055274  012603                               MOV     (SP)+,R3        ;;POP STACK INTO R3
 055276  012602                               MOV     (SP)+,R2        ;;POP STACK INTO R2
 055300  012601                               MOV     (SP)+,R1        ;;POP STACK INTO R1
 055302  012600                               MOV     (SP)+,R0        ;;POP STACK INTO R0
 055304  000002                               RTI
```

```
                                .SBTTL  BINARY TO ASCII AND TYPE ROUTINE

                                ;;**********************************************************************
                                ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 16-BIT
                                ;*BINARY-ASCII NUMBER AND TYPE IT.
                                ;*CALL:
                                ;*      MOV     NUMBER,-(SP)    ;;NUMBER TO BE TYPED
                                ;*      TYPBN                   ;;TYPE IT

055306  010146                  $TYPBN: MOV     R1,-(SP)        ;;SAVE R1 ON THE STACK
055310  016601  000006                  MOV     6(SP),R1        ;;GET THE INPUT NUMBER
055314  000261                          SEC                     ;;SET "C" SO CAN KEEP TRACK OF THE NUMBER OF BITS
055316  112737  000060  055360  1$:     MOVB    #'0,$BIN        ;;SET CHARACTER TO AN ASCII "0".
055324  006101                          ROL     R1              ;;GET THIS BIT
055326  001406                          BEQ     2$              ;;DONE?
055330  105537  055360                  ADCB    $BIN            ;;NO--SET THE CHARACTER EQUAL TO THIS BIT
055334  104401  055360                  TYPE    ,$BIN           ;;GO TYPE THIS BIT
055340  000241                          CLC                     ;;CLEAR "C" SO CAN KEEP TRACK OF BITS
055342  000765                          BR      1$              ;;GO DO THE NEXT BIT
055344  012601                  2$:     MOV     (SP)+,R1        ;;POP THE STACK INTO R1
055346  016666  000002  000004          MOV     2(SP),4(SP)     ;;ADJUST THE STACK
055354  012616                          MOV     (SP)+,(SP)
055356  000002                          RTI                     ;;RETURN TO USER
055360     000     000          $BIN:   .BYTE   0,0             ;;STORAGE FOR ASCII CHAR. AND TERMINATOR
```

```
                                .SBTTL  CONVERT BINARY TO DECIMAL AND TYPE ROUTINE

                                ;;*****************************************************************
                                ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 5-DIGIT
                                ;*SIGNED DECIMAL (ASCII) NUMBER AND TYPE IT. DEPENDING ON WHETHER THE
                                ;*NUMBER IS POSITIVE OR NEGATIVE A SPACE OR A MINUS SIGN WILL BE TYPED
                                ;*BEFORE THE FIRST DIGIT OF THE NUMBER. LEADING ZEROS WILL ALWAYS BE
                                ;*REPLACED WITH SPACES.
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;PUT THE BINARY NUMBER ON THE STACK
                                ;*      TYPDS                   ;;GO TO THE ROUTINE

055362                          $TYPDS:
055362  010046                         MOV     R0,-(SP)        ;;PUSH R0 ON STACK
055364  010146                         MOV     R1,-(SP)        ;;PUSH R1 ON STACK
055366  010246                         MOV     R2,-(SP)        ;;PUSH R2 ON STACK
055370  010346                         MOV     R3,-(SP)        ;;PUSH R3 ON STACK
055372  010546                         MOV     R5,-(SP)        ;;PUSH R5 ON STACK
055374  012746  020200                 MOV     #20200,-(SP)    ;;SET BLANK SWITCH AND SIGN
055400  016605  000020                 MOV     20(SP),R5       ;;GET THE INPUT NUMBER
055404  100004                         BPL     1$              ;;BR IF INPUT IS POS.
055406  005405                         NEG     R5              ;;MAKE THE BINARY NUMBER POS
055410  112766  000055  000001         MOVB    #'-,1(SP)       ;;MAKE THE ASCII NUMBER NEG.
055416  005000                 1$:     CLR     R0              ;;ZERO THE CONSTANTS INDEX
055420  012703  055576                 MOV     #$DBLK,R3       ;;SETUP THE OUTPUT POINTER
055424  112723  000040                 MOVB    #' ,(R3)+       ;;SET THE FIRST CHARACTER TO A BLANK
055430  005002                 2$:     CLR     R2              ;;CLEAR THE BCD NUMBER
055432  016001  055566                 MOV     $DTBL(R0),R1    ;;GET THE CONSTANT
055436  160105                 3$:     SUB     R1,R5           ;;FORM THIS BCD DIGIT
055440  002402                         BLT     4$              ;;BR IF DONE
055442  005202                         INC     R2              ;;INCREASE THE BCD DIGIT BY 1
055444  000774                         BR      3$
055446  060105                 4$:     ADD     R1,R5           ;;ADD BACK THE CONSTANT
055450  005702                         TST     R2              ;;CHECK IF BCD DIGIT=0
055452  001002                         BNE     5$              ;;FALL THROUGH IF 0
055454  105716                         TSTB    (SP)            ;;STILL DOING LEADING 0'S?
055456  100407                         BMI     7$              ;;BR IF YES
055460  106316                 5$:     ASLB    (SP)            ;;MSD?
055462  103003                         BCC     6$              ;;BR IF NO
055464  116663  000001  177777         MOVB    1(SP),-1(R3)    ;;YES--SET THE SIGN
055472  052702  000060         6$:     BIS     #'0,R2          ;;MAKE THE BCD DIGIT ASCII
055476  052702  000040         7$:     BIS     #' ,R2          ;;MAKE IT A SPACE IF NOT ALREADY A DIGIT
055502  110223                         MOVB    R2,(R3)+        ;;PUT THIS CHARACTER IN THE OUTPUT BUFFER
055504  005720                         TST     (R0)+           ;;JUST INCREMENTING
055506  020027  000010                 CMP     R0,#10          ;;CHECK THE TABLE INDEX
055512  002746                         BLT     2$              ;;GO DO THE NEXT DIGIT
055514  003002                         BGT     8$              ;;GO TO EXIT
055516  010502                         MOV     R5,R2           ;;GET THE LSD
055520  000764                         BR      6$              ;;GO CHANGE TO ASCII
055522  105726                 8$:     TSTB    (SP)+           ;;WAS THE LSD THE FIRST NON-ZERO?
055524  100003                         BPL     9$              ;;BR IF NO
055526  116663  177777  177776         MOVB    -1(SP),-2(R3)   ;;YES--SET THE SIGN FOR TYPING
055534  105013                 9$:     CLRB    (R3)            ;;SET THE TERMINATOR
055536  012605                         MOV     (SP)+,R5        ;;POP STACK INTO R5
055540  012603                         MOV     (SP)+,R3        ;;POP STACK INTO R3
055542  012602                         MOV     (SP)+,R2        ;;POP STACK INTO R2
055544  012601                         MOV     (SP)+,R1        ;;POP STACK INTO R1
```

CONVERT BINARY TO DECIMAL AND TYPE ROUTINE

```
055546  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
055550  104401  055576                  TYPE    ,$DBLK          ;;NOW TYPE THE NUMBER
055554  016666  000002  000004          MOV     2(SP),4(SP)     ;;ADJUST THE STACK
055562  012616                          MOV     (SP)+,(SP)
055564  000002                          RTI                     ;;RETURN TO USER
055566  023420                  $DTBL:  10000.
055570  001750                          1000.
055572  000144                          100.
055574  000012                          10.
055576                          $DBLK:  .BLKW   '
```

```
                                .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE

                                ;;*****************************************************************
                                ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
                                ;*OCTAL (ASCII) NUMBER AND TYPE IT.
                                ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                ;*      TYPOS                   ;;CALL FOR TYPEOUT
                                ;*      .BYTE   N               ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
                                ;*      .BYTE   M               ;;M=1 OR 0
                                ;*                                      ;;1=TYPE LEADING ZEROS
                                ;*                                      ;;0=SUPPRESS LEADING ZEROS
                                ;*
                                ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
                                ;*$TYPOS OR $TYPOC
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                ;*      TYPON                   ;;CALL FOR TYPEOUT
                                ;*
                                ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                ;*      TYPOC                   ;;CALL FOR TYPEOUT

055506  017646  000000          $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
055512  116637  000001  056031          MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
055520  112637  056033                  MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
055524  062716  000002                  ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
055530  000406                          BR      $TYPON
055532  112737  000001  056031  $TYPOC: MOVB    #1,$OFILL       ;;SET THE ZERO FILL SWITCH
055540  112737  000006  056033          MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
055546  112737  000005  056030  $TYPON: MOVB    #5,$OCNT        ;;SET THE ITERATION COUNT
055554  010346                          MOV     R3,-(SP)        ;;SAVE R3
055556  010446                          MOV     R4,-(SP)        ;;SAVE R4
055560  010546                          MOV     R5,-(SP)        ;;SAVE R5
055562  113704  056033                  MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
055566  005404                          NEG     R4
055570  062704  000006                  ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
055574  110437  056032                  MOVB    R4,$OMODE       ;;SAVE IT FOR USE
055700  113704  056031                  MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
055704  016605  000012                  MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
055710  005003                          CLR     R3              ;;CLEAR THE OUTPUT WORD
055712  006105                  1$:     ROL     R5              ;;ROTATE MSB INTO "C"
055714  000404                          BR      3$              ;;GO DO MSB
055716  006105                  2$:     ROL     R5              ;;FORM THIS DIGIT
055720  006105                          ROL     R5
055722  006105                          ROL     R5
055724  010503                          MOV     R5,R3
055726  006103                  3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
055730  105337  056032                  DECB    $OMODE          ;;TYPE THIS DIGIT?
055734  100016                          BPL     7$              ;;BR IF NO
055736  042703  177770                  BIC     #177770,R3      ;;GET RID OF JUNK
055742  001002                          BNE     4$              ;;TEST FOR 0
055744  005704                          TST     R4              ;;SUPPRESS THIS 0?
055746  001403                          BEQ     5$              ;;BR IF YES
055750  005204                  4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
```

```
055752  052703  000060              BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
055756  052703  000040      5$:     BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
055762  110337  056026              MOVB    R3,8$           ;;SAVE FOR TYPING
055766  104401  056026              TYPE    ,8$             ;;GO TYPE THIS DIGIT
055772  105337  056030      7$:     DECB    $OCNT           ;;COUNT BY 1
055776  003347                      BGT     2$              ;;BR IF MORE TO DO
056000  002402                      BLT     6$              ;;BR IF DONE
056002  005204                      INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
056004  000744                      BR      2$              ;;GO DO THE LAST DIGIT
056006  012605              6$:     MOV     (SP)+,R5        ;;RESTORE R5
056010  012604                      MOV     (SP)+,R4        ;;RESTORE R4
056012  012603                      MOV     (SP)+,R3        ;;RESTORE R3
056014  016666  000002  000004      MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
056022  012616                      MOV     (SP)+,(SP)
056024  000002                      RTI                     ;;RETURN
056026     000      8$:     .BYTE   0               ;;STORAGE FOR ASCII DIGIT
056027     000              .BYTE   0               ;;TERMINATOR FOR TYPE ROUTINE
056030     000      $OCNT:  .BYTE   0               ;;OCTAL DIGIT COUNTER
056031     000      $OFILL: .BYTE   0               ;;ZERO FILL SWITCH
056032  000000      $OMODE: .WORD   0               ;;NUMBER OF DIGITS TO TYPE
```

```
                                .SBTTL  TYPE ROUTINE

                                ;;*****************************************************************
                                ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
                                ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
                                ;*NOTE1:         $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
                                ;*NOTE2:         $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
                                ;*NOTE3:         $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
                                ;*
                                ;*CALL:
                                ;*1) USING A TRAP INSTRUCTION
                                ;*      TYPE    ,MESADR         ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
                                ;*OR
                                ;*      TYPE
                                ;*      MESADR
                                ;*

056034  105737  001173          $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
056040  100002                          BPL     1$              ;;BR IF YES
056042  000000                          HALT                    ;;HALT HERE IF NO TERMINAL
056044  000430                          BR      3$              ;;LEAVE
056046  010046                  1$:     MOV     R0,-(SP)        ;;SAVE R0
056050  017600  000002                  MOV     @2(SP),R0       ;;GET ADDRESS OF ASCIZ STRING
056054  122737  000001  001242          CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
056062  001011                          BNE     62$             ;;NO,GO CHECK FOR APT CONSOLE
056064  132737  000100  001243          BITB    #APTSPOOL,$ENVM ;;SPOOL MESSAGE TO APT
056072  001405                          BEQ     62$             ;;NO,GO CHECK FOR CONSOLE
056074  010037  056104                  MOV     R0,61$          ;;SETUP MESSAGE ADDRESS FOR APT
056100  004737  062606                  JSR     PC,$ATY3        ;;SPOOL MESSAGE TO APT
056104  000000                  61$:    .WORD   0               ;;MESSAGE ADDRESS
056106  132737  000040  001243  62$:    BITB    #APTCSUP,$ENVM  ;;APT CONSOLE SUPPRESSED
056114  001003                          BNE     60$             ;;YES,SKIP TYPE OUT
056116  112046                  2$:     MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
056120  001005                          BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
056122  005726                          TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
056124  012600                  60$:    MOV     (SP)+,R0        ;;RESTORE R0
056126  062716  000002          3$:     ADD     #2,(SP)         ;;ADJUST RETURN PC
056132  000002                          RTI                     ;;RETURN
056134  122716  000011          4$:     CMPB    #HT,(SP)        ;;BRANCH IF <HT>
056140  001430                          BEQ     8$
056142  122716  000200                  CMPB    #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
056146  001006                          BNE     5$
056150  005726                          TST     (SP)+           ;;POP  <CR><LF> EQUIV
056152  104401                          TYPE                    ;;TYPE A CR AND LF
056154  001217                          $CRLF
056156  105037  056364                  CLRB    $CHARCNT        ;;CLEAR CHARACTER COUNT
056162  000755                          BR      2$              ;;GET NEXT CHARACTER
056164  004737  056246          5$:     JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
056170  123726  001172          6$:     CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
056174  001350                          BNE     2$              ;;IF NO GO GET NEXT CHAR.
056176  013746  001170                  MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
                                                                ;;AND THE NULL CHAR.
056202  105366  000001          7$:     DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
056206  002770                          BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
056210  004737  056246                  JSR     PC,$TYPEC       ;;GO TYPE A NULL
056214  105337  056364                  DECB    $CHARCNT        ;;DO NOT COUNT AS A COUNT
056220  000770                          BR      7$              ;;LOOP
```

```
                                        ;HORIZONTAL TAB PROCESSOR

056222  112716  000040          8$:     MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
056226  004737  056246          9$:     JSR     PC,$TYPEC       ;;TYPE A SPACE
056232  132737  000007  056364          BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
056240  001372                          BNE     9$              ;;TAB STOP
056242  005726                          TST     (SP)+           ;;POP SPACE OFF STACK
056244  000724                          BR      2$              ;;GET NEXT CHARACTER
056246                          $TYPEC:
056246  105777  122706                  TSTB    @$TKS           ;;CHAR IN KYBD BUFFER?
056252  100022                          BPL     10$             ;;BR IF NOT
056254  017746  122702                  MOV     @$TKB,-(SP)     ;;GET CHAR
056260  042716  177600                  BIC     #177600,(SP)    ;;STRIP EXTRANEOUS BITS
056264  122716  000023                  CMPB    #$XOFF,(SP)     ;;WAS CHAR XOFF
056270  001012                          BNE     102$            ;;BR IF NOT
056272                          101$:
056272  105777  122662                  TSTB    @$TKS           ;;WAIT FOR CHAR
056276  100375                          BPL     101$
056300  117716  122656                  MOVB    @$TKB,(SP)      ;;GET CHAR
056304  042716  177600                  BIC     #177600,(SP)    ;;STRIP IT
056310  122716  000021                  CMPB    #$XON,(SP)      ;;WAS IT XON?
056314  001366                          BNE     101$            ;;BR IF NOT
056316                          102$:
056316  005726                          TST     (SP)+           ;;FIX STACK
056320                          10$:
056320  105777  122640                  TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
056324  100375                          BPL     10$
056326  116677  000002  122632          MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.
056334  122766  000015  000002          CMPB    #CR,2(SP)       ;;IS CHARACTER A CARRIAGE RETURN?
056342  001003                          BNE     1$              ;;BRANCH IF NO
056344  105037  056364                  CLRB    $CHARCNT        ;;YES--CLEAR CHARACTER COUNT
056350  000406                          BR      $TYPEX          ;;EXIT
056352  122766  000012  000002  1$:     CMPB    #LF,2(SP)       ;;IS CHARACTER A LINE FEED?
056360  001402                          BEQ     $TYPEX          ;;BRANCH IF YES
056362  105227                          INCB    (PC)+           ;;COUNT THE CHARACTER
056364  000000          $CHARCNT:.WORD  0                       ;;CHARACTER COUNT STORAGE
056366  000207          $TYPEX: RTS     PC
```

```
                                .SBTTL  SCOPE HANDLER ROUTINE

                                ;;**********************************************************
                                ;*THIS ROUTINE CONTROL THE LOOPING OF SUBTESTS. IT WILL INCREMENT
                                ;*AND LOAD THE TEST NUMBER($TSTNM) INTO THE DISPLAY REG.(DISPLAY<7:0>)
                                ;*AND LOAD THE ERROR FLAG ($ERFLG) INTO DISPLAY<15:08>
                                ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                ;*SW14=1         LOOP ON TEST
                                ;*SW11=1         INHIBIT ITERATIONS
                                ;*SW09=1         LOOP ON ERROR
                                ;*SW08=1         LOOP ON TEST IN SWR<7:0>
                                ;*CALL
                                ;*      SCOPE           ;;SCOPE=IOT

056370                          $SCOPE:
056370  104410                         CKSWR                   ;;TEST  FOR CHANGE IN SOFT-SWR
056372  032777  040000  122554  1$:     BIT     #BIT14,@SWR     ;;LOOP ON PRESENT TEST?
056400  001402                         BEQ     9$              ;;NO IF SW14=0
056402  000137  057032                 JMP     $OVER           ;;JUMP OVER SCOPE ROUTINE
056406                          9$:
                                ;#####START OF CODE FOR THE XOR TESTER#####
056406  000416                  $XTSTR: BR      6$              ;;IF RUNNING ON THE "XOR" TESTER CHANGE
                                                                ;;THIS INSTRUCTION TO A "NOP" (NOP=240)
056410  013746  000004                 MOV     @#ERRVEC,-(SP)  ;;SAVE THE CONTENTS OF THE ERROR VECTOR
056414  012737  056434  000004         MOV     #5$,@#ERRVEC    ;;SET FOR TIMEOUT
056422  005737  177060                 TST     @#177060        ;;TIME OUT ON XOR?
056426  012637  000004                 MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
056432  000561                         BR      $SVLAD          ;;GO TO THE NEXT TEST
056434  022626                  5$:     CMP     (SP)+,(SP)+     ;;CLEAR THE STACK AFTER A TIME OUT
056436  012637  000004                 MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
056442  000521                         BR      7$              ;;LOOP ON THE PRESENT TEST
056444                          6$:;#####END OF CODE FOR THE XOR TESTER#####
056444  032777  000400  122502         BIT     #BIT08,@SWR     ;;LOOP ON SPEC. TEST?
056452  001421                         BEQ     2$              ;;BR IF NO
056454  005046                         CLR     -(SP)           ;;CLEAR A TEMP. LOCATION
056456  117716  122472                 MOVB    @SWR,(SP)       ;;PICKUP THE DESIRED TEST NUMBER
056462  001414                         BEQ     8$              ;;BRANCH IF BAD TEST NUMBER IN SWR
056464  022716  000120                 CMP     #120,(SP)       ;;CHECK THE NUMBER IN THE SWR
056470  002411                         BLT     8$              ;;BRANCH IF TEST NUMBER IS OUT OF RANGE
056472  011637  001116                 MOV     (SP),$TSTNM     ;;UPDATE THE TEST NUMBER
056476  005316                         DEC     (SP)            ;;BACKUP BY ONE
056500  006316                         ASL     (SP)            ;;SCALE THE TEST NUMBER AS AN INDEX
056502  062716  057050                 ADD     #$SW08TBL,(SP)  ;;FORM THE ADDRESS OF TEST POINTER
056506  013637  001122                 MOV     @(SP)+,$LPADR   ;;SET LOOP ADDRESS TO DESIRED TEST
056512  000547                         BR      $OVER           ;;GO LOOP ON THE TEST
056514  005726                  8$:     TST     (SP)+           ;;CLEAN THE BAD TEST NUMBER OFF OF THE STACK
056516  105737  001117          2$:     TSTB    $ERFLG          ;;HAS AN ERROR OCCURRED?
056522  001502                         BEQ     3$              ;;BR IF NO
056524  022737  177777  057700         CMP     #-1,CPSAVE      ;;SEE IF TIMEOUT WAS PREVIOUSLY RECORDED
056532  001455                         BEQ     2003$           ;;KICK AROUND ROUTINE IF SO
056534  013746  000004                 MOV     ERRVEC,-(SP)    ;;SAVE CONTENTS OF ERROR VECTOR
056540  012737  056556  000004         MOV     #2000$,ERRVEC   ;;SETUP 'TRAP' RETURN ADDRESS
056546  013737  177766  057700         MOV     177766,CPSAVE   ;;MOVE CPU ERROR REGISTER TO CPSAVE FOR TEST
056554  000406                         BR      2001$
056556  012737  177777  057700  2000$: MOV     #-1,CPSAVE      ;;SET CPU ERROR REGISTER TIMEOUT INDICATOR
056564  012716  056572                 MOV     #2001$,(SP)     ;;SETUP RETURN ADDRESS
056570  000002                         RTI
```

```
056572  012637  000004          2001$:  MOV     (SP)+,ERRVEC    ;;RESTORE CONTENTS OF ERROR VECTOR

056576  022737  177777  057700  2002$:  CMP     #-1,CPSAVE      ;;SEE IF CPSAVE HAS CPU ERR REG TIMEOUT INDICATION
056604  001430                          BEQ     2003$           ;;BRANCH IF SO
056606  032737  000001  057700          BIT     #BIT00,CPSAVE   ;;SEE IF THE POWER MONITOR BIT IS ON
056614  001424                          BEQ     2003$           ;;BRANCH TO CONTINUE ROUTINE IF CLEAR
056616  042737  000001  177766          BIC     #BIT00,177766   ;;CLEAR THE BIT FOUND TO BE SET
056624  013746  001154                  MOV     SWR,-(SP)       ;;SAVE SWR ADDRESS
056630  017646  000000                  MOV     @(SP),-(SP)     ;;SAVE SWR VALUE
056634  012737  000176  001154          MOV     #176,SWR        ;;GET SOFTWARE SWR ADDRESS
056642  011677  122306                  MOV     (SP),@SWR       ;;GET CURRENT SWR VALUE
056646  042777  001000  122300          BIC     #BIT09,@SWR     ;;DON'T ALLOW LOOP ON ERROR ON THIS ERROR
056654  104177                          EMT     177             ;;CALL SPECIAL POWER FAIL BIT ERROR CALL
056656  012676  000000                  MOV     (SP)+,@(SP)     ;;RESTORE SWR TO ORIGINAL VALUE
056662  012637  001154                  MOV     (SP)+,SWR       ;;RESTORE SWR ADDRESS
056666                          2003$:
056666  123737  001131  001117          CMPB    $ERMAX,$ERFLG   ;;MAX. ERRORS FOR THIS TEST OCCURRED?
056674  101015                          BHI     3$              ;;BR IF NO
056676  032777  001000  122250          BIT     #BIT09,@SWR     ;;LOOP ON ERROR?
056704  001404                          BEQ     4$              ;;BR IF NO
056706  013737  001124  001122  7$:     MOV     $LPERR,$LPADR   ;;SET LOOP ADDRESS TO LAST SCOPE
056714  000446                          BR      $OVER
056716  105037  001117          4$:     CLRB    $ERFLG          ;;ZERO THE ERROR FLAG
056722  005037  001206                  CLR     $TIMES          ;;CLEAR THE NUMBER OF ITERATIONS TO MAKE
056726  000415                          BR      1$              ;;ESCAPE TO THE NEXT TEST
056730  032777  004000  122216  3$:     BIT     #BIT11,@SWR     ;;INHIBIT ITERATIONS?
056736  001011                          BNE     1$              ;;BR IF YES
056740  005737  001230                  TST     $PASS           ;;IF FIRST PASS OF PROGRAM
056744  001406                          BEQ     1$              ;;      INHIBIT ITERATIONS
056746  005237  001120                  INC     $ICNT           ;;INCREMENT ITERATION COUNT
056752  023737  001206  001120          CMP     $TIMES,$ICNT    ;;CHECK THE NUMBER OF ITERATIONS MADE
056760  002024                          BGE     $OVER           ;;BR IF MORE ITERATION REQUIRED
056762  012737  000001  001120  1$:     MOV     #1,$ICNT        ;;REINITIALIZE THE ITERATION COUNTER
056770  013737  057046  001206          MOV     $MXCNT,$TIMES   ;;SET NUMBER OF ITERATIONS TO DO
056776  105237  001116          $SVLAD: INCB    $TSTNM          ;;COUNT TEST NUMBERS
057002  113737  001116  001226          MOVB    $TSTNM,$TESTN   ;;SET TEST NUMBER IN APT MAILBOX
057010  011637  001122                  MOV     (SP),$LPADR     ;;SAVE SCOPE LOOP ADDRESS
057014  011637  001124                  MOV     (SP),$LPERR     ;;SAVE ERROR LOOP ADDRESS
057020  005037  001210                  CLR     $ESCAPE         ;;CLEAR THE ESCAPE FROM ERROR ADDRESS
057024  112737  000001  001131          MOVB    #1,$ERMAX       ;;ONLY ALLOW ONE(1) ERROR ON NEXT TEST
057032  013777  001116  122116  $OVER:  MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER
057040  013716  001122                  MOV     $LPADR,(SP)     ;;FUDGE RETURN ADDRESS
057044  000002                          RTI                     ;;FIXES PS
057046  000005          $MXCNT: 5.                              ;;MAX. NUMBER OF ITERATIONS
057050                  $SW08TBL:
                        .REPT   $TN-1
057050  007160                  .WORD   TST1+2          ;;STARTING ADDRESS OF TEST 1
057052  007470                  .WORD   TST2+2          ;;STARTING ADDRESS OF TEST 2
057054  007660                  .WORD   TST3+2          ;;STARTING ADDRESS OF TEST 3
057056  010030                  .WORD   TST4+2          ;;STARTING ADDRESS OF TEST 4
057060  010160                  .WORD   TST5+2          ;;STARTING ADDRESS OF TEST 5
057062  011264                  .WORD   TST6+2          ;;STARTING ADDRESS OF TEST 6
057064  012360                  .WORD   TST7+2          ;;STARTING ADDRESS OF TEST 7
057066  012454                  .WORD   TST10+2         ;;STARTING ADDRESS OF TEST 10
057070  012540                  .WORD   TST11+2         ;;STARTING ADDRESS OF TEST 11
057072  013000                  .WORD   TST12+2         ;;STARTING ADDRESS OF TEST 12
057074  013346                  .WORD   TST13+2         ;;STARTING ADDRESS OF TEST 13
```

```
057076  014130                  .WORD   TST14+2         ;;STARTING ADDRESS OF TEST 14
057100  014236                  .WORD   TST15+2         ;;STARTING ADDRESS OF TEST 15
057102  014670                  .WORD   TST16+2         ;;STARTING ADDRESS OF TEST 16
057104  015402                  .WORD   TST17+2         ;;STARTING ADDRESS OF TEST 17
057106  015504                  .WORD   TST20+2         ;;STARTING ADDRESS OF TEST 20
057110  015770                  .WORD   TST21+2         ;;STARTING ADDRESS OF TEST 21
057112  016106                  .WORD   TST22+2         ;;STARTING ADDRESS OF TEST 22
057114  016234                  .WORD   TST23+2         ;;STARTING ADDRESS OF TEST 23
057116  016506                  .WORD   TST24+2         ;;STARTING ADDRESS OF TEST 24
057120  017006                  .WORD   TST25+2         ;;STARTING ADDRESS OF TEST 25
057122  017430                  .WORD   TST26+2         ;;STARTING ADDRESS OF TEST 26
057124  017524                  .WORD   TST27+2         ;;STARTING ADDRESS OF TEST 27
057126  020012                  .WORD   TST30+2         ;;STARTING ADDRESS OF TEST 30
057130  020326                  .WORD   TST31+2         ;;STARTING ADDRESS OF TEST 31
057132  020616                  .WORD   TST32+2         ;;STARTING ADDRESS OF TEST 32
057134  021334                  .WORD   TST33+2         ;;STARTING ADDRESS OF TEST 33
057136  021646                  .WORD   TST34+2         ;;STARTING ADDRESS OF TEST 34
057140  022140                  .WORD   TST35+2         ;;STARTING ADDRESS OF TEST 35
057142  022462                  .WORD   TST36+2         ;;STARTING ADDRESS OF TEST 36
057144  023120                  .WORD   TST37+2         ;;STARTING ADDRESS OF TEST 37
057146  023626                  .WORD   TST40+2         ;;STARTING ADDRESS OF TEST 40
057150  024146                  .WORD   TST41+2         ;;STARTING ADDRESS OF TEST 41
057152  024464                  .WORD   TST42+2         ;;STARTING ADDRESS OF TEST 42
057154  025066                  .WORD   TST43+2         ;;STARTING ADDRESS OF TEST 43
057156  025236                  .WORD   TST44+2         ;;STARTING ADDRESS OF TEST 44
057160  025616                  .WORD   TST45+2         ;;STARTING ADDRESS OF TEST 45
057162  026326                  .WORD   TST46+2         ;;STARTING ADDRESS OF TEST 46
057164  026622                  .WORD   TST47+2         ;;STARTING ADDRESS OF TEST 47
057166  027224                  .WORD   TST50+2         ;;STARTING ADDRESS OF TEST 50
057170  027460                  .WORD   TST51+2         ;;STARTING ADDRESS OF TEST 51
057172  027666                  .WORD   TST52+2         ;;STARTING ADDRESS OF TEST 52
057174  030520                  .WORD   TST53+2         ;;STARTING ADDRESS OF TEST 53
057176  030772                  .WORD   TST54+2         ;;STARTING ADDRESS OF TEST 54
057200  031174                  .WORD   TST55+2         ;;STARTING ADDRESS OF TEST 55
057202  031406                  .WORD   TST56+2         ;;STARTING ADDRESS OF TEST 56
057204  031610                  .WORD   TST57+2         ;;STARTING ADDRESS OF TEST 57
057206  031776                  .WORD   TST60+2         ;;STARTING ADDRESS OF TEST 60
057210  032214                  .WORD   TST61+2         ;;STARTING ADDRESS OF TEST 61
057212  032362                  .WORD   TST62+2         ;;STARTING ADDRESS OF TEST 62
057214  032606                  .WORD   TST63+2         ;;STARTING ADDRESS OF TEST 63
057216  032722                  .WORD   TST64+2         ;;STARTING ADDRESS OF TEST 64
057220  033110                  .WORD   TST65+2         ;;STARTING ADDRESS OF TEST 65
057222  033340                  .WORD   TST66+2         ;;STARTING ADDRESS OF TEST 66
057224  033556                  .WORD   TST67+2         ;;STARTING ADDRESS OF TEST 67
057226  034004                  .WORD   TST70+2         ;;STARTING ADDRESS OF TEST 70
057230  034254                  .WORD   TST71+2         ;;STARTING ADDRESS OF TEST 71
057232  034462                  .WORD   TST72+2         ;;STARTING ADDRESS OF TEST 72
057234  035006                  .WORD   TST73+2         ;;STARTING ADDRESS OF TEST 73
057236  035234                  .WORD   TST74+2         ;;STARTING ADDRESS OF TEST 74
057240  035342                  .WORD   TST75+2         ;;STARTING ADDRESS OF TEST 75
057242  035466                  .WORD   TST76+2         ;;STARTING ADDRESS OF TEST 76
057244  035616                  .WORD   TST77+2         ;;STARTING ADDRESS OF TEST 77
057246  035750                  .WORD   TST100+2            ;;STARTING ADDRESS OF TEST 100
057250  036102                  .WORD   TST101+2            ;;STARTING ADDRESS OF TEST 101
057252  036272                  .WORD   TST102+2            ;;STARTING ADDRESS OF TEST 102
057254  036474                  .WORD   TST103+2            ;;STARTING ADDRESS OF TEST 103
057256  036622                  .WORD   TST104+2            ;;STARTING ADDRESS OF TEST 104
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057260  037026                  .WORD   TST105+2        ;;STARTING ADDRESS OF TEST 105
057262  037156                  .WORD   TST106+2        ;;STARTING ADDRESS OF TEST 106
057264  037352                  .WORD   TST107+2        ;;STARTING ADDRESS OF TEST 107
057266  037550                  .WORD   TST110+2        ;;STARTING ADDRESS OF TEST 110
057270  040026                  .WORD   TST111+2        ;;STARTING ADDRESS OF TEST 111
057272  040332                  .WORD   TST112+2        ;;STARTING ADDRESS OF TEST 112
057274  041724                  .WORD   TST113+2        ;;STARTING ADDRESS OF TEST 113
057276  043452                  .WORD   TST114+2        ;;STARTING ADDRESS OF TEST 114
057300  045632                  .WORD   TST115+2        ;;STARTING ADDRESS OF TEST 115
057302  046212                  .WORD   TST116+2        ;;STARTING ADDRESS OF TEST 116
057304  050354                  .WORD   TST117+2        ;;STARTING ADDRESS OF TEST 117
057306  052642                  .WORD   TST120+2        ;;STARTING ADDRESS OF TEST 120
```

```
                                .SBTTL  ERROR HANDLER ROUTINE

                                ;;**********************************************************************
                                ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
                                ;*SAVE THE ERROR ITEM NUMBER AND THE ADDRESS OF THE ERROR CALL
                                ;*AND GO TO ERRTYP ON ERROR
                                ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                ;*SW15=1         HALT ON ERROR
                                ;*SW13=1         INHIBIT ERROR TYPEOUTS
                                ;*SW10=1         BELL ON ERROR
                                ;*SW09=1         LOOP ON ERROR
                                ;*CALL
                                ;*      ERROR   N       ;;ERROR=EMT AND N=ERROR ITEM NUMBER

057310  105037  057702          $ERROR: CLRB    IBSAVE          ;;CLEAR THE ITEM BYTE SAVE LOCATION
057314  104410                          CKSWR                   ;;TEST FOR CHANGE IN SOFT-SWR
057316  105237  001117          7$:     INCB    $ERFLG          ;;SET THE ERROR FLAG
057322  001775                          BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
057324  013777  001116  121624          MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER AND ERROR FLAG
057332  032777  002000  121614          BIT     #BIT10,@SWR     ;;BELL ON ERROR?
057340  001402                          BEQ     1$              ;;NO - SKIP
057342  104401  001212                  TYPE    ,$BELL          ;;RING BELL
057346  005237  001126          1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
057352  011637  001132                  MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
057356  162737  000002  001132          SUB     #2,$ERRPC
057364  117737  121542  001130          MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
057372  032777  001000  121554          BIT     #BIT09,@SWR     ;;SEE IF LOOP ON ERROR IS SET
057400  001060                          BNE     1004$           ;;BRANCH AROUND ROUTINE IF SO
057402  122737  000177  001130          CMPB    #177,$ITEMB     ;;SEE IF THIS IS THE POWER FAIL CALL
057410  001454                          BEQ     1004$           ;;BRANCH AROUND ROUTINE IF IT IS
057412  105737  057702                  TSTB    IBSAVE          ;;SEE IF THIS IS THE 2ND ERROR CALL IN THIS ROUTINE
057416  001047                          BNE     1003$           ;;BRANCH IF SO
057420  022737  177777  057700          CMP     #-1,CPSAVE      ;;SEE IF CPSAVE HAS CPU ERR REG TIMEOUT INDICATION
057426  001445                          BEQ     1004$           ;;BRANCH IF SO
057430  013746  000004                  MOV     ERRVEC,-(SP)    ;;SAVE CONTENTS OF ERROR VECTOR
057434  012737  057452  000004          MOV     #1000$,ERRVEC   ;;SETUP 'TRAP' RETURN ADDRESS
057442  013737  177766  057700          MOV     177766,CPSAVE   ;;MOVE CPU ERROR REGISTER TO CPSAVE FOR TEST
057450  000406                          BR      1001$
057452  012737  177777  057700  1000$:  MOV     #-1,CPSAVE      ;;SET CPU ERROR REGISTER TIMEOUT INDICATOR
057460  012716  057466                  MOV     #1001$,(SP)     ;;SETUP RETURN ADDRESS
057464  000002                          RTI
057466  012637  000004          1001$:  MOV     (SP)+,ERRVEC    ;;RESTORE CONTENTS OF ERROR VECTOR

057472  022737  177777  057700  1002$:  CMP     #-1,CPSAVE      ;;SEE IF CPSAVE HAS CPU ERR REG TIMEOUT INDICATION
057500  001420                          BEQ     1004$           ;;BRANCH IF SO
057502  032737  000001  057700          BIT     #BIT00,CPSAVE   ;;SEE IF POWER MONITOR BIT IS SET IN CPU ERR REG
057510  001414                          BEQ     1004$           ;;BRANCH IF OK
057512  042737  000001  177766          BIC     #BIT00,177766   ;;CLEAR THE BIT FOUND SET
057520  113737  001130  057702          MOVB    $ITEMB,IBSAVE   ;;MAKE IBSAVE NON-ZERO FOR DUAL ERROR CALL
057526  112737  000177  001130          MOVB    #177,$ITEMB     ;;SET $ITEMB TO SPECIAL POWER FAIL POINTER
057534  000402                          BR      1004$           ;;BRANCH OVER IBSAVE CLEARING

057536  105037  057702          1003$:  CLRB    IBSAVE          ;;CLEAR IBSAVE SO 2ND TIME THROUGH EXITS
057542                          1004$:
057542  032777  020000  121404          BIT     #BIT13,@SWR     ;;SKIP TYPEOUT IF SET
057550  001004                          BNE     20$             ;;SKIP TYPEOUTS
057552  004737  057704                  JSR     PC,ERRTYP       ;;GO TO USER ERROR ROUTINE
```

ERROR HANDLER ROUTINE

```
057556  104401  001217                  TYPE    ,$CRLF
057562                          20$:
057562  122737  000001  001242          CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
057570  001007                          BNE     2$              ;;NO,SKIP APT ERROR REPORT
057572  113737  001130  057604          MOVB    $ITEMB,21$      ;;SET ITEM NUMBER AS ERROR NUMBER
057600  004737  062616                  JSR     PC,$ATY4        ;;REPORT FATAL ERROR TO APT
057604     000                  21$:    .BYTE   0
057605     000                          .BYTE   0
057606  000777                  22$:    BR      22$             ;;APT ERROR LOOP
057610  105737  057702          2$:     TSTB    IBSAVE          ;;SEE IF IBSAVE IS LOADED
057614  001005                          BNE     3$              ;;BRANCH IF NOT - NO HALT ON PWR MON BIT ERROR
057616  005777  121332                  TST     @SWR            ;;HALT ON ERROR
057622  100002                          BPL     3$              ;;SKIP IF CONTINUE
057624  000000                          HALT                    ;;HALT ON ERROR!
057626  104410                          CKSWR                   ;;TEST FOR CHANGE IN SOFT-SWR
057630                          3$:
057630  032777  001000  121316          BIT     #BIT09,@SWR     ;;LOOP ON ERROR SWITCH SET?
057636  001402                          BEQ     4$              ;;BR IF NO
057640  013716  001124                  MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
057644  005737  001210          4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
057650  001402                          BEQ     5$              ;;BR IF NONE
057652  013716  001210                  MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
057656                          5$:
057656  022737  054302  000042          CMP     #$ENDAD,@#42    ;;ACT-11 AUTO-ACCEPT?
057664  001001                          BNE     6$              ;;BRANCH IF NO
057666  000000                          HALT                    ;;YES
057670                          6$:
057670  105737  057702                  TSTB    IBSAVE          ;;SEE IF ITEM BYTE SAVE LOCATION HAS AN ERROR CALL
057674  001210                          BNE     7$              ;;BRANCH BACK TO CALL ORIGINAL ERROR
057676  000002                          RTI                     ;;RETURN
057700  000000          CPSAVE: .WORD   0                       ;;LOCATION TO SAVE CPU ERROR REG CONTENTS
057702  000000          IBSAVE: .WORD   0                       ;;LOCATION TO SAVE ITEM BYTE
```

ERROR TYPEOUT ROUTINE

```
                                        .SBTTL  ERROR TYPEOUT ROUTINE
 2
 3                                      ;*THE ERROR TYPEOUT ROUTINE ASSEMBLES AND PRINTS INFORMATION
 4                                      ;*REGARDING THE DETECTION OF AN ERROR AS FOLLOWS:
 5                                      ;*
 6                                      ;*      .UNIT NUMBER, DRIVE TYPE, TEST NUMBER, ERROR NUMBER AND
 7                                      ;*PROGRAM COUNTER ARE PRINTED ON THE FIRST LINE;
 8                                      ;*      .ERROR MESSAGE IS ASSEMBLED, FORMATTED AND PRINTED ON
 9                                      ;*ONE OR MORE SUCCEEDING LINES;
10                                      ;*      .PAIRED LINES OF ERROR HEADERS AND ERROR DATA ARE PRINTED
11                                      ;*AFTER THE ERROR MESSAGE.
12
13 057704  104414                      ERRTYP: SAVREG
14 057706  032777  020000  121240              BIT     #SW13,@SWR      ;INHIBIT TYPEOUTS??
15 057714  001402                            BEQ     1$              ;NO!!
16 057716  000137  060514                     JMP     27$             ;YES!!
17
18                                      ;TYPE UNIT NUMBER, DRIVE TYPE, TEST NUMBER, ERROR NUMBER, AND
19                                      ;PROGRAM COUNTER
20 057722  104401  001217              1$:     TYPE    ,$CRLF
21 057726  104401  060530                      TYPE    ,ERTY00         ;TYPE "DRV#"
22 057732  013746  001234                      MOV     $UNIT,-(SP)     ;;SAVE $UNIT FOR TYPEOUT
                                                                        ;;TYPE DRIVE NUMBER
   057736  104403                              TYPOS                   ;;GO TYPE--OCTAL ASCII
   057740     003                              .BYTE   3               ;;TYPE 3 DIGIT(S)
   057741     000                              .BYTE   0               ;;SUPPRESS LEADING ZEROS
23
24                                      ;TYPE 'DRIVE TYPE', RM80 FOR UNIT UNDER TEST
25 057742  013700  001276                      MOV     $BASE,R0        ;GET RM BASE ADDRESS
26 057746  016000  000026                      MOV     RMDT(R0),R0     ;GET DRIVE TYPE REGISTER
27 057752  042700  177740                      BIC     #177740,R0      ;SAVE DRIVE TYPE BITS AND
28 057756  012737  063512  060000              MOV     #$RM80,3$       ;GET ASCII DRIVE TYPE
29 057764  022700  000026                      CMP     #26,R0          ;IS DEVICE AN RM80 ?
30 057770  001004                            BNE     4$              ;NO !!
31 057772  104401  060565              2$:     TYPE    ,ERTY05         ;TYPE " - "
32 057776  104401                            TYPE                    ;TYPE DRIVE TYPE
33 060000  000000                      3$:     .WORD   0               ;DRIVE TYPE MESSAGE IS STORED HERE
34
35                                      ;TYPE TEST NUMBER, ERROR NUMBER AND PROGRAM COUNTER
36 060002  005037  060520              4$:     CLR     TSTNMB          ;LOAD TEST NUMBER FOR
37 060006  013737  001226  060520              MOV     $TESTN,TSTNMB
38 060014  104401  060535                      TYPE    ,ERTY01         ;TYPE "TST#"
39 060020  013746  060520                      MOV     TSTNMB,-(SP)    ;;SAVE TSTNMB FOR TYPEOUT
                                                                        ;;TYPE TEST NUMBER
   060024  104403                              TYPOS                   ;;GO TYPE--OCTAL ASCII
   060026     003                              .BYTE   3               ;;TYPE 3 DIGIT(S)
   060027     000                              .BYTE   0               ;;SUPPRESS LEADING ZEROS
40 060030  005037  060522                      CLR     ERRNMB          ;LOAD ERROR NUMBER FOR
41 060034  113737  001130  060522              MOVB    $ITEMB,ERRNMB   ;TYPEOUT
42 060042  001406                            BEQ     5$              ;SKIP IF NO ERROR CALLED
43 060044  104401  060545                      TYPE    ,ERTY02         ;TYPE "ERR#"
44 060050  013746  060522                      MOV     ERRNMB,-(SP)    ;;SAVE ERRNMB FOR TYPEOUT
                                                                        ;;TYPE ERROR NUMBER
   060054  104403                              TYPOS                   ;;GO TYPE--OCTAL ASCII
   060056     003                              .BYTE   3               ;;TYPE 3 DIGIT(S)
   060057     000                              .BYTE   0               ;;SUPPRESS LEADING ZEROS
45 060060  104401  060554              5$:     TYPE    ,ERTY03         ;TYPE "PC="
```

ERROR TYPEOUT ROUTINE

```
     46 060064  013746  001132                    MOV     $ERRPC,-(SP)    ;;SAVE $ERRPC FOR TYPEOUT
                                                                          ;;TYPE PROGRAM COUNTER
        060070  104403                            TYPOS                   ;;GO TYPE--OCTAL ASCII
        060072     006                            .BYTE   6               ;;TYPE 6 DIGIT(S)
        060073     001                            .BYTE   1               ;;TYPE LEADING ZEROS
     47
     48                                 ;GENERATE POINTER TO ERROR TABLE UNLESS ERROR NUMBER IS 0
     49 060074  005737  060522            6$:     TST     ERRNMB          ;WAS AN ERROR CALLED?
     50 060100  001002                            BNE     7$              ;BR IF YES
     51 060102  000137  060514                    JMP     27$             ;NO--EXIT
     52
     53 060106  104401  001217            7$:     TYPE    ,$CRLF          ;YES-TYPE CRLF
     54 060112  105037  060526                    CLRB    BOTFLG          ;CLEAR BOT FLAG
     55 060116  105037  060527                    CLRB    CHRCNT          ;CLEAR CHARACTER COUNTER
     56 060122  013700  060522                    MOV     ERRNMB,R0       ;R0 POINTS TO FIRST OF
     57 060126  122700  000177                    CMPB    #177,R0         ;SEE IF THIS ERROR CALL IS SPECIAL POWER FAIL CALL
     58 060132  001003                            BNE     8$              ;BRANCH IF NOT
     59 060134  012700  060572                    MOV     #PFECH,R0       ;MOVE POWER FAIL ERROR CALL TABLE TO R0
     60 060140  000405                            BR      9$
     61 060142  006300                    8$:     ASL     R0              ;FOUR ENTRIES IN ERROR
     62 060144  006300                            ASL     R0              ;TABLE
     63 060146  006300                            ASL     R0
     64 060150  062700  001532                    ADD     #$ERRTB-8.,R0
     65 060154  011001                    9$:     MOV     (R0),R1         ;R1 POINTS TO ERROR MESSAGE
     66                                                                   ;TABLE
     67 060156  001507                            BEQ     19$             ;BRANCH IF NO ERROR MESSAGE
     68
     69                                 ;TYPE THE ERROR MESSAGE
     70 060160  012102                    10$:    MOV     (R1)+,R2        ;R2=ADDRESS OF MESSAGE STRING
     71 060162  001505                            BEQ     19$             ;BRANCH IF END OF MESSAGE
     72 060164  010237  060332                    MOV     R2,18$          ;LOAD ADDRESS OF STRING
     73 060170  005037  060524                    CLR     BOTADR          ;CLEAR BOT ADDRESS
     74 060174  112203                    11$:    MOVB    (R2)+,R3        ;END OF STRING??
     75 060176  001454                            BEQ     17$             ;YES!!
     76 060200  122703  000015                    CMPB    #CR,R3          ;CARRIAGE RETURN??
     77 060204  001003                            BNE     12$             ;NO!!
     78 060206  105037  060527                    CLRB    CHRCNT          ;YES-CLEAR CHAR COUNT
     79 060212  000770                            BR      11$             ;GET NEXT CHARACTER
     80 060214  122703  000012            12$:    CMPB    #LF,R3          ;LINE FEED??
     81 060220  001765                            BEQ     11$             ;YES-GET NEXT CHARACTER
     82 060222  122703  000011                    CMPB    #HT,R3          ;HORIZONTAL TAB??
     83 060226  001007                            BNE     14$             ;NO!!
     84 060230  105237  060527            13$:    INCB    CHRCNT          ;ADJUST CHARACTER COUNT
     85 060234  132737  000007  060527            BITB    #7,CHRCNT
     86 060242  001372                            BNE     13$
     87 060244  000407                            BR      15$
     88 060246  105237  060527            14$:    INCB    CHRCNT          ;INCREMENT CHARACTER COUNT
     89 060252  122703  000040                    CMPB    #' ,R3          ;SPACE??
     90 060256  001002                            BNE     15$             ;NO!!
     91 060260  010237  060524                    MOV     R2,BOTADR       ;SAVE ADDRESS OF SPACE
     92 060264  122737  000100  060527    15$:    CMPB    #64.,CHRCNT     ;END OF LINE??
     93 060272  103340                            BHIS    11$             ;NO!!
     94 060274  013704  060524                    MOV     BOTADR,R4       ;GET ADDRESS OF LAST SPACE
     95 060300  001007                            BNE     16$             ;BRANCH IF SPACE DETECTED
     96 060302  104401  001217                    TYPE    ,$CRLF          ;TYPE CRLF
     97 060306  105037  060527                    CLRB    CHRCNT          ;CLEAR CHARACTER COUNT
     98 060312  013702  060332                    MOV     18$,R2          ;SET UP R2 FOR TESTING
```

```
 99 060316  000726                          BR      11$
100 060320  105044                  16$:    CLRB    -(R4)           ;REPLACE SPACE
101 060322  112737  177777  060526          MOVB    #-1,BOTFLG      ;SET BOT FLAG
102 060330  104401                  17$:    TYPE                    ;TYPE ERROR MESSAGE STRING
103 060332  000000                  18$:    .WORD                   ;STRING ADDRESS GOES HERE
104 060334  105737  060526                  TSTB    BOTFLG          ;WAS STRING TRUNCATED??
105 060340  001707                          BEQ     10$             ;NO!!
106 060342  104401  001217                  TYPE    ,$CRLF          ;YES-TYPE CRLF
107 060346  105037  060526                  CLRB    BOTFLG          ;CLEAR BOT FLAG
108 060352  105037  060527                  CLRB    CHRCNT          ;CLEAR CHARACTER COUNT
109 060356  013702  060524                  MOV     BOTADR,R2       ;SETUP R2 FOR TESTING
110 060362  010237  060332                  MOV     R2,18$          ;SETUP 18$ FOR TYPING
111 060366  112742  000040                  MOVB    #' ,-(R2)       ;RESTORE SPACE
112 060372  105722                          TSTB    (R2)+           ;RESTORE R2
113 060374  000677                          BR      11$             ;TYPE REST OF STRING
114
115                                 ;TYPE ERROR HEADER AND ERROR DATA
116 060376  016001  000002          19$:    MOV     2(R0),R1        ;R1 POINTS TO ERROR HEADER TABLE
117 060402  001444                          BEQ     27$             ;BRANCH IF NO HEADER
118 060404  104401  001217                  TYPE    ,$CRLF          ;(ASSUME NO DATA)
119 060410  016002  000004                  MOV     4(R0),R2        ;R2 POINTS TO DATA ADDRESS TABLE
120 060414  016003  000006                  MOV     6(R0),R3        ;R3 POINTS TO FORMAT TABLE
121 060420  012137  060430          20$:    MOV     (R1)+,21$       ;PUT HEADER ADDRESS FOR TYPE
122 060424  001433                          BEQ     27$             ;BRANCH IF END OF HEADERS
123                                                                 ;(ASSUME END OF DATA)
124 060426  104401                          TYPE
125 060430  000000                  21$:    .WORD   0               ;HEADER ADDRESS GOES HERE
126 060432  104401  001217                  TYPE    ,$CRLF
127 060436  005702                          TST     R2              ;DATA WITH HEADER??
128 060440  001767                          BEQ     20$             ;NO!!
129 060442  012204                          MOV     (R2)+,R4        ;R4 POINTS TO DATA ADDRESS
130 060444  012305                          MOV     (R3)+,R5        ;R5 POINTS TO FORMAT
131 060446  105725                  22$:    TSTB    (R5)+           ;WHAT KIND OF DATA??
132 060450  100407                          BMI     24$             ;BINARY
133 060452  001403                          BEQ     23$             ;OCTAL
134 060454  013446                          MOV     @(R4)+,-(SP)    ;DECIMAL
135 060456  104405                          TYPDS
136 060460  000405                          BR      25$
137 060462  013446                  23$:    MOV     @(R4)+,-(SP)
138 060464  104402                          TYPOC
139 060466  000402                          BR      25$
140 060470  013446                  24$:    MOV     @(R4)+,-(SP)
141 060472  104406                          TYPBN
142 060474  005714                  25$:    TST     (R4)            ;MORE DATA??
143 060476  001403                          BEQ     26$             ;NO!!
144 060500  104401  060562                  TYPE    ,ERTY04         ;YES-TYPE 2 SPACES
145 060504  000760                          BR      22$             ;AND CONTINUE
146 060506  104401  001217          26$:    TYPE    ,$CRLF          ;TYPE ONE BLANK LINE
147 060512  000742                          BR      20$             ;BEFORE NEXT HEADER
148 060514  104415                  27$:    RESREG
149 060516  000207                          RTS     PC
150
151 060520  000000                  TSTNMB: .WORD   0               ;TEST NUMBER
152 060522  000000                  ERRNMB: .WORD   0               ;ERROR NUMBER
153 060524  000000                  BOTADR: .WORD   0               ;BEGINNING OF TEXT ADDRESS
154 060526     000                  BOTFLG: .BYTE   0               ;BOT FLAG
155 060527     000                  CHRCNT: .BYTE   0               ;CHARACTER COUNT
```

ERROR TYPEOUT ROUTINE

```
    156
    157 060530      104      122      126  ERTY00: .ASCIZ  @DRV#@
    158 060535      054      040      124  ERTY01: .ASCIZ  @, TEST#@
    159 060545      054      040      105  ERTY02: .ASCIZ  @, ERR#@
    160 060554      054      040      120  ERTY03: .ASCIZ  @, PC=@
    161 060562      040      040      000  ERTY04: .ASCIZ  @ @
    162 060565      040      055      040  ERTY05: .ASCIZ  @ - @
    163                                    .EVEN
    164 060572  060602  060670  060706  PFECH:  PFECH1,PFECH2,PFECH3,PFECH4 ;WORDS DEFINING TABLES BELOW
    165 060602  060606  000000           PFECH1: .+4,0
    166 060606      120      117      127        .ASCIZ  ?POWER MONITOR BIT IN CPU ERROR REGISTER FOUND SET?
    167                                    .EVEN
    168 060670  060674  000000           PFECH2: .+4,0
    169 060674      103      120      125        .ASCIZ  ?CPUERREG?
    170                                    .EVEN
    171 060706  060710                   PFECH3: .+2
    172 060710  057700  000000                   .WORD   CPSAVE,0
    173 060714  060716                   PFECH4: .+2
    174 060716      000      000                .BYTE   0,0
```

```
      1                                 .SBTTL  TTY INPUT ROUTINE

                                        ;;*******************************************************************
                                        .ENABL  LSB
060720  000000                          $TKCNT: .WORD   0               ;;NUMBER OF ITEMS IN QUEUE
060722  000000                          $TKQIN: .WORD   0               ;;INPUT POINTER
060724  000000                          $TKQOUT: .WORD  0               ;;OUTPUT POINTER
060726                                  $TKQSRT: .BLKB  1               ;;TTY KEYBOARD QUEUE
        060727                          $TKQEND=.
                                        .EVEN

                                        ;*TK INITIALIZE ROUTINE
                                        ;*THIS ROUTINE WILL INITIALIZE THE TTY KEYBOARD INPUT QUEUE
                                        ;*SETUP THE INTERRUPT VECTOR AND TURN ON THE KEYBOARD INTERRUPT
                                        ;*
                                        ;*CALL:
                                        ;*      JSR     PC,$TKINT
                                        ;*      RETURN
                                        ;*
060730  005037  060720                  $TKINT: CLR     $TKCNT          ;;CLEAR COUNT OF ITEMS IN QUEUE
060734  012737  060726  060722                  MOV     #$TKQSRT,$TKQIN ;;MOVE THE STARTING ADDRESS OF THE
060742  013737  060722  060724                  MOV     $TKQIN,$TKQOUT  ;;QUEUE INTO THE INPUT & OUTPUT POINTERS.
060750  012737  061000  000060                  MOV     #$TKSRV,@#TKVEC ;;INITIALIZE THE KEYBOARD VECTOR
060756  012737  000200  000062                  MOV     #200,@#TKVEC+2  ;;'BR' LEVEL 4
060764  005777  120172                          TST     @$TKB           ;;CLEAR DONE FLAG
060770  012777  000100  120162                  MOV     #100,@$TKS      ;;ENABLE TTY KEYBOARD INTERRUPT
060776  000207                                  RTS     PC              ;;RETURN TO CALLER

                                        ;*TK SERVICE ROUTINE
                                        ;*THIS ROUTINE WILL SERVICE THE TTY KEYBOARD INTERRUPT
                                        ;*BY READING THE CHARACTER FROM THE INPUT BUFFER AND PUTTING
                                        ;*IT IN THE QUEUE.
                                        ;*IF THE CHARACTER IS A "CONTROL-C" (^C) $TKINT IS CALLED AND
                                        ;*UPON RETURN EXIT IS MADE TO THE "CONTROL-C" RESTART ADDRESS (SHUT)
                                        ;*
061000  117746  120156                  $TKSRV: MOVB    @$TKB,-(SP)     ;;PICKUP THE CHARACTER
061004  042716  177600                          BIC     #^C177,(SP)     ;;STRIP THE JUNK
061010  021627  000021                          CMP     (SP),#$XON      ;;IS IT A RANDOM XON?
061014  001002                                  BNE     30$             ;;BRANCH IF NO
061016  005726                                  TST     (SP)+           ;;CLEAN RANDOM XON OFF STACK
061020  000002                                  RTI                     ;;RETURN
061022                                  30$:
061022  021627  000003                          CMP     (SP),#3         ;;IS IT A CONTROL C?
061026  001007                                  BNE     1$              ;;BRANCH IF NO
061030  104401  062126                          TYPE    ,$CNTLC         ;;TYPE A CONTROL-C (^C)
061034  004737  060730                          JSR     PC,$TKINT       ;;INIT THE KEYBOARD
061040  005726                                  TST     (SP)+           ;;CLEAN UP STACK
061042  000137  0621..                         JMP     SHUT            ;;CONTROL C RESTART
061046  021627  000007                  1$:     CMP     (SP),#7         ;;IS IT A CONTROL G?
061052  001004                                  BNE     2$              ;;BRANCH IF NO
061054  022737  000176  001154                  CMP     #SWREG,SWR      ;;IS SOFT-SWR SELECTED?
061062  001500                                  BEQ     6$              ;;GO TO SWR CHANGE

061064                                  2$:
061064  022737  000001  060720                  CMP     #1,$TKCNT       ;;I_ THE QUEUE FULL?
061072  001004                                  BNE     3$              ;;BRANCH IF NO
061074  104401  001212                          TYPE    ,$BELL          ;;RING THE TTY BELL
```

```
061100  005726                          TST     (SP)+           ;;CLEAN CHARACTER OFF OF STACK
061102  000451                          BR      5$              ;;EXIT
061104  021627  000023          3$:     CMP     (SP),#23        ;;IS IT A CONTROL-S?
061110  001021                          BNE     32$             ;;BRANCH IF NO
061112  005077  120042                  CLR     @$TKS           ;;DISABLE TTY KEYBOARD INTERRUPTS
061116  005726                          TST     (SP)+           ;;CLEAN CHAR OFF STACK
061120  105777  120034          31$:    TSTB    @$TKS           ;;WAIT FOR A CHAR
061124  100375                          BPL     31$             ;;LOOP UNTIL ITS THERE
061126  117746  120030                  MOVB    @$TKB,-(SP)     ;;GET THE CHARACTER
061132  042716  177600                  BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII
061136  022627  000021                  CMP     (SP)+,#21       ;;IS IT A CONTROL-Q?
061142  001366                          BNE     31$             ;;BRANCH IF NO
061144  012777  000100  120006          MOV     #100,@$TKS      ;;REENABLE TTY KEYBOARD INTERRUPTS
061152  000002                          RTI                     ;;RETURN
061154  005237  060720          32$:    INC     $TKCNT          ;;COUNT THIS CHARACTER
061160  021627  000140                  CMP     (SP),#140       ;;IS IT UPPER CASE?
061164  002405                          BLT     4$              ;;BRANCH IF YES
061166  021627  000175                  CMP     (SP),#175       ;;IS IT A SPECIAL CHAR?
061172  003002                          BGT     4$              ;;BRANCH IF YES
061174  042716  000040                  BIC     #40,(SP)        ;;MAKE IT UPPER CASE
061200  112677  177516          4$:     MOVB    (SP)+,@$TKQIN   ;;AND PUT IT IN QUEUE
061204  005237  060722                  INC     $TKQIN          ;;UPDATE THE POINTER
061210  023727  060722  060727          CMP     $TKQIN,#$TKQEND ;;GO OFF THE END?
061216  001003                          BNE     5$              ;;BRANCH IF NO
061220  012737  060726  060722          MOV     #$TKQSRT,$TKQIN ;;RESET THE POINTER
061226  000002                  5$:     RTI                     ;;RETURN

                        ;;**************************************************************************
                        ;*SOFTWARE SWITCH REGISTER CHANGE ROUTINE.
                        ;*ROUTINE IS ENTERED  FROM THE TRAP HANDLER, AND WILL
                        ;*SERVICE THE TEST FOR CHANGE IN SOFTWARE SWITCH REGISTER TRAP
                        ;*CALL WHEN OPERATING IN TTY INTERRUPT MODE.
061230  022737  000176  001154  $CKSWR: CMP     #SWREG,SWR      ;;IS THE SOFT-SWR SELECTED
061236  001124                          BNE     15$             ;;EXIT IF NOT
061240  105777  117714                  TSTB    @$TKS           ;;IS A CHAR WAITING?
061244  100121                          BPL     15$             ;;IF NOT, EXIT
061246  117746  117710                  MOVB    @$TKB,-(SP)     ;;YES
061252  042716  177600                  BIC     #^C177,(SP)     ;;MAKE IT  7-BIT ASCII
061256  021627  000007                  CMP     (SP),#7         ;;IS IT A CONTROL-G?
061262  001300                          BNE     2$              ;;IF NOT, PUT IT IN THE TTY QUEUE
                                                                ;;AND EXIT

                        ;;**************************************************************************
                        ;*CONTROL IS PASSED TO THIS POINT FROM EITHER THE TTY INTERRUPT SERVICE
                        ;*ROUTINE OR FROM THE SOFTWARE SWITCH REGISTER TRAP CALL, AS A RESULT OF A
                        ;*CONTROL-G BEING TYPED, AND THE SOFTWARE SWITCH REGISTER BEING SELECTED.
061264  123727  001150  000001  6$:     CMPB    $AUTOB,#1       ;;ARE WE RUNNING IN AUTO-MODE?
061272  001674                          BEQ     2$              ;;BRANCH IF YES
061274  005726                          TST     (SP)+           ;;CLEAR CONTROL-G OFF STACK
061276  004737  060730                  JSR     PC,$TKINT       ;;FLUSH THE TTY INPUT QUEUE
061302  005077  117652                  CLR     @$TKS           ;;DISABLE TTY KEYBOARD INTERRUPTS
061306  112737  000001  001151          MOVB    #1,$INTAG       ;;SET INTERRUPT MODE INDICATOR

061314  104401  062140                  TYPE    ,$CNTLG         ;;ECHO THE CONTROL-G (^G)
061320  104401  062145  $GTSWR: TYPE    ,$MSWR          ;;TYPE CURRENT CONTENTS
061324  013746  000176                  MOV     SWREG,-(SP)     ;;SAVE SWREG FOR TYPEOUT
061330  104402                          TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
```

```
061332  104401  062156                  TYPE    ,$MNEW          ;;PROMPT FOR NEW SWR
061336  005046                  19$:    CLR     -(SP)           ;;CLEAR COUNTER
061340  005046                          CLR     -(SP)           ;;THE NEW SWR
061342  105777  117612          7$:     TSTB    @$TKS           ;;CHAR THERE?
061346  100375                          BPL     7$              ;;IF NOT TRY AGAIN

061350  117746  117606                  MOVB    @$TKB,-(SP)     ;;PICK UP CHAR
061354  042716  177600                  BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII

061360  021627  000003                  CMP     (SP),#3         ;;IS IT A CONTROL-C?
061364  001015                          BNE     9$              ;;BRANCH IF NOT
061366  104401  062126                  TYPE    ,$CNTLC         ;;YES, ECHO CONTROL-C (^C)
061372  062706  000006                  ADD     #6,SP           ;;CLEAN UP STACK
061376  123727  001151  000001          CMPB    $INTAG,#1       ;;REENABLE TTY KEYBOARD INTERRUPTS?
061404  001003                          BNE     8$              ;;BRANCH IF NO
061406  012777  000100  117544          MOV     #100,@$TKS      ;;ALLOW TTY KEYBOARD INTERRUPTS
061414  000137  062170          8$:     JMP     SHUT            ;;CONTROL-C RESTART


061420  021627  000025          9$:     CMP     (SP),#25        ;;IS IT A CONTROL-U?
061424  001005                          BNE     10$             ;;BRANCH IF NOT
061426  104401  062133                  TYPE    ,$CNTLU         ;;YES, ECHO CONTROL-U (^U)
061432  062706  000006          20$:    ADD     #6,SP           ;;IGNORE PREVIOUS INPUT
061436  000737                          BR      19$             ;;LET'S TRY IT AGAIN


061440  021627  000015          10$:    CMP     (SP),#15        ;;IS IT A <CR>?
061444  001022                          BNE     16$             ;;BRANCH IF NO
061446  005766  000004                  TST     4(SP)           ;;YES, IS IT THE FIRST CHAR?
061452  001403                          BEQ     11$             ;;BRANCH IF YES
061454  016677  000002  117472          MOV     2(SP),@SWR      ;;SAVE NEW SWR
061462  062706  000006          11$:    ADD     #6,SP           ;;CLEAR UP STACK
061466  104401  001217          14$:    TYPE    ,$CRLF          ;;ECHO <CR> AND <LF>
061472  123727  001151  000001          CMPB    $INTAG,#1       ;;RE-ENABLE TTY KBD INTERRUPTS?
061500  001003                          BNE     15$             ;;BRANCH IF NOT
061502  012777  000100  117450          MOV     #100,@$TKS      ;;RE-ENABLE TTY KBD INTERRUPTS
061510  000002                  15$:    RTI                     ;;RETURN
061512  004737  056246          16$:    JSR     PC,$TYPEC       ;;ECHO CHAR
061516  021627  000060                  CMP     (SP),#60        ;;CHAR < 0?
061522  002420                          BLT     18$             ;;BRANCH IF YES
061524  021627  000067                  CMP     (SP),#67        ;;CHAR > 7?
061530  003015                          BGT     18$             ;;BRANCH IF YES
061532  042726  000060                  BIC     #60,(SP)+       ;;STRIP-OFF ASCII
061536  005766  000002                  TST     2(SP)           ;;IS THIS THE FIRST CHAR
061542  001403                          BEQ     17$             ;;BRANCH IF YES
061544  006316                          ASL     (SP)            ;;NO, SHIFT PRESENT
061546  006316                          ASL     (SP)            ;;    CHAR OVER TO MAKE
061550  006316                          ASL     (SP)            ;;    ROOM FOR NEW ONE.
061552  005266  000002          17$:    INC     2(SP)           ;;KEEP COUNT OF CHAR
061556  056616  177776                  BIS     -2(SP),(SP)     ;;SET IN NEW CHAR
061562  000667                          BR      7$              ;;GET THE NEXT ONE
061564  104401  001216          18$:    TYPE    ,$QUES          ;;TYPE ?<CR><LF>
061570  000720                          BR      20$             ;;SIMULATE CONTROL-U
                                .DSABL  LSB

                                ;;**************************************************************************
```

TTY INPUT ROUTINE

```
                                ;*THIS ROUTINE WILL INPUT A SINGLE CHARACTER FROM THE TTY
                                ;*CALL:
                                ;*      RDCHR                   ;;GET A CHARACTER FROM THE QUEUE
                                ;*      RETURN HERE             ;;CHARACTER IS ON THE STACK
                                ;*                              ;;WITH PARITY BIT STRIPPED OFF
                                ;

061572  011646                  $RDCHR: MOV     (SP),-(SP)      ;;PUSH DOWN THE PC AND
061574  016666  000004  000002          MOV     4(SP),2(SP)     ;;THE PS
061602  005066  000004                  CLR     4(SP)           ;;GET READY FOR A CHARACTER
061606  005046                          CLR     -(SP)           ;;PUT NEW PS ON STACK
061610  012746  061616                  MOV     #64$,-(SP)      ;;PUT NEW PC ON  STACK
061614  000002                          RTI                     ;;POP NEW PC AND PS
061616                          64$:
061616  005737  060720          1$:     TST     $TKCNT          ;;WAIT ON A CHARACTER
061622  001775                          BEQ     1$
061624  005337  060720                  DEC     $TKCNT          ;;DECREMENT THE COUNTER
061630  117766  177070  000004          MOVB    @$TKQOUT,4(SP)  ;;GET ONE CHARACTER
061636  005237  060724                  INC     $TKQOUT         ;;UPDATE THE POINTER
061642  023727  060724  060727          CMP     $TKQOUT,#$TKQEND ;;DID IT GO OFF OF THE END?
061650  001003                          BNE     2$              ;;BRANCH IF NO
061652  012737  060726  060724          MOV     #$TKQSRT,$TKQOUT ;;RESET THE POINTER
061660  000002                  2$:     RTI                     ;;RETURN
                                ;;**************************************************************
                                ;*THIS ROUTINE WILL INPUT A STRING FROM THE TTY
                                ;*CALL:
                                ;*      RDLIN                   ;;INPUT A STRING FROM THE TTY
                                ;*      RETURN HERE             ;;ADDRESS OF FIRST CHARACTER WILL BE ON THE STACK
                                ;*                              ;;TERMINATOR WILL BE A BYTE OF ALL 0'S

061662  010346                  $RDLIN: MOV     R3,-(SP)        ;;SAVE R3
061664  005046                          CLR     -(SP)           ;;CLEAR THE RUBOUT KEY
061666  012703  062116          1$:     MOV     #$TTYIN,R3      ;;GET ADDRESS
061672  022703  062126          2$:     CMP     #$TTYIN+8.,R3   ;;BUFFER FULL?
061676  101456                          BLOS    4$              ;;BR IF YES
061700  104411                          RDCHR                   ;;GO READ ONE CHARACTER FROM THE TTY
061702  112613                          MOVB    (SP)+,(R3)      ;;GET CHARACTER
061704  122713  000177          10$:    CMPB    #177,(R3)       ;;IS IT A RUBOUT
061710  001022                          BNE     5$              ;;BR IF NO
061712  005716                          TST     (SP)            ;;IS THIS THE FIRST RUBOUT?
061714  001007                          BNE     6$              ;;BR IF NO
061716  112737  000134  062114          MOVB    #'\,9$          ;;TYPE A BACK SLASH
061724  104401  062114                  TYPE    ,9$
061730  012716  177777                  MOV     #-1,(SP)        ;;SET THE RUBOUT KEY
061734  005303                  6$:     DEC     R3              ;;BACKUP BY ONE
061736  020327  062116                  CMP     R3,#$TTYIN      ;;STACK EMPTY?
061742  103434                          BLO     4$              ;;BR IF YES
061744  111337  062114                  MOVB    (R3),9$         ;;SETUP TO TYPEOUT THE DELETED CHAR.
061750  104401  062114                  TYPE    ,9$             ;;GO TYPE
061754  000746                          BR      2$              ;;GO READ ANOTHER CHAR.
061756  005716                  5$:     TST     (SP)            ;;RUBOUT KEY SET?
061760  001406                          BEQ     7$              ;;BR IF NO
061762  112737  000134  062114          MOVB    #'\,9$          ;;TYPE A BACK SLASH
061770  104401  062114                  TYPE    ,9$
061774  005016                          CLR     (SP)            ;;CLEAR THE RUBOUT KEY
061776  122713  000025          7$:     CMPB    #25,(R3)        ;;IS CHARACTER A CTRL U?
062002  001003                          BNE     8$              ;;BR IF NO
```

```
062004  104401  062133                  TYPE    ,$CNTLU         ;;TYPE A CONTROL 'U'
062010  000726                          BR      1$              ;;GO START OVER
062012  122713  000022          8$:     CMPB    #22,(R3)        ;;IS CHARACTER A '^R'?
062016  001011                          BNE     3$              ;;BRANCH IF NO
062020  105013                          CLRB    (R3)            ;;CLEAR THE CHARACTER
062022  104401  001217                  TYPE    ,$CRLF          ;;TYPE A 'CR' & 'LF'
062026  104401  062116                  TYPE    ,$TTYIN         ;;TYPE THE INPUT STRING
062032  000717                          BR      2$              ;;GO PICKUP ANOTHER CHACTER
062034  104401  001216          4$:     TYPE    ,$QUES          ;;TYPE A '?'
062040  000712                          BR      1$              ;;CLEAR THE BUFFER AND LOOP
062042  111337  062114          3$:     MOVB    (R3),9$         ;;ECHO THE CHARACTER
062046  104401  062114                  TYPE    ,9$
062052  122723  000015                  CMPB    #15,(R3)+       ;;CHECK FOR RETURN
062056  001305                          BNE     2$              ;;LOOP IF NOT RETURN
062060  105063  177777                  CLRB    -1(R3)          ;;CLEAR RETURN (THE 15)
062064  104401  001220                  TYPE    ,$LF            ;;TYPE A LINE FEED
062070  005726                          TST     (SP)+           ;;CLEAN RUBOUT KEY FROM THE STACK
062072  012603                          MOV     (SP)+,R3        ;;RESTORE R3
062074  011646                          MOV     (SP),-(SP)      ;;ADJUST THE STACK AND PUT ADDRESS OF THE
062076  016666  000004  000002          MOV     4(SP),2(SP)     ;;      FIRST ASCII CHARACTER ON IT
062104  012766  062116  000004          MOV     #$TTYIN,4(SP)
062112  000002                          RTI                     ;;RETURN
062114     000          9$:     .BYTE   0                       ;;STORAGE FOR ASCII CHAR. TO TYPE
062115     000                  .BYTE   0                       ;;TERMINATOR
062116                  $TTYIN: .BLKB   8.                      ;;RESERVE 8 BYTES FOR TTY INPUT
062126     136     103     015  $CNTLC: .ASCIZ   /^C/<15><12>   ;;CONTROL "C"
062133     136     125     015  $CNTLU: .ASCIZ   /^U/<15><12>   ;;CONTROL "U"
062140     136     107     015  $CNTLG: .ASCIZ   /^G/<15><12>   ;;CONTROL "G"
062145     015     012     123  $MSWR:  .ASCIZ   <15><12>/SWR = /
062156     040     040     116  $MNEW:  .ASCIZ   /  NEW = /
                                .EVEN

2
3 062170  005737  000042          SHUT:   TST     @#42            ;ANY MONITOR PRESENT ?
4 062174  001002                          BNE     1$              ;BR IF YES
5 062176  000137  004652                  JMP     START           ;GO TO START
6 062202  005037  001300          1$:     CLR     $DEVM           ;FUDGE NO DRIVES IN MAP
7 062206  000137  054104                  JMP     $EOP            ;RETURN TO $EOP
```

```
      1                                 .SBTTL  READ AN OCTAL NUMBER FROM THE TTY

                                        ;;*****************************************************************
                                        ;*THIS ROUTINE WILL READ AN OCTAL (ASCII) NUMBER FROM THE TTY AND
                                        ;*CHANGE IT TO BINARY.
                                        ;*CALL:
                                        ;*      RDOCT                       ;;READ AN OCTAL NUMBER
                                        ;*      RETURN HERE                 ;;LOW ORDER BITS ARE ON TOP OF THE STACK
                                        ;*                                  ;;HIGH ORDER BITS ARE IN $HIOCT

 062212  011646                        $RDOCT: MOV     (SP),-(SP)          ;;PROVIDE SPACE FOR THE
 062214  016666  000004  000002                 MOV     4(SP),2(SP)         ;;INPUT NUMBER
 062222  010046                                 MOV     R0,-(SP)            ;;PUSH R0 ON STACK
 062224  010146                                 MOV     R1,-(SP)            ;;PUSH R1 ON STACK
 062226  010246                                 MOV     R2,-(SP)            ;;PUSH R2 ON STACK
 062230  104412                         1$:     RDLIN                       ;;READ AN ASCIZ LINE
 062232  012600                                 MOV     (SP)+,R0            ;;GET ADDRESS OF 1ST CHARACTER
 062234  005001                                 CLR     R1                  ;;CLEAR DATA WORD
 062236  005002                                 CLR     R2
 062240  112046                         2$:     MOVB    (R0)+,-(SP)         ;;PICKUP THIS CHARACTER
 062242  001412                                 BEQ     3$                  ;;IF ZERO GET OUT
 062244  006301                                 ASL     R1                  ;;*2
 062246  006102                                 ROL     R2
 062250  006301                                 ASL     R1                  ;;*4
 062252  006102                                 ROL     R2
 062254  006301                                 ASL     R1                  ;;*8
 062256  006102                                 ROL     R2
 062260  042716  177770                         BIC     #^C7,(SP)           ;;STRIP THE ASCII JUNK
 062264  062601                                 ADD     (SP)+,R1            ;;ADD IN THIS DIGIT
 062266  000764                                 BR      2$                  ;;LOOP
 062270  005726                         3$:     TST     (SP)+               ;;CLEAN TERMINATOR FROM STACK
 062272  010166  000012                         MOV     R1,12(SP)           ;;SAVE THE RESULT
 062276  010237  062312                         MOV     R2,$HIOCT
 062302  012602                                 MOV     (SP)+,R2            ;;POP STACK INTO R2
 062304  012601                                 MOV     (SP)+,R1            ;;POP STACK INTO R1
 062306  012600                                 MOV     (SP)+,R0            ;;POP STACK INTO R0
 062310  000002                                 RTI                         ;;RETURN
 062312  000000                         $HIOCT: .WORD   0                   ;;HIGH ORDER BITS GO HERE
```

```
                                .SBTTL  TRAP DECODER

                                ;;******************************************************************
                                ;*THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE "TRAP" INSTRUCTION
                                ;*AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
                                ;*OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL
                                ;*GO TO THAT ROUTINE.

062314  016646  000002          $TRAP:  MOV     2(SP),-(SP)     ;;ASSUME THE STATUS OF
062320  042716  000020                  BIC     #20,(SP)        ;; THE CALLER--DO NOT ALLOW
062324  012746  062332                  MOV     #1$,-(SP)       ;; T-BIT TRAPS
062330  000002                          RTI                     ;;SET THE NEW STATUS
062332  010046                  1$:     MOV     R0,-(SP)        ;;SAVE R0
062334  016600  000002                  MOV     2(SP),R0        ;;GET TRAP ADDRESS
062340  005740                          TST     -(R0)           ;;BACKUP BY 2
062342  111000                          MOVB    (R0),R0         ;;GET RIGHT BYTE OF TRAP
062344  006300                          ASL     R0              ;;POSITION FOR INDEXING
062346  016000  062366                  MOV     $TRPAD(R0),R0   ;;INDEX TO TABLE
062352  000200                          RTS     R0              ;;GO TO ROUTINE


                                ;;THIS IS USE TO HANDLE THE "GETPRI" MACRO

062354  011646                  $TRAP2: MOV     (SP),-(SP)      ;;MOVE THE PC DOWN
062356  016666  000004  000002          MOV     4(SP),2(SP)     ;;MOVE THE PSW DOWN
062364  000002                          RTI                     ;;RESTORE THE PSW

                                .SBTTL  TRAP TABLE

                                ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
                                ;*BY THE "TRAP" INSTRUCTION.

                                ;       ROUTINE
                                ;       -------
062366  062354                  $TRPAD: .WORD   $TRAP2
062370  056034                          $TYPE   ;;CALL=TYPE     TRAP+1(104401)  TTY TYPEOUT ROUTINE
062372  055632                          $TYPOC  ;;CALL=TYPOC    TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
062374  055606                          $TYPOS  ;;CALL=TYPOS    TRAP+3(104403)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
062376  055646                          $TYPON  ;;CALL=TYPON    TRAP+4(104404)  TYPE OCTAL NUMBER (AS PER LAST CALL)
062400  055362                          $TYPDS  ;;CALL=TYPDS    TRAP+5(104405)  TYPE DECIMAL NUMBER (WITH SIGN)
062402  055306                          $TYPBN  ;;CALL=TYPBN    TRAP+6(104406)  TYPE BINARY (ASCII) NUMBER

062404  061320                          $GTSWR  ;;CALL=GTSWR    TRAP+7(104407)  GET SOFT-SWR SETTING

062406  061230                          $CKSWR  ;;CALL=CKSWR    TRAP+10(104410) TEST FOR CHANGE IN SOFT-SWR
062410  061572                          $RDCHR  ;;CALL=RDCHR    TRAP+11(104411) TTY TYPEIN CHARACTER ROUTINE
062412  061662                          $RDLIN  ;;CALL=RDLIN    TRAP+12(104412) TTY TYPEIN STRING ROUTINE
062414  062212                          $RDOCT  ;;CALL=RDOCT    TRAP+13(104413) READ AN OCTAL NUMBER FROM TTY
062416  055212                          $SAVREG ;;CALL=SAVREG   TRAP+14(104414) SAVE R0-R5 ROUTINE
062420  055250                          $RESREG ;;CALL=RESREG   TRAP+15(104415) RESTORE R0-R5 ROUTINE
```

```
                                        .SBTTL  POWER DOWN AND UP ROUTINES

                                        ;;**********************************************************************
                                        ;POWER DOWN ROUTINE
062422  012737  062562  000024  $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
062430  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
062436  010046                        MOV     R0,-(SP)        ;;PUSH R0 ON STACK
062440  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
062442  010246                        MOV     R2,-(SP)        ;;PUSH R2 ON STACK
062444  010346                        MOV     R3,-(SP)        ;;PUSH R3 ON STACK
062446  010446                        MOV     R4,-(SP)        ;;PUSH R4 ON STACK
062450  010546                        MOV     R5,-(SP)        ;;PUSH R5 ON STACK
062452  017746  116476                MOV     @SWR,-(SP)      ;;PUSH @SWR ON STACK
062456  010637  062566                MOV     SP,$SAVR6       ;;SAVE SP
062462  012737  062474  000024        MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
062470  000000                        HALT
062472  000776                        BR      .-2             ;;HANG UP

                                        ;;**********************************************************************
                                        ;POWER UP ROUTINE
062474  012737  062562  000024  $PWRUP: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST DOWN
062502  013706  062566                MOV     $SAVR6,SP       ;;GET SP
062506  005037  062566                CLR     $SAVR6          ;;WAIT LOOP FOR THE TTY
062512  005237  062566          1$:   INC     $SAVR6          ;;WAIT FOR THE INC
062516  001375                        BNE     1$              ;;OF  WORD
062520  012677  116430                MOV     (SP)+,@SWR      ;;POP STACK INTO @SWR
062524  012605                        MOV     (SP)+,R5        ;;POP STACK INTO R5
062526  012604                        MOV     (SP)+,R4        ;;POP STACK INTO R4
062530  012603                        MOV     (SP)+,R3        ;;POP STACK INTO R3
062532  012602                        MOV     (SP)+,R2        ;;POP STACK INTO R2
062534  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
062536  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
062540  012737  062422  000024        MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
062546  012737  000340  000026        MOV     #340,@#PWRVEC+2 ;;PRIO:7
062554  104401                        TYPE                    ;REPORT THE POWER FAILURE
062556  062570              $PWRMG:   .WORD   $POWER          ;;POWER FAIL MESSAGE POINTER
062560  000002                        RTI
062562  000000              $ILLUP:   HALT                    ;;THE POWER UP SEQUENCE WAS STARTED
062564  000776                        BR      .-2             ;; BEFORE THE POWER DOWN WAS COMPLETE
062566  000000              $SAVR6:   0                       ;;PUT THE SP HERE
062570     015     012     120  $POWER: .ASCIZ  <15><12>'POWER'
                                        .EVEN
```

```
                                        .SBTTL  APT COMMUNICATIONS ROUTINE

                                        ;;**************************************************************************
062600  112737  000001  063044  $ATY1:  MOVB    #1,$FFLG        ;;TO REPORT FATAL ERROR
062606  112737  000001  063042  $ATY3:  MOVB    #1,$MFLG        ;;TO TYPE A MESSAGE
062614  000403                        BR      $ATYC
062616  112737  000001  063044  $ATY4:  MOVB    #1,$FFLG        ;;TO ONLY REPORT FATAL ERROR
062624                          $ATYC:
062624  010046                        MOV     R0,-(SP)        ;;PUSH R0 ON STACK
062626  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
062630  105737  063042                TSTB    $MFLG           ;;SHOULD TYPE A MESSAGE?
062634  001450                        BEQ     5$              ;;IF NOT:  BR
062636  122737  000001  001242        CMPB    #APTENV,$ENV    ;;OPERATING UNDER APT?
062644  001031                        BNE     3$              ;;IF NOT:  BR
062646  132737  000100  001243        BITB    #APTSPOOL,$ENVM ;;SHOULD SPOOL MESSAGES?
062654  001425                        BEQ     3$              ;;IF NOT:  BR
062656  017600  000004                MOV     @4(SP),R0       ;;GET MESSAGE ADDR.
062662  062766  000002  000004        ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
062670  005737  001222          1$:   TST     $MSGTYPE        ;;SEE IF DONE W/ LAST XMISSION?
062674  001375                        BNE     1$              ;;IF NOT:  WAIT
062676  010037  001236                MOV     R0,$MSGAD       ;;PUT ADDR IN MAILBOX
062702  105720                  2$:   TSTB    (R0)+           ;;FIND END OF MESSAGE
062704  001376                        BNE     2$
062706  163700  001236                SUB     $MSGAD,R0       ;;SUB START OF MESSAGE
062712  006200                        ASR     R0              ;;GET MESSAGE LNGTH IN WORDS
062714  010037  001240                MOV     R0,$MSGLGT      ;;PUT LENGTH IN MAILBOX
062720  012737  000004  001222        MOV     #4,$MSGTYPE     ;;TELL APT TO TAKE MSG.
062726  000413                        BR      5$
062730  017637  000004  062754  3$:   MOV     @4(SP),4$       ;;PUT MSG ADDR IN JSR LINKAGE
062736  062766  000002  000004        ADD     #2,4(SP)                ;;BUMP RETURN ADDRESS
062744  013746  177776                MOV     177776,-(SP)    ;;PUSH 177776 ON STACK
062750  004737  056034                JSR     PC,$TYPE        ;;CALL TYPE MACRO
062754  000000                  4$:   .WORD   0
062756                          5$:
062756  105737  063044          10$:  TSTB    $FFLG           ;;SHOULD REPORT FATAL ERROR?
062762  001416                        BEQ     12$             ;;IF NOT:  BR
062764  005737  001242                TST     $ENV            ;;RUNNING UNDER APT?
062770  001413                        BEQ     12$             ;;IF NOT:  BR
062772  005737  001222          11$:  TST     $MSGTYPE        ;;FINISHED LAST MESSAGE?
062776  001375                        BNE     11$             ;;IF NOT:  WAIT
063000  017637  000004  001224        MOV     @4(SP),$FATAL   ;;GET ERROR #
063006  062766  000002  000004        ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
063014  005237  001222                INC     $MSGTYPE        ;;TELL APT TO TAKE ERROR
063020  105037  063044          12$:  CLRB    $FFLG           ;;CLEAR FATAL FLAG
063024  105037  063043                CLRB    $LFLG           ;;CLEAR LOG FLAG
063030  105037  063042                CLRB    $MFLG           ;;CLEAR MESSAGE FLAG
063034  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
063036  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
063040  000207                        RTS     PC              ;;RETURN
063042     000          $MFLG:  .BYTE   0               ;;MESSG. FLAG
063043     000          $LFLG:  .BYTE   0               ;;LOG FLAG
063044     000          $FFLG:  .BYTE   0               ;;FATAL FLAG
                                .EVEN
            000200      APTSIZE = 200
            000001      APTENV  = 001
            000100      APTSPOOL= 100
            000040      APTCSUP = 040
```

```
                                        .SBTTL  CONSOLE MESSAGES

                                EQUALS: .ASCIZ  @=@
063046  075     000             ALL:    .ASCIZ  @ALL@<CRLF>
063050  101     114     114     QUES:   .ASCIZ  @ ? @
063055  040     077     040     COMMA:  .ASCIZ  @, @
063061  054     040     000     MSHELP: .ASCIZ  <CRLF>@TYPE HELP TEXT (L) N ? @
063064  200     124     131     CNSL01: .ASCIZ  <CRLF>@RMCS1=@
063115  200     122     115     CNSL02: .ASCIZ  @ LIMITS - LO= 160000, HI= 17XXXX@<CRLF>
063125  040     114     111     CNSL03: .ASCIZ  @RMVEC=@
063167  122     115     126     CNSL04: .ASCIZ  @ LIMITS - LO= 0, HI= 1000@<CRLF><LF>
063176  040     114     111     CNSL07: .ASCII  <CRLF>@TYPE "A" TO TEST ALL DRIVES, OR TYPE DRIVE NUMBER(S)@
063232  200     124     131             .ASCIZ  <CRLF>@AND TERMINATE INPUT WITH A CARRIAGE RETURN.@
063317  200     101     116     CNSL08: .ASCII  <CRLF>
063374  200                     CNSL09: .ASCIZ  @ ?ILLEGAL INPUT@<CRLF>
063375  040     077     111     DRIVES: .ASCIZ  <CRLF>/DRIVE(S) TO BE TESTED/
063416  200     104     122     NONE:   .ASCIZ  /NONE/
063445  116     117     116     MSDRVS: .ASCIZ  <CRLF>/DRIVE(S): /
063452  200     104     122     MSGDRV: .ASCIZ  /DRIVE/
063466  ,04     122     111     SYSTAT: .ASCIZ  <CRLF>/UNIT STATUS:/
063474  200     125     116     $RM80:  .ASCIZ  /RM80/
063512  122     115     070     NOTRM:  .ASCIZ  / NOT AN RM80/
063517  040     116     117     LODEV:  .ASCIZ  / LOAD DEVICE/
063534  040     114     117     NOTPRS: .ASCIZ  / NOT PRESENT/
063551  040     116     117     NOTAVL: .ASCIZ  / NOT AVAILABLE/
063566  040     116     117     UNTOFF: .ASCIZ  / OFFLINE/
063605  040     117     106     UNTON:  .ASCIZ  / ONLINE/
063616  040     117     116     N:      .ASCIZ  /N/
063626  116     000             Y:      .ASCIZ  /Y/
063630  131     000             BLNKS4: .ASCII  / /
063632  040                     BLNKS3: .ASCII  / /
063633  040                     BLNKS2: .ASCII  / /
063634  040                     BLNKS1: .ASCIZ  / /
063635  040     000             .EVEN
```

```
                                .SBTTL  FUNCTION CODE TABLE

                                ;THE FUNCTION CODE TABLE IS USED TO DEFINE STATUS CONDITIONS FOR
                                ;EACH FUNCTION CODE.  BIT USAGE IS AS FOLLOWS:

                                ;       ATA - BIT 15 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF ATA SHOULD BE SET WHEN THE FUNCTION CODE IS EXECUTED, OTHERWISE,
                                ;BIT 15 IS ZERO, INDICATING THAT ATA SHOULD NOT NORMALLY BE SET.
                                ;NOTE THAT ATA MAY BE SET WHEN A COMMAND IS EXECUTED EVEN THOUGH
                                ;IT IS NOT EXPECTED AS A RESULT OF THE COMMAND.

                                ;       WCE - BIT 14 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF WRITE CHECK ERRORS ARE ENABLED AS A FUNCTION OF THE COMMAND.

                                ;       OPI - BIT 13 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF OPI ERRORS ARE ENABLED DURING THE EXECUTION OF THAT COMMAND.

                                ;       IVC - BIT 12 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF IVC ERRORS ARE ENABLED DURING THE EXECUTION OF THAT COMMAND.

                                ;       WLE - BIT 11 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF WRITE ERRORS ARE ENABLED DURING THE EXECUTION OF THAT COMMAND.
                                ;THE WRITE ERRORS WHICH ARE ENABLED ARE "WLE", "WCF", "DPE", "UPE".

                                ;       IAE - BIT 10 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF INVALID ADDRESS ERROR IS ENABLED FOR THAT COMMAND.

                                ;       AOE - BIT 09 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF READ AND WRITE ERRORS ARE ENABLED DURING THE EXECUTION OF THE
                                ;COMMAND.  THE ERRORS ENABLED BY THIS BIT ARE "TRE", "DLT", "NEM",
                                ;"MXF", "LBT", AND "AOE".

                                ;               BIT 08 IS NOT USED.

                                ;       HCE - BIT 07 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF HEADER ERRORS ARE ENABLED DURING THE EXECUTION OF THAT COMMAND.
                                ;HEADER ERRORS INCLUDE "HCRC", "HCE", "FER", AND "BSE".

                                ;       ECH - BIT 06 IS SET IN THE ENTRY FOR A GIVEN FUNCTION CODE
                                ;IF DATA FIELD ERRORS ARE ENABLED DURING THE EXECUTION OF THAT
                                ;COMMAND.  THESE ERRORS INCLUDE "MDPE", "DCK", AND "ECH".

                                ;               BIT 05 IS NOT USED.

                                ;               BIT 04 IS NOT USED.

                                ;               BIT 03 IS NOT USED.

                                ;               BIT 02 IS NOT USED.

                                ;               BIT 01 IS NOT USED.

                                ;       ILF - BIT 00 IS SET IF THE FUNCTION CODE IS ILLEGAL.

063640                          FNCD1B:                                 ;FUNCTION CODE TABLE

063640  020000                  .WORD   OPI                             ;NOP
```

FUNCTION CODE TABLE

```
     58 063642  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (2)
     59 063644  132000                .WORD   ATA!OPI!IVC!IAE                    ;SEEK
     60 063646  130000                .WORD   ATA!OPI!IVC                        ;RECALIBRATE
     61 063650  020000                .WORD   OPI                                ;DRIVE CLEAR
     62 063652  030000                .WORD   OPI!IVC                            ;RELEASE
     63 063654  130000                .WORD   OPI!ATA!IVC                        ;OFFSET
     64 063656  130000                .WORD   OPI!ATA!IVC                        ;RETURN TO CENTERLINE
     65 063660  020000                .WORD   OPI                                ;READ IN PRESET
     66 063662  020000                .WORD   OPI                                ;PACK ACKNOWLEDGE
     67 063664  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (24)
     68 063666  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (26)
     69 063670  132000                .WORD   ATA!OPI!IVC!IAE                    ;SEARCH
     70 063672  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (32)
     71 063674  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (34)
     72 063676  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (36)
     73 063700  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (40)
     74 063702  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (42)
     75 063704  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (44)
     76 063706  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (46)
     77 063710  073300                .WORD   WCE!OPI!IVC!IAE!AOE!HCE!ECH        ;WRITE CHECK DATA
     78 063712  073300                .WORD   WCE!OPI!IVC!IAE!AOE!HCE!ECH        ;WRITE CHECK HEADER AND DATA
     79 063714  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (54)
     80 063716  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (56)
     81 063720  037200                .WORD   OPI!IVC!WLE!IAE!AOE!HCE            ;WRITE DATA
     82 063722  037000                .WORD   OPI!IVC!WLE!IAE!AOE                ;WRITE HEADER AND DATA
     83 063724  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (64)
     84 063726  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (66)
     85 063730  033300                .WORD   OPI!IVC!IAE!AOE!HCE!ECH            ;READ DATA
     86 063732  033300                .WORD   OPI!IVC!IAE!AOE!HCE!ECH            ;READ HEADER AND DATA
     87 063734  13000                 .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (74)
     88 063736  130001                .WORD   OPI!ATA!ILF!IVC                    ;ILLEGAL FUNCTION (76)
```

```
                                .SBTTL  ATTENTION (ATA) TABLE

                        ATN^BL: .BYTE   1.
                                .BYTE   2.
                                .BYTE   4.
                                .BYTE   8.
                                .BYTE   16.
                                .BYTE   32.
                                .BYTE   64.
                                .BYTE   128.
```

DATA PATTERN TABLE

```
                                .SBTTL  DATA PATTERN TABLE

                        ;GDTPT:
                        MIXED:
063750  000000                  .WORD   0.
063752  000001                  .WORD   1.
063754  000003                  .WORD   3.
063756  000007                  .WORD   7.
063760  000017                  .WORD   15.
063762  000037                  .WORD   31.
063764  000077                  .WORD   63.
063766  000177                  .WORD   127.
063770  000377                  .WORD   255.
063772  000777                  .WORD   511.
063774  001777                  .WORD   1023.
063776  003777                  .WORD   2047.
064000  007777                  .WORD   4095.
064002  017777                  .WORD   8191.
064004  037777                  .WORD   16383.
064006  077777                  .WORD   32767.
064010  177777          ONES:   .WORD   65535.
064012  177777                  .WORD   65535.
064014  077777                  .WORD   32767.
064016  037777                  .WORD   16383.
064020  017777                  .WORD   8191.
064022  007777                  .WORD   4095.
064024  003777                  .WORD   2047.
064026  001777                  .WORD   1023.
064030  000777                  .WORD   511.
064032  000377                  .WORD   255.
064034  000177                  .WORD   127.
064036  000077                  .WORD   63.
064040  000037                  .WORD   31.
064042  000017                  .WORD   15.
064044  000007                  .WORD   7.
064046  000003                  .WORD   3.
064050  000001                  .WORD   1.
064052  000000          ZEROS:  .WORD   0.
064054  000000                  .WORD   0.
064056  000001                  .WORD   1.
064060  000002                  .WORD   2.
064062  000004                  .WORD   4.
064064  000010                  .WORD   8.
064066  000020                  .WORD   16.
064070  000040                  .WORD   32.
064072  000100                  .WORD   64.
064074  000200                  .WORD   128.
064076  000400                  .WORD   256.
064100  001000                  .WORD   512.
064102  002000                  .WORD   1024.
064104  004000                  .WORD   2048.
064106  010000                  .WORD   4096.
064110  020000                  .WORD   8192.
064112  040000                  .WORD   16384.
064114  100000                  .WORD   32768.
064116  100000                  .WORD   32768.
064120  040000                  .WORD   16384.
```

DATA PATTERN TABLE

```
 58 064122  020000                    .WORD   8192.
 59 064124  010000                    .WORD   4096.
 60 064126  004000                    .WORD   2048.
 61 064130  002000                    .WORD   1024.
 62 064132  001000                    .WORD   512.
 63 064134  000400                    .WORD   256.
 64 064136  000200                    .WORD   128.
 65 064140  000100                    .WORD   64.
 66 064142  000040                    .WORD   32.
 67 064144  000020                    .WORD   16.
 68 064146  000010                    .WORD   8.
 69 064150  000004                    .WORD   4.
 70 064152  000002                    .WORD   2.
 71 064154  000001                    .WORD   1.
 72 064156  000000                    .WORD   0.
 73 064160  177777                    .WORD   65535.
 74 064162  177776                    .WORD   65534.
 75 064164  177774                    .WORD   65532.
 76 064166  177770                    .WORD   65528.
 77 064170  177760                    .WORD   65520.
 78 064172  177740                    .WORD   65504.
 79 064174  177700                    .WORD   65472.
 80 064176  177600                    .WORD   65408.
 81 064200  177400                    .WORD   65280.
 82 064202  177000                    .WORD   65024.
 83 064204  176000                    .WORD   64512.
 84 064206  174000                    .WORD   63488.
 85 064210  170000                    .WORD   61440.
 86 064212  160000                    .WORD   57344.
 87 064214  140000                    .WORD   49152.
 88 064216  100000                    .WORD   32768.
 89 064220  000000                    .WORD   0.
 90 064222  000000                    .WORD   0.
 91 064224  100000                    .WORD   32768.
 92 064226  140000                    .WORD   49152.
 93 064230  160000                    .WORD   57344.
 94 064232  170000                    .WORD   61440.
 95 064234  174000                    .WORD   63488.
 96 064236  176000                    .WORD   64512.
 97 064240  177000                    .WORD   65024.
 98 064242  177400                    .WORD   65280.
 99 064244  177600                    .WORD   65408.
100 064246  177700                    .WORD   65472.
101 064250  177740                    .WORD   65504.
102 064252  177760                    .WORD   65520.
103 064254  177770                    .WORD   65528.
104 064256  177774                    .WORD   65532.
105 064260  177776                    .WORD   65534.
106 064262  177777                    .WORD   65535.
107 064264  125252                    .WORD   43690.
108 064266  152525                    .WORD   43690./2
109 064270  125252                    .WORD   43690.
110 064272  177777                    .WORD   65535.
111 064274  177776                    .WORD   65534.
112 064276  177775                    .WORD   65533.
113 064300  177773                    .WORD   65531.
114 064302  177767                    .WORD   65527.
```

DATA PATTERN TABLE

```
    115 064304  177757                        .WORD   65519.
    116 064306  177737                        .WORD   65503.
    117 064310  177677                        .WORD   65471.
    118 064312  177577                        .WORD   65407.
    119 064314  177377                        .WORD   65279.
    120 064316  176777                        .WORD   65023.
    121 064320  175777                        .WORD   64511.
    122 064322  173777                        .WORD   63487.
    123 064324  167777                        .WORD   61439.
    124 064326  157777                        .WORD   57343.
    125 064330  137777                        .WORD   49151.
    126 064332  077777                        .WORD   32767.
    127 064334  077777                        .WORD   32767.
    128 064336  137777                        .WORD   49151.
    129 064340  157777                        .WORD   57343.
    130 064342  167777                        .WORD   61439.
    131 064344  173777                        .WORD   63487.
    132 064346  175777                        .WORD   64511.
    133 064350  176777                        .WORD   65023.
    134 064352  177377                        .WORD   65279.
    135 064354  177577                        .WORD   65407.
    136 064356  177677                        .WORD   65471.
    137 064360  177737                        .WORD   65503.
    138 064362  177757                        .WORD   65519.
    139 064364  177767                        .WORD   65527.
    140 064366  177773                        .WORD   65531.
    141 064370  177775                        .WORD   65533.
    142 064372  177776                        .WORD   65534.
    143 064374  177777                        .WORD   65535.
    144 064376                          ENRGDT:
    145                                 .EVEN
```

ERROR MESSAGE TABLE

```
                                        .SBTTL  ERROR MESSAGE TABLE
                                        
064376  077527  072436  000000  EMT1:   .WORD   EMS300,EMS1,0
064404  077545  077570  077615  EMT2:   .WORD   EMS301,EMS302,EMS303,EMS1,EMS304
064416  102545  101754  102115          .WORD   EMS511,EMS500,EMS501,EMS502,EMS503,0
064432  077545  077635  077570  EMT3:   .WORD   EMS301,EMS306,EMS302
064440  102545  102272  102115          .WORD   EMS511,EMS505,EMS501,EMS502,0
064452  077527  077570  077651  EMT4:   .WORD   EMS300,EMS302,EMS307,EMS2
064462  102545  102142  102115          .WORD   EMS511,EMS502,EMS501,EMS503,0
064474  077545  077712  077727  EMT5:   .WORD   EMS301,EMS310,EMS311
064502  102545  102142  102115          .WORD   EMS511,EMS502,EMS501,EMS503,EMS504
064514  077773  000000                  .WORD   EMS312,0
064520  077545  077635  077727  EMT6:   .WORD   EMS301,EMS306,EMS311
064526  102545  102142  102115          .WORD   EMS511,EMS502,EMS501,EMS503,EMS504,0
064542  077545  100031  077570  EMT7:   .WORD   EMS301,EMS313,EMS302
064550  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,EMS504,EMS503,0
064564  100137  100160  100062  EMT10:  .WORD   EMS316,EMS317,EMS314
064572  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064602  100137  100160  100111  EMT11:  .WORD   EMS316,EMS317,EMS315
064610  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064620  100137  100200  100062  EMT12:  .WORD   EMS316,EMS320,EMS314
064626  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064636  100137  100200  100111  EMT13:  .WORD   EMS316,EMS320,EMS315
064644  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064654  100137  100220  100062  EMT14:  .WORD   EMS316,EMS321,EMS314
064662  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064672  100137  100220  100111  EMT15:  .WORD   EMS316,EMS321,EMS315
064700  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064710  100137  100240  100062  EMT16:  .WORD   EMS316,EMS322,EMS314
064716  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064726  100137  100240  100111  EMT17:  .WORD   EMS316,EMS322,EMS315
064734  102545  102115  102142          .WORD   EMS511,EMS501,EMS502,0
064744  077545  100277  077015  EMT20:  .WORD   EMS301,EMS324,EMS250
064752  102545  102237                  .WORD   EMS511,EMS504
064756  077773  100330  000000          .WORD   EMS312,EMS326,0
064764  077545  100260  077015  EMT21:  .WORD   EMS301,EMS323,EMS250
064772  102545  102237                  .WORD   EMS511,EMS504
064776  077773  100317  000000          .WORD   EMS312,EMS325,0
065004  077545  100031  077015  EMT22:  .WORD   EMS301,EMS313,EMS250
065012  102545  102237  000000          .WORD   EMS511,EMS504,0
065020  077545  100277  077053  EMT23:  .WORD   EMS301,EMS324,EMS251
065026  102545  102115                  .WORD   EMS511,EMS501
065032  077773  100330  000000          .WORD   EMS312,EMS326,0
065040  077545  100260  077053  EMT24:  .WORD   EMS301,EMS323,EMS251
065046  102545  102115                  .WORD   EMS511,EMS501
065052  077773  100317  000000          .WORD   EMS312,EMS325,0
065060  077545  100031  077053  EMT25:  .WORD   EMS301,EMS313,EMS251
065066  102545  102115  000000          .WORD   EMS511,EMS501,0
065074  077545  077635  077117  EMT26:  .WORD   EMS301,EMS306,EMS252,EMS253,EMS327,EMS254
065110  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,EMS502
065120  100346  100062  000000          .WORD   EMS330,EMS314,0
065126  077527  077117          EMT27:  .WORD   EMS300,EMS252
065132  102545  102115  000000          .WORD   EMS511,EMS501,0
065140  077527  077117          EMT30:  .WORD   EMS300,EMS252
065144  102545  102115  102237          .WORD   EMS511,EMS501,EMS504,0
065154  077527  077117          EMT31:  .WORD   EMS300,EMS252
065160  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
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 58 065170  077545  100277  077117  EMT32:  .WORD   EMS301,EMS324,EMS252
 59 065176  102545  102115  000000          .WORD   EMS511,EMS501,0
 60 065204  077545  100277  077117  EMT33:  .WORD   EMS301,EMS324,EMS252
 61 065212  102545  102115  102237          .WORD   EMS511,EMS501,EMS504,0
 62 065222  077545  100277  077117  EMT34:  .WORD   EMS301,EMS324,EMS252
 63 065230  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
 64 065240  077545  100260  077117  EMT35:  .WORD   EMS301,EMS323,EMS252
 65 065246  102545  102115  000000          .WORD   EMS511,EMS501,0
 66 065254  077545  100031  077117  EMT36:  .WORD   EMS301,EMS313,EMS252
 67 065262  102545  102115  000000          .WORD   EMS511,EMS501,0
 68 065270  077545  100277  077246  EMT37:  .WORD   EMS301,EMS324,EMS255
 69 065276  077773  100330  000000          .WORD   EMS312,EMS326,0
 70 065304  077545  100260  077246  EMT40:  .WORD   EMS301,EMS323,EMS255
 71 065312  102545  102237                  .WORD   EMS511,EMS504
 72 065316  077773  100317  000000          .WORD   EMS312,EMS325,0
 73 065324  077545  100031  077246  EMT41:  .WORD   EMS301,EMS313,EMS255
 74 065332  102545  102237  000000          .WORD   EMS511,EMS504,0
 75 065340  077545  100260  077015  EMT42:  .WORD   EMS301,EMS323,EMS250,EMS327,EMS255
 76 065352  102545  102237  102115          .WORD   EMS511,EMS504,EMS501,EMS503,0
 77 065364  077527  072556          EMT43:  .WORD   EMS300,EMS3
 78 065370  102545  102115  000000          .WORD   EMS511,EMS501,0
 79 065376  100365  072623  077152  EMT44:  .WORD   EMS331,EMS4,EMS253
 80 065404  102545  102115  000000          .WORD   EMS511,EMS501,0
 81 065412  077527  077152          EMT45:  .WORD   EMS300,EMS253
 82 065416  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
 83 065426  077527  077152          EMT46:  .WORD   EMS300,EMS253
 84 065432  102545  102115  102237          .WORD   EMS511,EMS501,EMS504,0
 85 065442  077545  100277  077152  EMT47:  .WORD   EMS301,EMS324,EMS253
 86 065450  102545  102115  102212          .WORD   EMS511,EMS501,EMS503
 87 065456  077773  100330  000000          .WORD   EMS312,EMS326,0
 88 065464  077545  100277  077152  EMT50:  .WORD   EMS301,EMS324,EMS253
 89 065472  102545  102115  102237          .WORD   EMS511,EMS501,EMS504
 90 065500  077773  100330  000000          .WORD   EMS312,EMS326,0
 91 065506  077545  100260  077152  EMT51:  .WORD   EMS301,EMS323,EMS253
 92 065514  102545  102115                  .WORD   EMS511,EMS501
 93 065520  077773  100317  000000          .WORD   EMS312,EMS325,0
 94 065526  077545  100031  077152  EMT52:  .WORD   EMS301,EMS313,EMS253
 95 065534  102545  102115  000000          .WORD   EMS511,EMS501,0
 96 065542  100365  072623  077310  EMT53:  .WORD   EMS331,EMS4,EMS256
 97 065550  102545  102115  000000          .WORD   EMS511,EMS501,0
 98 065556  077545  100277  077310  EMT54:  .WORD   EMS301,EMS324,EMS256
 99 065564  102545  102115                  .WORD   EMS511,EMS501
100 065570  077773  100330  000000          .WORD   EMS312,EMS326,0
101 065576  077545  100260  077310  EMT55:  .WORD   EMS301,EMS323,EMS256
102 065604  102545  102115                  .WORD   EMS511,EMS501
103 065610  077773  100317  000000          .WORD   EMS312,EMS325,0
104 065616  077545  100031  077310  EMT56:  .WORD   EMS301,EMS313,EMS256
105 065624  102545  102115  000000          .WORD   EMS511,EMS501,0
106 065632  077340  100415          EMT57:  .WORD   EMS257,EMS332
107 065636  102545  102345  102115          .WORD   EMS511,EMS506,EMS501,0
108 065646  072654  100433          EMT60:  .WORD   EMS5,EMS333
109 065652  102545  102402  102115          .WORD   EMS511,EMS507,EMS501,0
110 065662  077545  100277  077374  EMT61:  .WORD   EMS301,EMS324,EMS260
111 065670  102545  102115                  .WORD   EMS511,EMS501
112 065674  077773  100330  000000          .WORD   EMS312,EMS326,0
113 065702  077545  100260  077374  EMT62:  .WORD   EMS301,EMS323,EMS260
114 065710  102545  102115                  .WORD   EMS511,EMS501
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ERROR MESSAGE TABLE

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    115 065714  077773  100317  000000            .WORD   EMS312,EMS325,0
    116 065722  077545  100031  077374  EMT63:    .WORD   EMS301,EMS313,EMS260
    117 065730  102545  102115  000000            .WORD   EMS511,EMS501,0
    118 065736  077527  073175          EMT64:    .WORD   EMS300,EMS12
    119 065742  102545  102115  000000            .WORD   EMS511,EMS501,0
    120 065750  073175  100457  100555  EMT65:    .WORD   EMS12,EMS335,EMS342
    121 065756  102545  102115  000000            .WORD   EMS511,EMS501,0
    122 065764  073175  100502  100555  EMT66:    .WORD   EMS12,EMS336,EMS342
    123 065772  102545  102115  000000            .WORD   EMS511,EMS501,0
    124 066000  077527  072724          EMT67:    .WORD   EMS300,EMS6
    125 066004  102545  102115                    .WORD   EMS511,EMS501
    126 066010  072770  100433  000000            .WORD   EMS7,EMS333,0
    127 066016  077527  072724  100340  EMT70:    .WORD   EMS300,EMS6,EMS327,EMS7
    128 066026  102545  102115  102237            .WORD   EMS511,EMS501,EMS504,0
    129 066036  072724  100457  100535  EMT71:    .WORD   EMS6,EMS335,EMS340,EMS10,EMS333,EMS342
    130 066052  102545  102115  102142            .WORD   EMS511,EMS501,EMS502,0
    131 066062  072724  100502  100535  EMT72:    .WORD   EMS6,EMS336,EMS340,EMS10,EMS334,EMS342
    132 066076  102545  102115  102142            .WORD   EMS511,EMS501,EMS502,0
    133 066106  077545  077374  077615  EMT73:    .WORD   EMS301,EMS260,EMS303,EMS11
    134 066116  102545  102115  102142            .WORD   EMS511,EMS501,EMS502,0
    135 066126  100607  100623  100555  EMT74:    .WORD   EMS343,EMS344,EMS342,0
    136 066136  077527  073253          EMT75:    .WORD   EMS300,EMS13
    137 066142  102545  102212  000000            .WORD   EMS511,EMS503,0
    138 066150  100700  073253  100652  EMT76:    .WORD   EMS346,EMS13,EMS345
    139 066156  102545  102212  000000            .WORD   EMS511,EMS503,0
    140 066164  100521  073253  100652  EMT77:    .WORD   EMS337,EMS13,EMS345
    141 066172  102545  102212  000000            .WORD   EMS511,EMS503,0
    142 066200  077545  100031  077205  EMT100:   .WORD   EMS301,EMS313,EMS254,EMS347,EMS13
    143 066212  102545  102212  000000            .WORD   EMS511,EMS503,0
    144 066220  100700  073322  100546  EMT101:   .WORD   EMS346,EMS14,EMS341,EMS15
    145 066230  102545  102212  102115            .WORD   EMS511,EMS503,EMS501,0
    146 066240  100521  073322  100546  EMT102:   .WORD   EMS337,EMS14,EMS341,EMS15
    147 066250  102545  102212  102115            .WORD   EMS511,EMS503,EMS501,0
    148 066260  077545  100031  077205  EMT103:   .WORD   EMS301,EMS313,EMS254,EMS347,EMS15
    149 066272  102545  102212                    .WORD   EMS511,EMS503
    150 066276  073322  100415  000000            .WORD   EMS14,EMS332,0
    151 066304  100700  073526  100546  EMT104:   .WORD   EMS346,EMS17,EMS341,EMS16
    152 066314  102545  102212  102115            .WORD   EMS511,EMS503,EMS501,0
    153 066324  100521  073526  100546  EMT105:   .WORD   EMS337,EMS17,EMS341,EMS16
    154 066334  102545  102212  102115            .WORD   EMS511,EMS503,EMS501,0
    155 066344  077545  100031  077205  EMT106:   .WORD   EMS301,EMS313,EMS254,EMS347,EMS16
    156 066356  102545  102212                    .WORD   EMS511,EMS503
    157 066362  073526  100415  000000            .WORD   EMS17,EMS332,0
    158 066370  100700  073567  100546  EMT107:   .WORD   EMS346,EMS20,EMS341,EMS21
    159 066400  102545  102212  102115            .WORD   EMS511,EMS503,EMS501,0
    160 066410  073567  100744  073633  EMT110:   .WORD   EMS20,EMS351,EMS21,EMS350,EMS22,EMS315
    161 066424  102545  102115  000000            .WORD   EMS511,EMS501,0
    162 066432  073567  100447  100737  EMT111:   .WORD   EMS20,EMS334,EMS350,EMS22,EMS333
    163 066444  102545  102115  000000            .WORD   EMS511,EMS501,0
    164 066452  100521  073567  100546  EMT112:   .WORD   EMS337,EMS20,EMS341,EMS21
    165 066462  102545  102212  102115            .WORD   EMS511,EMS503,EMS501,0
    166 066472  100521  073567  100546  EMT113:   .WORD   EMS337,EMS20,EMS341,EMS21,EMS350,EMS22,EMS334
    167 066510  102545  102115  000000            .WORD   EMS511,EMS501,0
    168 066516  073567  100762  073633  EMT114:   .WORD   EMS20,EMS352,EMS21,EMS350,EMS22,EMS333
    169 066532  102545  102115  000000            .WORD   EMS511,EMS501,0
    170 066540  077545  100031  077205  EMT115:   .WORD   EMS301,EMS313,EMS254,EMS347,EMS21
    171 066552  102545  102212                    .WORD   EMS511,EMS503
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ERROR MESSAGE TABLE

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172 066556  073567  100415  000000          .WORD   EMS20,EMS332,0
173 066564  100700  073757  100546  EMT116: .WORD   EMS346,EMS23,EMS341,EMS24
174 066574  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
175 066604  100521  073757  100546  EMT117: .WORD   EMS337,EMS23,EMS341,EMS24
176 066614  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
177 066624  077545  100031  077205  EMT120: .WORD   EMS301,EMS313,EMS254,EMS347,EMS24
178 066636  102545  102212                  .WORD   EMS511,EMS503
179 066642  073757  100415  000000          .WORD   EMS23,EMS332,0
180 066650  100700  074114  100546  EMT121: .WORD   EMS346,EMS25,EMS341,EMS26
181 066660  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
182 066670  100521  074114  100546  EMT122: .WORD   EMS337,EMS25,EMS341,EMS26
183 066700  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
184 066710  077545  100031  077205  EMT123: .WORD   EMS301,EMS313,EMS254,EMS347,EMS26
185 066722  102545  102212                  .WORD   EMS511,EMS503
186 066726  074114  100415  000000          .WORD   EMS25,EMS332,0
187 066734  077527  074251  077651  EMT124: .WORD   EMS300,EMS27,EMS307,EMS2
188 066744  102545  102212  000000          .WORD   EMS511,EMS503,0
189 066752  100365  074251  100776  EMT125: .WORD   EMS331,EMS27,EMS353
190 066760  102545  102212                  .WORD   EMS511,EMS503
191 066764  074315  100111  000000          .WORD   EMS30,EMS315,0
192 066772  100521  074251  100546  EMT126: .WORD   EMS337,EMS27,EMS341,EMS30
193 067002  102545  102212  000000          .WORD   EMS511,EMS503,0
194 067010  077545  100031  077205  EMT127: .WORD   EMS301,EMS313,EMS254,EMS347,EMS30
195 067022  102545  102212                  .WORD   EMS511,EMS503
196 067026  074251  100415  000000          .WORD   EMS27,EMS332,0
197 067034  074375  101022  077015  EMT130: .WORD   EMS31,EMS354,EMS250
198 067042  102545  102237  102212          .WORD   EMS511,EMS504,EMS503,0
199 067052  074446  101022  077015  EMT131: .WORD   EMS32,EMS354,EMS250
200 067060  102545  102237  102212          .WORD   EMS511,EMS504,EMS503,0
201 067070  101055  074526  077015  EMT132: .WORD   EMS355,EMS33,EMS250,EMS341,EMS30
202 067102  102545  102237  000000          .WORD   EMS511,EMS504,0
203 067110  101055  074556  077015  EMT133: .WORD   EMS355,EMS34,EMS250,EMS341,EMS30
204 067122  102545  102237  000000          .WORD   EMS511,EMS504,0
205 067130  100365  072623  077246  EMT134: .WORD   EMS331,EMS4,EMS255
206 067136  102545  102237  000000          .WORD   EMS511,EMS504,0
207 067144  074605  101117  101141  EMT135: .WORD   EMS35,EMS357,EMS360,EMS15
208 067154  102545  102115  000000          .WORD   EMS511,EMS501,0
209 067162  077425  101215          EMT136: .WORD   EMS261,EMS362
210 067166  102545  102212  000000          .WORD   EMS511,EMS503,0
211 067174  077527  074647  077651  EMT137: .WORD   EMS300,EMS36,EMS307,EMS2
212 067204  102545  102115  000000          .WORD   EMS511,EMS501,0
213 067212  101055  074677  077246  EMT140: .WORD   EMS355,EMS37,EMS255,EMS341,EMS30
214 067224  102545  102237  000000          .WORD   EMS511,EMS504,0
215 067232  100700  074730  100652  EMT141: .WORD   EMS346,EMS40,EMS345
216 067240  102545  102237  000000          .WORD   EMS511,EMS504,0
217 067246  100521  074730  100546  EMT142: .WORD   EMS337,EMS40,EMS341,EMS30
218 067256  102545  102237  000000          .WORD   EMS511,EMS504,0
219 067264  101236  077712  075006  EMT143: .WORD   EMS363,EMS310,EMS41
220 067272  102545  102115  000000          .WORD   EMS511,EMS501,0
221 067300  100521  075006  100546  EMT144: .WORD   EMS337,EMS41,EMS341,EMS252,EMS327,EMS253
222 067314  102545  102115  000000          .WORD   EMS511,EMS501,0
223 067322  075006  101022  101253  EMT145: .WORD   EMS41,EMS354,EMS364,EMS252,EMS365,EMS253
224 067336  102545  102115  000000          .WORD   EMS511,EMS501,0
225 067344  077545  077635  074647  EMT146: .WORD   EMS301,EMS306,EMS36
226 067352  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
227 067362  101301  075054          EMT147: .WORD   EMS366,EMS42
228 067366  102545  102212  000000          .WORD   EMS511,EMS503,0
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    229 067374  101324  100776  101274  EMT150: .WORD   EMS367,EMS353,EMS365,EMS42,EMS354,EMS3
    230 067410  102545  102212  000000          .WORD   EMS511,EMS503,0
    231 067416  100521  074647          EMT151: .WORD   EMS337,EMS36
    232 067422  102545  102115  000000          .WORD   EMS511,EMS501,0
    233 067430  075136  101022  074647  EMT152: .WORD   EMS43,EMS354,EMS36
    234 067436  102545  102115  000000          .WORD   EMS511,EMS501,0
    235 067444  101324  100776  101274  EMT153: .WORD   EMS367,EMS353,EMS365,EMS36,EMS370
    236 067456  102545  102212  000000          .WORD   EMS511,EMS503,0
    237 067464  101324  100776  101274  EMT154: .WORD   EMS367,EMS353,EMS365,EMS36,EMS371
    238 067476  102545  102212  000000          .WORD   EMS511,EMS503,0
    239 067504  077527  075207  077651  EMT155: .WORD   EMS300,EMS44,EMS307,EMS2
    240 067514  102545  102212  0000C0          .WORD   EMS511,EMS503,0
    241 067522  101324  100776  101274  EMT156: .WORD   EMS367,EMS353,EMS365,EMS44,EMS354,EMS3
    242 067536  102545  102212  000000          .WORD   EMS511,EMS503,0
    243 067544  077527  075250  077651  EMT157: .WORD   EMS300,EMS45,EMS307,EMS2
    244 067554  102545  102212  000000          .WORD   EMS511,EMS503,0
    245 067562  101324  100776  101274  EMT160: .WORD   EMS367,EMS353,EMS365,EMS45,EMS354,EMS3
    246 067576  102545  102212  102115          .WORD   EMS511,EMS503,EMS501
    247 067604  074605  100433  000000          .WORD   EMS35,EMS333,0
    248 067612  077527  075325  077651  EMT161: .WORD   EMS300,EMS46,EMS307,EMS2
    249 067622  102545  102212  000000          .WORD   EMS511,EMS503,0
    250 067630  100521  075325  100776  EMT162: .WORD   EMS337,EMS46,EMS353
    251 067636  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
    252 067646  074605  100457  100521  EMT163: .WORD   EMS35,EMS335,EMS337,EMS41,EMS334,EMS372
    253 067662  102545  102115  000000          .WORD   EMS511,EMS501,0
    254 067670  075407  100457  100521  EMT164: .WORD   EMS47,EMS335,EMS337,EMS41,EMS335,EMS372
    255 067704  102545  102115  000000          .WORD   EMS511,EMS501,0
    256 067712  100521  074605  100340  EMT165: .WORD   EMS337,EMS35,EMS327,EMS47
    257 067722  102545  102115                  .WORD   EMS511,EMS501
    258 067726  C75006  100433  101440          .WORD   EMS41,EMS333,EMS372,0
    259 067736  C77527  075407  077651  EMT166: .WORD   EMS300,EMS47,EMS307,EMS2
    260 067746  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
    261 067756  075447  100457  100535  EMT167: .WORD   EMS50,EMS335,EMS340,EMS36,EMS333
    262 067770  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
    263 070000  100521  074605          EMT170: .WORD   EMS337,EMS35
    264 070004  102545  102115  000000          .WORD   EMS511,EMS501,0
    265 070012  075447  074556  072556  EMT171: .WORD   EMS50,EMS34,EMS3
    266 070020  102545  102115  000000          .WORD   EMS511,EMS501,0
    267 070026  077545  077635  075516  EMT172: .WORD   EMS301,EMS306,EMS51
    268 070034  102545  102115  102237          .WORD   EMS511,EMS501,EMS504,0
    269 070044  101324  100776  101274  EMT173: .WORD   EMS367,EMS353,EMS365,EMS47,EMS354,EMS3
    270 070060  102545  102115  000000          .WORD   EMS511,EMS501,0
    271 070066  077527  077015  100340  EMT174: .WORD   EMS300,EMS250,EMS327,EMS255,EMS327,EMS256
    272 070102  100546  102644                  .WORD   EMS341,EMS600
    273 070106  102545  102115  102237          .WORD   EMS511,EMS501,EMS504,0
    274 070116  077527  077310  100546  EMT175: .WORD   EMS300,EMS256,EMS341,EMS600
    275 070126  102545  102115  102237          .WORD   EMS511,EMS501,EMS504,0
    276 070136  077527  077015  100546  EMT176: .WORD   EMS300,EMS250,EMS341,EMS600
    277 070146  102545  102237  000000          .WORD   EMS511,EMS504,0
    278 070154  000000          EMT177: .WORD
    279 070156  100521  075565  100546  EMT200: .WORD   EMS337,EMS52,EMS341,EMS601
    280 070166  102545  102115  000000          .WORD   EMS511,EMS501,0
    281 070174  100700  075565  100546  EMT201: .WORD   EMS346,EMS52,EMS341,EMS602
    282 070204  102545  102115  000000          .WORD   EMS511,EMS501,0
    283 070212  100700  075516  100546  EMT202: .WORD   EMS346,EMS51,EMS341,EMS602
    284 070222  102545  102115  000000          .WORD   EMS511,EMS501,0
    285 070230  100700  075565  100652  EMT203: .WORD   EMS346,EMS52,EMS345,EMS373,EMS255
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    286 070242  102545  102237  102115          .WORD   EMS511,EMS504,EMS501,0
    287 070252  100700  075565  100546  EMT204: .WORD   EMS346,EMS52,EMS341,EMS27
    288 070262  102545  102237  102115          .WORD   EMS511,EMS504,EMS501,0
    289 070272  075626  101022  072556  EMT205: .WORD   EMS53,EMS354,EMS3
    290 070300  102545  102212  102142          .WORD   EMS511,EMS503,EMS502,EMS510,0
    291 070312  100521  075667  101476  EMT206: .WORD   EMS337,EMS54,EMS374,EMS250,EMS327,EMS255
    292 070326  100340  072556                  .WORD   EMS327,EMS3
    293 070332  102545  102237  102115          .WORD   EMS511,EMS504,EMS501,0
    294 070342  075667  101022  072556  EMT207: .WORD   EMS54,EMS354,EMS3
    295 070350  102545  102115  000000          .WORD   EMS511,EMS501,0
    296 070356  075667  101022  101253  EMT210: .WORD   EMS54,EMS354,EMS364,EMS250
    297 070366  102545  102237  000000          .WORD   EMS511,EMS504,0
    298 070374  075667  101022  101253  EMT211: .WORD   EMS54,EMS354,EMS364,EMS255
    299 070404  102545  102237  000000          .WORD   EMS511,EMS504,0
    300 070412  100521  075744          EMT212: .WORD   EMS337,EMS55
    301 070416  102545  102237  000000          .WORD   EMS511,EMS504,0
    302 070424  076022  100447  100652  EMT213: .WORD   EMS56,EMS334,EMS345,EMS373,EMS262,EMS327,EMS251
    303 070442  102545  102115                  .WORD   EMS511,EMS501
    304 070446  076022  100457  000000          .WORD   EMS56,EMS335,0
    305 070454  100521  076022          EMT214: .WORD   EMS337,EMS56
    306 070460  102545  102115  000000          .WORD   EMS511,EMS501,0
    307 070466  076115  100433  100737  EMT215: .WORD   EMS57,EMS333,EMS350,EMS60,EMS334
    308 070500  102545  102115  000000          .WORD   EMS511,EMS501,0
    309 070506  101236  077635  072654  EMT216: .WORD   EMS363,EMS306,EMS5
    310 070514  102545  102115  000000          .WORD   EMS511,EMS501,0
    311 070522  101236  077635  076253  EMT217: .WORD   EMS363,EMS306,EMS61
    312 070530  102545  102115  000000          .WORD   EMS511,EMS501,0
    313 070536  076326  100433  101527  EMT220: .WORD   EMS62,EMS333,EMS375,EMS251
    314 070546  102545  102115  000000          .WORD   EMS511,EMS501,0
    315 070554  076326  100433  101543  EMT221: .WORD   EMS62,EMS333,EMS376,EMS262
    316 070564  102545  102115  000000          .WORD   EMS511,EMS501,0
    317 070572  076326  100433  101543  EMT222: .WORD   EMS62,EMS333,EMS376,EMS250
    318 070602  102545  102115  000000          .WORD   EMS511,EMS501,0
    319 070610  100700  076326  100546  EMT223: .WORD   EMS346,EMS62,EMS341,EMS603
    320 070620  102545  102115  000000          .WORD   EMS511,EMS501,0
    321 070626  100700  076407  101543  EMT224: .WORD   EMS346,EMS63,EMS376,EMS262
    322 070636  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
    323 070646  076407  100733  100737  EMT225: .WORD   EMS63,EMS333,EMS350,EMS363,EMS310,EMS262
    324 070662  102545  102115  000000          .WORD   EMS511,EMS501,0
    325 070670  076407  101117  074647  EMT226: .WORD   EMS63,EMS357,EMS36,EMS372
    326 070700  102545  102115  000000          .WORD   EMS511,EMS501,0
    327 070706  076407  101077  101141  EMT227: .WORD   EMS63,EMS356,EMS360,EMS15
    328 070716  102545  102115  000000          .WORD   EMS511,EMS501,0
    329 070724  076407  101077  101167  EMT230: .WORD   EMS63,EMS356,EMS361,EMS15
    330 070734  102545  102115  000000          .WORD   EMS511,EMS501,0
    331 070742  076407  101077  075006  EMT231: .WORD   EMS63,EMS356,EMS41
    332 070750  102545  102115  000000          .WORD   EMS511,EMS501,0
    333 070756  075006  101557  100555  EMT232: .WORD   EMS41,EMS377,EMS342,EMS365,EMS63,EMS332
    334 070772  102545  102115  000000          .WORD   EMS511,EMS501,0
    335 071000  101324  100776  101274  EMT233: .WORD   EMS367,EMS353,EMS365,EMS63,EMS401
    336 071012  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
    337 071022  073445  101557  101440  EMT234: .WORD   EMS16,EMS377,EMS372,EMS365,EMS64,EMS354,EMS3
    338 071040  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
    339 071050  077527  076517  077651  EMT235: .WORD   EMS300,EMS65,EMS307,EMS2
    340 071060  102545  102142  102212          .WORD   EMS511,EMS502,EMS503,0
    341 071070  076022  101557  101543  EMT236: .WORD   EMS56,EMS377,EMS376,EMS252,EMS372,EMS350
    342 071104  076517  101605                  .WORD   EMS65,EMS401
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ERROR MESSAGE TABLE

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343 071110  102545  102142  102212          .WORD   EMS511,EMS502,EMS503,EMS501,0
344 071122  077527  076560  077651  EMT237: .WORD   EMS300,EMS66,EMS307,EMS2
345 071132  102545  102115  102212          .WORD   EMS511,EMS501,EMS503,0
346 071142  073367  101570  101440  EMT240: .WORD   EMS15,EMS400,EMS372,EMS350,EMS66,EMS401
347 071156  102545  102212  102115          .WORD   EMS511,EMS503,EMS501,0
348 071166  076560  100502  100535  EMT241: .WORD   EMS66,EMS336,EMS340,EMS15,EMS406,EMS405,EMS604
349 071204  102545  102212  000000          .WORD   EMS511,EMS503,0
350 071212  101631  102776  101622  EMT242: .WORD   EMS403,EMS604,EMS402,EMS21,EMS377
351 071224  102545  102212                  .WORD   EMS511,EMS503
352 071230  074647  100457  000000          .WORD   EMS36,EMS335,0
353 071236  076560  100502  100535  EMT243: .WORD   EMS66,EMS336,EMS340,EMS26,EMS404,EMS405,EMS604
354 071254  102545  102212  000000          .WORD   EMS511,EMS503,0
355 071262  076407  101605  101711  EMT244: .WORD   EMS63,EMS401,EMS405,EMS604
356 071272  102545  102212  000000          .WORD   EMS511,EMS503,0
357 071300  074647  101374  101711  EMT245: .WORD   EMS36,EMS370,EMS405,EMS604
358 071310  102545  102212  000000          .WORD   EMS511,EMS503,0
359 071316  101631  102776  101622  EMT246: .WORD   EMS403,EMS604,EMS402,EMS24,EMS377
360 071330  102545  102212                  .WORD   EMS511,EMS503
361 071334  074647  100457  000000          .WORD   EMS36,EMS335,0
362 071342  076635  100415  101711  EMT247: .WORD   EMS67,EMS332,EMS405,EMS604
363 071352  102545  102212  000000          .WORD   EMS511,EMS503,0
364 071360  076560  100502  100535  EMT250: .WORD   EMS66,EMS336,EMS340,EMS15,EMS406,EMS405,EMS605
365 071376  102545  102212  000000          .WORD   EMS511,EMS503,0
366 071404  101631  103023  101622  EMT251: .WORD   EMS403,EMS605,EMS402,EMS21,EMS377
367 071416  102545  102212                  .WORD   EMS511,EMS503
368 071422  074647  100457  000000          .WORD   EMS36,EMS335,0
369 071430  076560  100502  100535  EMT252: .WORD   EMS66,EMS336,EMS340,EMS26,EMS404,EMS405,EMS605
370 071446  102545  102212  000000          .WORD   EMS511,EMS503,0
371 071454  076407  101605  101711  EMT253: .WORD   EMS63,EMS401,EMS405,EMS605
372 071464  102545  102212  000000          .WORD   EMS511,EMS503,0
373 071472  074647  101374  101711  EMT254: .WORD   EMS36,EMS370,EMS405,EMS605
374 071502  102545  102212  000000          .WORD   EMS511,EMS503,0
375 071510  101631  103023  101622  EMT255: .WORD   EMS403,EMS605,EMS402,EMS24,EMS377
376 071522  102545  102212                  .WORD   EMS511,EMS503
377 071526  074647  100457  000000          .WORD   EMS36,EMS335,0
378 071534  076635  100415  101711  EMT256: .WORD   EMS67,EMS332,EMS405,EMS605
379 071544  102545  102212  000000          .WORD   EMS511,EMS503,0
380 071552  076560  100502  100535  EMT257: .WORD   EMS66,EMS336,EMS340,EMS15,EMS406,EMS405,EMS606
381 071570  102545  102212  000000          .WORD   EMS511,EMS503,0
382 071576  101631  103041  101622  EMT260: .WORD   EMS403,EMS606,EMS402,EMS21,EMS377
383 071610  102545  102212                  .WORD   EMS511,EMS503
384 071614  074647  100457  000000          .WORD   EMS36,EMS335,0
385 071622  076560  100502  100535  EMT261: .WORD   EMS66,EMS336,EMS340,EMS26,EMS404,EMS405,EMS606
386 071640  102545  102212  000000          .WORD   EMS511,EMS503,0
387 071646  076407  101605  101711  EMT262: .WORD   EMS63,EMS401,EMS405,EMS606
388 071656  102545  102212  000000          .WORD   EMS511,EMS503,0
389 071664  074647  101374  101711  EMT263: .WORD   EMS36,EMS370,EMS405,EMS606
390 071674  102545  102212  000000          .WORD   EMS511,EMS503,0
391 071702  101631  103041  101622  EMT264: .WORD   EMS403,EMS606,EMS402,EMS24,EMS377
392 071714  102545  102212                  .WORD   EMS511,EMS503
393 071720  074647  100457  000000          .WORD   EMS36,EMS335,0
394 071726  076747  101605  101711  EMT265: .WORD   EMS70,EMS401,EMS405,EMS606
395 071736  102545  102212  000000          .WORD   EMS511,EMS503,0
396 071744  076635  100415  101711  EMT266: .WORD   EMS67,EMS332,EMS405,EMS606
397 071754  102545  102212  000000          .WORD   EMS511,EMS503,0
398 071762  076560  101077  101734  EMT267: .WORD   EMS66,EMS356,EMS407
399 071770  102545  102212  000000          .WORD   EMS511,EMS503,0
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ERROR MESSAGE TABLE

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400 071776  076560  100502  100535  EMT270: .WORD   EMS66,EMS336,EMS340,EMS15,EMS406,EMS405,EMS607
401 072014  102545  102212  000000          .WORD   EMS511,EMS503,0
402 072022  101631  103061  101622  EMT271: .WORD   EMS403,EMS607,EMS402,EMS21,EMS377
403 072034  102545  102212                  .WORD   EMS511,EMS503
404 072040  074251  100502  000000          .WORD   EMS27,EMS336,0
405 072046  074251  101374  101711  EMT272: .WORD   EMS27,EMS370,EMS405,EMS607
406 072056  102545  102212  000000          .WORD   EMS511,EMS503,0
407 072064  074251  101411  101711  EMT273: .WORD   EMS27,EMS371,EMS405,EMS607
408 072074  102545  102212  000000          .WORD   EMS511,EMS503,0
409 072102  074647  101672  101711  EMT274: .WORD   EMS36,EMS404,EMS405,EMS607
410 072112  102545  102212  000000          .WORD   EMS511,EMS503,0
411 072120  075626  101605  101711  EMT275: .WORD   EMS53,EMS401,EMS405,EMS607
412 072130  102545  102212  102142          .WORD   EMS511,EMS503,EMS502,0
413 072140  076635  100415  101711  EMT276: .WORD   EMS67,EMS332,EMS405,EMS607
414 072150  102545  102212  000000          .WORD   EMS511,EMS503,0
415 072156  076560  100502  100535  EMT277: .WORD   EMS66,EMS336,EMS340,EMS26,EMS404,EMS405,EMS607
416 072174  102545  102212  000000          .WORD   EMS511,EMS503,0
417 072202  101631  103061  101622  EMT300: .WORD   EMS403,EMS607,EMS402,EMS24,EMS377
418 072214  102545  102212                  .WORD   EMS511,EMS503
419 072220  074251  100502  000000          .WORD   EMS27,EMS336,0
420 072226  076747  101605  101711  EMT301: .WORD   EMS70,EMS401,EMS405,EMS607
421 072236  102545  102212  000000          .WORD   EMS511,EMS503,0
422 072244  077527  077246  100546  EMT302: .WORD   EMS300,EMS255,EMS341,EMS600
423 072254  102545  102237  000000          .WORD   EMS511,EMS504,0
```

ERROR MESSAGE TABLE

```
      1 072262  103077  000000          EHT1:    .WORD   EH1,0
      2 072266  103155  000000          EHT2:    .WORD   EH2,0
      3 072272  103172  000000          EHT5:    .WORD   EH5,0
      4 072276  103230  000000          EHT7:    .WORD   EH7,0
      5 072302  103247  000000          EHT57:   .WORD   EH57,0
      6 072306  103305  000000          EHT65:   .WORD   EH65,0
      7 072312  103361  000000          EHT71:   .WORD   EH71,0
      8 072316  103163  000000          EHT74:   .WORD   EH3,0
      9 072322  103436  000000          EHT115:  .WORD   EH115,0
     10 072326  103533  000000          EHT130:  .WORD   EH130,0
     11 072332  103651  000000          EHT132:  .WORD   EH132,0
     12 072336  103747  000000          EHT142:  .WORD   EH142,0
     13 072342  104045  000000          EHT145:  .WORD   EH145,0
     14 072346  104162  000000          EHT150:  .WORD   EH150,0
     15 072352  104260  000000          EHT213:  .WORD   EH213,0
     16 072356  104355  000000          EHT220:  .WORD   EH220,0
```

ERROR MESS..GE TABLE

```
     1 072362  104414                    EDT1:    .WORD   ED1
     2 072364  104424                    EDT2:    .WORD   ED2
     3 072366  104430                    EDT5:    .WORD   ED5
     4 072370  104436                    EDT57:   .WORD   ED57
     5 072372  104444                    EDT65:   .WORD   ED65
     6 072374  104454                    EDT71:   .WORD   ED71
     7 072376  104424                    EDT74:   .WORD   ED2
     8 072400  104464                    EDT115:  .WORD   ED115
     9 072402  104476                    EDT130:  .WORD   ED130
    10 072404  104464                    EDT132:  .WORD   ED115
    11 072406  104512                    EDT220:  .WORD   ED220
```

ERROR MESSAGE TABLE

```
      1 072410  104516                EFT1:    .WORD   EF1
      2 072412  104521                EFT2:    .WORD   EF2
      3 072414  104522                EFT5:    .WORD   EF5
      4 072416  104524                EFT57:   .WORD   EF57
      5 072420  104516                EFT65:   .WORD   EF1
      6 072422  104516                EFT71:   .WORD   EF1
      7 072424  104521                EFT74:   .WORD   EF2
      8 072426  104524                EFT115:  .WORD   EF57
      9 072430  104530                EFT130:  .WORD   EF130
     10 072432  104524                EFT132:  .WORD   EF57
     11 072434  104522                EFT220:  .WORD   EF5
```

ERROR MESSAGE STRINGS

```
                                .SBTTL  ERROR MESSAGE STRINGS
                        ;
072436  116  117  116  EMS1:   .ASCIZ  @NONEXISTENT DEVICE "NED" (RMCS2,BIT 12) @
072507  103  117  116  EMS2:   .ASCIZ  @CONTROLLER CLEAR "CLR" (RMCS2,BIT 05) @
072556  106  125  116  EMS3:   .ASCIZ  @FUNCTION CODE (RMCS1, BITS 01 - 05) @
072623  125  116  125  EMS4:   .ASCIZ  @UNUSED BIT POSITIONS OF @
072654  104  105  126  EMS5:   .ASCIZ  @DEVICE AVAILABLE "DVA" (RMCS1, BIT 11) @
072724  120  101  122  EMS6:   .ASCIZ  @PARTIY ERROR "PAR" (RMER1, BIT 03) @
072770  104  101  124  EMS7:   .ASCIZ  @DATA PARITY ERROR "DPE" (RMER2, BIT 03) @
073041  120  101  122  EMS10:  .ASCIZ  @PARITY TEST "PAT" (RMCS2, BIT 04) @
073104  115  101  123  EMS11:  .ASCII  @MASSBUS CONTROL BUS PARITY ERROR "MCPE" @
073154  050  122  115          .ASCIZ  @(RMCS1, BIT 13) @
073175  111  114  114  EMS12:  .ASCIZ  @ILLEGAL REGISTER ERROR "ILR" (RMER1, BIT 01) @
073253  104  111  101  EMS13:  .ASCIZ  @DIAGNOSTIC MODE "DMD" (RMMR1, BIT 00) @
073322  115  105  104  EMS14:  .ASCIZ  @MEDIUM ON LINE "MOL" (RMDS, BIT 12) @
073367  115  101  111  EMS15:  .ASCIZ  @MAINTENANCE UNIT READY "MUR" (RMMR1, BIT 09) @
073445  115  101  111  EMS16:  .ASCIZ  @MAINTENANCE WRITE PROTECT "MWP" (RMMR1, BIT 03) @
073526  127  122  111  EMS17:  .ASCIZ  @WRITE LOCK "WRL" (RMDS, BIT 11) @
073567  104  105  126  EMS20:  .ASCIZ  @DEVICE CHECK "DVC" (RMER2, BIT 07) @
073633  115  101  111  EMS21:  .ASCIZ  @MAINTENANCE DRIVE FAULT "MDF" (RMMR1, BIT 06) @
073712  125  116  123  EMS22:  .ASCIZ  @UNSAFE STATUS "UNS" (RMER1, BIT 14) @
073757  123  105  105  EMS23:  .ASCIZ  @SEEK INCOMPLETE STATUS "SKI" (RMER2, BIT 14) @
074035  115  101  111  EMS24:  .ASCIZ  @MAINTENANCE SEEK ERROR "MSER" (RMMR1, BIT 07) @
074114  120  117  123  EMS25:  .ASCIZ  @POSITIONING IN PROGRESS "PIP" (RMDS, BIT 13) @
074172  115  101  111  EMS26:  .ASCIZ  @MAINTENANCE ON CYLINDER "MOC" (RMMR1, BIT 08) @
074251  105  116  104  EMS27:  .ASCIZ  @END OF BLOCK "EBL" (RMMR1, BIT 13) @
074315  104  111  101  EMS30:  .ASCIZ  @DIAGNOSTIC END OF BLOCK "DEBL" (RMMR1, BIT 13) @
074375  114  101  123  EMS31:  .ASCIZ  @LAST SECTOR STATUS "LS" (RMMR1, BIT 02) @
074446  114  101  123  EMS32:  .ASCIZ  @LAST SECTOR/TRACK STATUS "LST" (RMMR1, BIT 01) @
074526  123  105  103  EMS33:  .ASCIZ  @SECTOR ADDRESS BITS OF @
074556  124  122  101  EMS34:  .ASCIZ  @TRACK ADDRESS BITS OF @
074605  126  117  114  EMS35:  .ASCIZ  @VOLUME VALID "VV" (RMDS, BIT 06) @
074647  107  117  040  EMS36:  .ASCIZ  @GO BIT (RMCS1, BIT 00) @
074677  103  131  114  EMS37:  .ASCIZ  @CYLINDER ADDRESS BIT OF @
074730  114  101  123  EMS40:  .ASCIZ  @LAST BLOCK TRANSFERRED, "LBT" (RMDS, BIT 10) @
075006  103  117  115  EMS41:  .ASCIZ  @COMPOSITE ERROR "ERR" (RMDS, BIT 14) @
075054  103  117  115  EMS42:  .ASCIZ  @COMMAND SEQUENCER TEST BIT "TST" (RMMR2, BIT 12) @
075136  104  122  111  EMS43:  .ASCIZ  @DRIVE READY STATUS "DRY" (RMDS, BIT 07) @
075207  103  117  116  EMS44:  .ASCIZ  @CONTINUE "CONT" (RMMR1, BIT 06) @
075250  111  116  126  EMS45:  .ASCIZ  @INVALID COMMAND ERROR "IVC" (RMER2, BIT 12) @
075325  114  117  123  EMS46:  .ASCIZ  @LOSS OF SYSTEM CLOCK ERROR "LSC" (RMER2, BIT 11) @
075407  117  103  103  EMS47:  .ASCIZ  @OCCUPIED "OCC" (RMMR1, BIT 15) @
075447  111  114  114  EMS50:  .ASCIZ  @ILLEGAL FUNCTION "ILF" (RMER1, BIT 0) @
075516  117  106  106  EMS51:  .ASCIZ  @OFFSET DIRECTION "OFD" (RMOF, BIT 07) @
075565  117  106  106  EMS52:  .ASCIZ  @OFFSET MODE "OM" (RMDS, BIT 00) @
075626  122  125  116  EMS53:  .ASCIZ  @RUN AND GO "RG" (RMMR1, BIT 14) @
075667  111  116  126  EMS54:  .ASCIZ  @INVALID ADDRESS ERROR "IAE" (RMER1, BIT 10) @
075744  101  104  104  EMS55:  .ASCIZ  @ADDRESS OVERFLOW ERROR "AOE" (RMER1, BIT 09) @
076022  122  105  107  EMS56:  .ASCII  @REGISTER MODIFICATION REFUSED ERROR @
076066  042  122  115          .ASCIZ  @"RMR" (RMER1, BIT 02) @
076115  104  122  111  EMS57:  .ASCIZ  @DRIVE REQUEST REQUIRED STATUS "DRQ" (RMDT, BIT 11) @
076201  120  122  117  EMS60:  .ASCIZ  @PROGRAMMABLE STATUS "PGM" (RMDS, BIT 09) @
076253  104  122  111  EMS61:  .ASCIZ  @DRIVE PRESENT STATUS "DPR" (RMDS, BIT 08) @
076326  120  117  122  EMS62:  .ASCIZ  @PORT REQUEST FLOP "RQA,RQB" (RMMR2, BITS 15,14) @
076407  101  124  124  EMS63:  .ASCIZ  @ATTENTION "ATA" (RMDS, BIT 15) @
076447  127  122  111  EMS64:  .ASCIZ  @WRITE LOCK ERROR "WLE" (RMER1, BIT 11) @
076517  105  130  103  EMS65:  .ASCIZ  @EXCEPTION "REX" (RMMR1, BIT 12) @
```

ERROR MESSAGE STRINGS

```
 58 076560  111  116  126  EMS66:  .ASCIZ  @INVALID COMMAND ERROR "IVC" (RMER2, BIT 12) @
 59 076635  124  101  107  EMS67:  .ASCIZ  @TAG BUS (RMMR2, BITS 00-09) OR TAG CONTROL @
 60 076711  114  111  116          .ASCIZ  @LINES (RMMR2, BITS 10,11,13) @
 61 076747  123  105  101  EMS70:  .ASCIZ  @SEARCH ENABLE "ESRC" (RMMR1, BIT 11) @
 62
 63 077015  104  111  123  EMS250: .ASCIZ  @DISK ADDRESS REGISTER (RMDA) @
 64 077053  103  117  116  EMS251: .ASCIZ  @CONTROL STATUS REGISTER #1 (RMCS1) @
 65 077117  105  122  122  EMS252: .ASCIZ  @ERROR REGISTER #1 (RMER1) @
 66 077152  105  122  122  EMS253: .ASCIZ  @ERROR REGISTER #2 (RMER2) @
 67 077205  115  101  111  EMS254: .ASCIZ  @MAINTENANCE REGISTER #1 (RMMR1) @
 68 077246  104  105  123  EMS255: .ASCIZ  @DESIRED CYLINDER REGISTER (RMDC) @
 69 077310  117  106  106  EMS2_6: .ASCIZ  @OFFSET REGISTER (RMOF) @
 70 077340  104  122  111  EMS257: .ASCIZ  @DRIVE TYPE REGISTER (RMDT) @
 71 077374  110  117  114  EMS260: .ASCIZ  @HOLDING REGISTER (RMHR) @
 72 077425  123  105  122  EMS261: .ASCIZ  @SERIAL NUMBER REGISTER (RMSN) @
 73 077464  101  124  124  EMS262: .ASCIZ  @ATTENTION SUMMARY REGISTER (RMAS) @
 74
 75 077527  103  101  116  EMS300: .ASCIZ  @CANNCT CLEAR @
 76 077545  103  101  116  EMS301: .ASCIZ  @CANNOT WRITE/READ @
 77 077570  101  116  131  EMS302: .ASCIZ  @ANY DEVICE REGISTER @
 78 077615  127  111  124  EMS303: .ASCIZ  @WITHOUT @
 79 077626  105  122  122  EMS304: .ASCIZ  @ERROR @
 80 077635  101  040  117  EMS306: .ASCIZ  @A ONE FROM @
 81 077651  125  123  111  EMS307: .ASCIZ  @USING MASSBUS INITIALIZE, I.E., @
 82 077712  101  040  132  EMS310: .ASCIZ  @A ZERO FROM @
 83 077727  105  126  105  EMS311: .ASCIZ  @EVERY DEVICE REGISTER BIT POSITION @
 84 077773  124  110  105  EMS312: .ASCIZ  @THE FOLLOWING BITS ARE STUCK @
 85 100031  101  040  123  EMS313: .ASCIZ  @A SHIFTING ONE BIT FROM @
 86 100062  101  120  120  EMS314: .ASCIZ  @APPEARS STUCK AT ZERO @
 87 100111  101  120  120  EMS315: .ASCIZ  @APPEARS STUCK AT ONE @
 88 100137  122  105  107  EMS316: .ASCIZ  @REGISTER SELECT @
 89 100160  061  040  050  EMS317: .ASCIZ  @1 (1,2,4,8,16) @
 90 100200  062  040  050  EMS320: .ASCIZ  @2 (1,2,4,8,16) @
 91 100220  064  040  050  EMS321: .ASCIZ  @4 (1,2,4,8,16) @
 92 100240  070  040  050  EMS322: .ASCIZ  @8 (1,2,4,8,16) @
 93 100260  101  114  114  EMS323: .ASCIZ  @ALL ONES FROM @
 94 100277  101  114  114  EMS324: .ASCIZ  @ALL ZEROS FROM @
 95 100317  101  124  040  EMS325: .ASCIZ  @AT ZERO @
 96 100330  101  124  040  EMS326: .ASCIZ  @AT ONE @
 97 100340  054  040  117  EMS327: .ASCIZ  @, OR @
 98 100346  015  012  103  EMS330: .ASCIZ  <CR><LF>@CS MBA CLRL @
 99 100355  103  101  116  EMS331: .ASCIZ  @CANNOT READ ZEROS FROM @
100 100415  111  123  040  EMS332: .ASCIZ  @IS INCORRECT @
101 100433  111  123  040  EMS333: .ASCIZ  @IS NOT SET @
102 100447  111  123  040  EMS334: .ASCIZ  @IS SET @
103 100457  123  110  117  EMS335: .ASCIZ  @SHOULD NOT BE SET @
104 100502  123  110  117  EMS336: .ASCIZ  @SHOULD BE SET @
105 100521  103  101  116  EMS337: .ASCIZ  @CANNOT SET @
106 100535  102  105  103  EMS340: .ASCIZ  @BECAUSE @
107 100546  125  123  111  EMS341: .ASCIZ  @USING @
108 100555  104  125  122  EMS342: .ASCIZ  @DURING REGISTER TRANSFER @
109 100607  125  116  105  EMS343: .ASCIZ  @UNEXPECTED @
110 100623  102  125  123  EMS344: .ASCIZ  @BUS TIMEOUT (04 TRAP) @
111 100652  102  131  040  EMS345: .ASCIZ  @BY REGISTER TRANSFER @
112 100700  103  101  116  EMS346: .ASCIZ  @CANNOT RESET @
113 100716  127  111  124  EMS347: .ASCIZ  @WITHOUT SETTING @
114 100737  102  125  124  EMS350: .ASCIZ  @BUT @
```

ERROR MESSAGE STRINGS

```
    115 100744      127     101     123  EMS351: .ASCIZ  @WAS RESET BY @
    116 100762      127     101     123  EMS352: .ASCIZ  @WAS SET BY @
    117 100776      111     116     040  EMS353: .ASCIZ  @IN DIAGNOSTIC MODE @
    118 101022      111     123     040  EMS354: .ASCIZ  @IS INCORRECT ACCORDING TO @
    119 101055      103     101     116  EMS355: .ASCIZ  @CANNOT INCREMENT @
    120 101077      127     101     123  EMS356: .ASCIZ  @WAS NOT SET BY @
    121 101117      127     101     123  EMS357: .ASCIZ  @WAS NOT RESET BY @
    122 101141      060     040     124  EMS360: .ASCIZ  @0 TO 1 TRANSITION OF @
    123 101167      061     040     124  EMS361: .ASCIZ  @1 TO 0 TRANSITION OF @
    124 101215      111     123     040  EMS362: .ASCIZ  @IS INCONSISTENT @
    125 101236      103     101     116  EMS363: .ASCIZ  @CANNOT READ @
    126 101253      124     105     123  EMS364: .ASCIZ  @TEST PATTERN IN @
    127 101274      101     116     104  EMS365: .ASCIZ  @AND @
    128 101301      103     101     116  EMS366: .ASCIZ  @CANNOT INITIALIZE @
    129 101324      124     110     105  EMS367: .ASCIZ  @THE COMMAND SEQUENCER HAS BEEN CLOCKED @
    130 101374      122     105     123  EMS370: .ASCIZ  @RESET EARLY @
    131 101411      104     111     104  EMS371: .ASCIZ  @DID NOT RESET ON TIME @
    132 101440      104     125     122  EMS372: .ASCIZ  @DURING COMMAND EXECUTION @
    133 101472      124     117     040  EMS373: .ASCIZ  @TO @
    134 101476      127     111     124  EMS374: .ASCIZ  @WITH ANY COMBINATION OF @
    135 101527      102     131     040  EMS375: .ASCIZ  @BY READING @
    136 101543      102     131     040  EMS376: .ASCIZ  @BY WRITING @
    137 101557      127     101     123  EMS377: .ASCIZ  @WAS SET @
    138 101570      127     101     123  EMS400: .ASCIZ  @WAS NOT SET @
    139 101605      104     111     104  EMS401: .ASCIZ  @DID NOT SET @
    140 101622      127     110     111  EMS402: .ASCIZ  @WHILE @
    141 101631      103     117     115  EMS403: .ASCIZ  @COMMAND SEQUENCER DID NOT ABORT @
    142 101672      127     101     123  EMS404: .ASCIZ  @WAS NOT RESET @
    143 101711      104     125     122  EMS405: .ASCIZ  @DURING @
    144 101721      127     101     123  EMS406: .ASCIZ  @WAS RESET @
    145 101734      123     105     101  EMS407: .ASCIZ  @SEARCH TIMEOUT @
    146
    147 101754      011     104     105  EMS500: .ASCII  @       DEVICE IS NON-EXISTENT,@<CR><LF>
    148 102006      011     104     105          .ASCII  @       DEVICE IS SWITCHED TO OTHER PORT@<CR><LF>
    149 102051      011     124     122          .ASCIZ  @       TRANSCEIVER ENABLE SWITCH IS OFF@<CR><LF>
    150 102115      011     111     106  EMS501: .ASCIZ  @       IF MODULE, M7686,@<CR><LF>
    151 102142      011     115     101  EMS502: .ASCIZ  @       MASSBUS TRANSCEIVER, M5922 OR M5923     @<CR><LF>
    152 102212      011     103     123  EMS503: .ASCIZ  @       CS MODULE, M7684,@<CR><LF>
    153 102237      011     104     123  EMS504: .ASCIZ  @       DS MODULE, M8685/M7685,@<CR><LF>
    154 102272      011     104     105  EMS505: .ASCIZ  @       DEVICE IS SWITCHED TO A/B PORT POSITION@<CR><LF>
    155 102345      011     104     105  EMS506: .ASCIZ  @       DEVICE IS NOT AN RM80, OR@<CR><LF>
    156 102402      011     104     105  EMS507: .ASCIZ  @       DEVICE IS SWITCHED TO PROGRAMMABLE PORT POSITION, OR@<CR><LF>
    157 102472      011     101     123  EMS510: .ASCIZ  @       ASSUMING THE RH CONTROLLER HAS NO FAULT@<CR><LF>
    158 102545      015     012     011  EMS511: .ASCII          <CR><LF>@       PROBABLE FAULT(S):@<CR><LF>
    159 102574      011     050     116          .ASCIZ  @       (NOT INCLUDING CABLES OR CONNECTORS)@<CR><LF>
    160
    161 102644      122     105     101  EMS600: .ASCIZ  @READ IN PRESET COMMAND @
    162 102674      117     106     106  EMS601: .ASCIZ  @OFFSET COMMAND @
    163 102714      122     105     124  EMS602: .ASCIZ  @RETURN TO CENTER CENTER COMMAND @
    164 102755      122     105     114  EMS603: .ASCIZ  @RELEASE COMMAND @
    165 102776      122     105     103  EMS604: .ASCIZ  @RECALIBRATE COMMAND @
    166 103023      123     105     105  EMS605: .ASCIZ  @SEEK COMMAND @
    167 103041      123     105     101  EMS606: .ASCIZ  @SEARCH COMMAND @
    168 103061      104     101     124  EMS607: .ASCIZ  @DATA COMMAND @
```

ERROR MESSAGE STRINGS

```
      1 103077     105     130     120  EH1:    .ASCII  @EXPCTD  RECEVD  REGSTR@<CRLF>
      2 103126     123     124     101          .ASCIZ  @STATUS  STATUS  ADRESS@
      3 103155     040     102     101  EH2:    .ASCII  @ BASE@<CRLF>
      4 103163     101     104     122  EH3:    .ASCIZ  @ADRESS@
      5 103172     105     130     120  EH5:    .ASCII  @EXPCTD   STUCK@<CRLF>
      6 103211     122     105     123          .ASCIZ  @RESULT  BIT(S)@
      7 103230     105     130     120  EH7:    .ASCIZ  @EXPCTD  RECEVD@
      8 103247     122     105     103  EH57:   .ASCII  @RECEVD  DRVTYP@<CRLF>
      9 103266     104     122     126          .ASCIZ  @DRVTYP  REGADR@
     10 103305     105     130     120  EH65:   .ASCII  @EXPCTD  RECEVD  TEST@<CRLF>
     11 103332     123     124     101          .ASCIZ  @STATUS  STATUS  REGSTR@
     12 103361     105     130     120  EH71:   .ASCII  @EXPCTD  RECEVD   TEST@<CRLF>
     13 103407     123     124     101          .ASCIZ  @STATUS  STATUS  PATTRN@
     14 103436     105     130     120  EH115:  .ASCII  @EXPCTD  RECEVD  REGSTR   TEST@<CRLF>
     15 103474     123     124     101          .ASCIZ  @STATUS  STATUS  ADRESS  PATTRN@
     16 103533     105     130     120  EH130:  .ASCII  @EXPCTD  RECEVD  REGSTR   TEST   OFFSET@<CRLF>
     17 103602     123     124     101          .ASCIZ  @STATUS  STATUS  ADRESS  PATTRN  REGSTR@
     18 103651     105     130     120  EH132:  .ASCII  @EXPCTD  ACTUAL  REGSTR  OFFSET@<CRLF>
     19 103710     103     117     125          .ASCIZ  @COUNT   COUNT   ADRESS  REGSTR@
     20 103747     105     130     120  EH142:  .ASCII  @EXPCTD  RECEVD  REGSTR  OFFSET@<CRLF>
     21 104006     123     124     101          .ASCIZ  @STATUS  STATUS  ADRESS  REGSTR@
     22 104045     105     130     120  EH145:  .ASCII  @EXPCTD  ACTUAL  REGSTR  RMER1   RMER2@<CRLF>
     23 104113     103     115     120          .ASCIZ  @CMPERR  CMPERR  ADRESS  PATTRN  PATTRN@
     24
     25 104162     105     130     120  EH150:  .ASCII  @EXPCTD  ACTUAL  REGSTR FUNCTION@<CRLF>
     26 104222     122     105     123          .ASCIZ  @RESULT  RESULT  ADRESS   CODE@
     27 104260     105     130     120  EH213:  .ASCII  @EXPCTD  ACTUAL  STATUS   TEST@<CRLF>
     28 104316     122     105     123          .ASCIZ  @RESULT  RESULT  ADRESS  REGSTR@
     29 104355     101     103     124  EH220:  .ASCII  @ACTUAL  REGSTR@<CRLF>
     30 104374     122     105     123          .ASCIZ  @RESULT  ADRESS@
     31                                  .EVEN
```

ERROR MESSAGE STRINGS

```
      1 104414  001140  001142  001136  ED1:    .WORD   $GDDAT,$BDDAT,$BDADR,0
      2 104424  001136  000000          ED2:    .WORD   $BDADR,0
      3 104430  001140  001142  000000  ED5:    .WORD   $GDDAT,$BDDAT,0
      4 104436  001142  001136  000000  ED57:   .WORD   $BDDAT,$BDADR,0
      5 104444  001140  001142  001174  ED65:   .WORD   $GDDAT,$BDDAT,$TMP0,0
      6 104454  001140  001142  001450  ED71:   .WORD   $GDDAT,$BDDAT,RMHR0,0
      7 104464  001140  001142  001136  ED115:  .WORD   $GDDAT,$BDDAT,$BDADR,$TMP0,0
      8 104476  001140  001142  001136  ED130:  .WORD   $GDDAT,$BDDAT,$BDADR,$TMP0,$TMP1,0
      9 104512  001142  001136          ED220:  .WORD   $BDDAT,$BDADR
     10
     11 104516     000     000     000  EF1:    .BYTE   0,0,0
     12 104521     000                  EF2:    .BYTE   0
     13 104522     000     000          EF5:    .BYTE   0,0
     14 104524     000     000     000  EF57:   .BYTE   0,0,0,0
     15 104530     000     000     000  EF130:  .BYTE   0,0,0,0,0
     16                                 .EVEN
```

ERROR MESSAGE STRINGS

```
                                BUFFER:
                                BUFONE: .BLKW   258.
                                BUFTWO: .BLKW   258.

                104536          .=BUFFER

                                HELP:
104536  200                     .ASCII  <CRLF>
104537  200                     .ASCII  <CRLF>
104540  114     111     123     .ASCII  @LIST OF TESTS@<CRLF>
104556  055     055     055     .ASCII  @------------@<CRLF>
104574  124     061     011     .ASCII  @T1     TRANSFER TEST@<CRLF>
104615  124     062     011     .ASCII  @T2     CTOD TEST@<CRLF>
104632  124     063     011     .ASCII  @T3     MASSBUS INITIALIZE TEST@<CRLF>
104665  124     064     011     .ASCII  @T4     CLEAR STUCK ACTIVE TEST@<CRLF>
104720  124     065     011     .ASCII  @T5     TRISTATE TRANSFER TEST@<CRLF>
104752  124     066     011     .ASCII  @T6     REGISTER SELECT TEST@<CRLF>
105002  124     067     011     .ASCII  @T7     DRIVE TYPE TEST@<CRLF>
105025  124     061     060     .ASCII  @T10    DEVICE AVAILABLE TEST@<CRLF>
105057  124     061     061     .ASCII  @T11    HOLDING REGISTER TRANSFER TEST@<CRLF>
105122  124     061     062     .ASCII  @T12    CONTROL STATUS #1 TRANSFER TEST@<CRLF>
105166  124     061     063     .ASCII  @T13    ERROR REGISTER #1 TRANSFER TEST@<CRLF>
105232  124     061     064     .ASCII  @T14    CLEAR OFFSET STUCK ACTIVE TEST@<CRLF>
105275  124     061     065     .ASCII  @T15    OFFSET REGISTER TRANSFER TEST@<CRLF>
105337  124     061     066     .ASCII  @T16    ERROR REGISTER #2 TRANSFER TEST@<CRLF>
105403  124     061     067     .ASCII  @T17    SERIAL NUMBER TEST@<CRLF>
105432  124     062     060     .ASCII  @T20    CONTROL BUS PARITY DETECTION TEST@<CRLF>
105500  124     062     061     .ASCII  @T21    CONTROL BUS PARITY GENERATION TEST@<CRLF>
105547  124     062     062     .ASCII  @T22    RMDA,RMDC FAULT TEST@<CRLF>
105600  124     062     063     .ASCII  @T23    DISK ADDRESS TRANSFER TEST@<CRLF>
105637  124     062     064     .ASCII  @T24    DESIRED CYLINDER TRANSFER TEST@<CRLF>
105702  124     062     065     .ASCII  @T25    ILLEGAL REGISTER TEST@<CRLF>
105734  124     062     066     .ASCII  @T26    RESET GO BY INIT TEST@<CRLF>
105766  124     062     067     .ASCII  @T27    DIAGNOSTIC MODE TEST@<CRLF>
106017  124     063     060     .ASCII  @T30    MOL TEST@<CRLF>
106034  124     063     061     .ASCII  @T31    WRITE LOCK TEST@<CRLF>
106060  124     063     062     .ASCII  @T32    DRIVE FAULT TEST@<CRLF>
106105  124     063     063     .ASCII  @T33    SEEK ERROR TEST@<CRLF>
106131  124     063     064     .ASCII  @T34    PIP TEST@<CRLF>
106146  124     063     065     .ASCII  @T35    EBL TEST@<CRLF>
106163  124     063     066     .ASCII  @T36    LAST SECTOR, LAST TRACK TEST@<CRLF>
106224  124     063     067     .ASCII  @T37    RMDA COUNT TEST@<CRLF>
106250  124     064     060     .ASCII  @T40    RMDC COUNT TEST@<CRLF>
106274  124     064     061     .ASCII  @T41    LBT TEST@<CRLF>
106311  124     064     062     .ASCII  @T42    COMPOSITE ERROR TEST@<CRLF>
106342  124     064     063     .ASCII  @T43    WRITE GO TEST@<CRLF>
106364  124     064     064     .ASCII  @T44    BRANCH MULTIPLEXOR TEST@<CRLF>
106420  124     064     065     .ASCII  @T45    SET/RESET GO TEST@<CRLF>
106446  124     064     066     .ASCII  @T46    END 1 RESET GO TEST@<CRLF>
106476  124     064     067     .ASCII  @T47    SET PULSE TEST@<CRLF>
106521  124     065     060     .ASCII  @T50    SET/RESET IVC TEST@<CRLF>
106550  124     065     061     .ASCII  @T51    SET LSC TEST@<CRLF>
106571  124     065     062     .ASCII  @T52    DECODE TEST@<CRLF>
106611  124     065     063     .ASCII  @T53    SET/RESET VOLUME VALID TEST@<CRLF>
106651  124     065     064     .ASCII  @T54    ILLEGAL FUNCTION TEST@<CRLF>
106703  124     065     065     .ASCII  @T55    OCCUPIED TEST@<CRLF>
106725  124     065     066     .ASCII  @T56    READ IN PRESET TEST@<CRLF>
```

ERROR MESSAGE STRINGS

```
 58 106755  124  065  067  .ASCII  @T57   RIP/RMOF TEST@<CRLF>
 59 106777  124  066  060  .ASCII  @T60   RMDA/RMDC/RIP TEST@<CRLF>
 60 107026  124  066  061  .ASCII  @T61   OFFSET COMMAND TEST@<CRLF>
 61 107056  124  066  062  .ASCII  @T62   RETURN TO CENTER TEST@<CRLF>
 62 107110  124  066  063  .ASCII  @T63   RMDC CLEAR OFFSET TEST@<CRLF>
 63 107143  124  066  064  .ASCII  @T64   EBL CLEAR OFFSET TEST@<CRLF>
 64 107175  124  066  065  .ASCII  @T65   RUN AND GO TEST@<CRLF>
 65 107221  124  066  066  .ASCII  @T66   SET IAE TEST@<CRLF>
 66 107242  124  066  067  .ASCII  @T67   SEARCH, SEEK, READ, WRITE TEST@<CRLF>
 67 107305  124  067  060  .ASCII  @T70   INVALID TRACK/SECTOR TEST@<CRLF>
 68 107343  124  067  061  .ASCII  @T71   INVALID CYLINDER TEST@<CRLF>
 69 107375  124  067  062  .ASCII  @T72   SET AOE TEST@<CRLF>
 70 107416  124  067  063  .ASCII  @T73   SET RMR TEST@<CRLF>
 71 107437  124  067  064  .ASCII  @T74   PGM STATUS CHECK@<CRLF>
 72 107464  124  067  065  .ASCII  @T75   DVA/DPR STATUS CHECK@<CRLF>
 73 107515  124  067  066  .ASCII  @T76   PORT REQUEST TEST, PART 1@<CRLF>
 74 107553  124  067  067  .ASCII  @T77   PORT REQUEST TEST, PART 2@<CRLF>
 75 107611  124  061  060  .ASCII  @T100  PORT REQUEST TEST, PART 3@<CRLF>
 76 107650  124  061  060  .ASCII  @T101  RELEASE TEST@<CRLF>
 77 107672  124  061  060  .ASCII  @T102  WRITE ATA TEST@<CRLF>
 78 107716  124  061  060  .ASCII  @T103  RESET ATA BY GO TEST@<CRLF>
 79 107750  124  061  060  .ASCII  @T104  UNIT READY ATA TEST@<CRLF>
 80 110001  124  061  060  .ASCII  @T105  ERROR ATA TEST@<CRLF>
 81 110025  124  061  060  .ASCII  @T106  REGISTER TRANSFER ATA TEST@<CRLF>
 82 110065  124  061  060  .ASCII  @T107  P SET ATA TEST@<CRLF>
 83 110111  124  061  061  .ASCII  @T110  SET WLE TEST@<CRLF>
 84 110133  124  061  061  .ASCII  @T111  EXCEPTION TEST@<CRLF>
 85 110157  124  061  061  .ASCII  @T112  RECALIBRATE TEST@<CRLF>
 86 110205  124  061  061  .ASCII  @T113  SEEK TEST@<CRLF>
 87 110224  124  061  061  .ASCII  @T114  SEARCH TEST@<CRLF>
 88 110245  124  061  061  .ASCII  @T115  SEARCH TIMEOUT TEST@<CRLF>
 89 110276  124  061  061  .ASCII  @T116  DATA COMMAND TESTS (1)@<CRLF>
 90 110332  124  061  061  .ASCII  @T117  DATA COMMAND TESTS (2)@<CRLF>
 91 110366  124  061  062  .ASCII  @T120  DATA COMMAND TESTS (3)@<CRLF>
 92 110422  200              .ASCII  <CRLF>
 93 110423  117  120  105  .ASCII  @OPERATIONAL SWITCH SETTINGS@<CRLF>
 94 110457  055  055  055  .ASCII  @--------------------------@<CRLF>
 95 110513  123  127  111  .ASCII  @SWITCH                    USE@<CRLF>
 96 110530  055  055  055  .ASCII  @------          --------------------@<CRLF>
 97 110565  040  040  061  .ASCII  @  15           HALT ON ERROR@<CRLF>
 98 110611  040  040  061  .ASCII  @  14           LOOP ON TEST@<CRLF>
 99 110634  040  040  061  .ASCII  @  13           INHIBIT ERROR TYPEOUTS@<CRLF>
100 110671  040  040  061  .ASCII  @  12           @<CRLF>
101 110700  040  040  061  .ASCII  @  11           INHIBIT ITERATIONS@<CRLF>
102 110731  040  040  061  .ASCII  @  10           BELL ON ERROR@<CRLF>
103 110755  040  040  040  .ASCII  @   9           LOOP ON ERROR@<CRLF>
104 111001  040  040  040  .ASCII  @   8           LOOP ON TEST IN SWR<7:0>@<CRLF>
105 111040  040  040  040  .ASCII  @   7           TN128@<CRLF>
106 111054  040  040  040  .ASCII  @   6           TN64@<CRLF>
107 111067  040  040  040  .ASCII  @   5           TN32@<CRLF>
108 111102  040  040  040  .ASCII  @   4           TN16@<CRLF>
109 111115  040  040  040  .ASCII  @   3           TN8@<CRLF>
110 111127  040  040  040  .ASCII  @   2           TN4@<CRLF>
111 111141  040  040  040  .ASCII  @   1           TN2@<CRLF>
112 111153  040  040  040  .ASCIZ  @   0           TN1@<CRLF>
113
114         000200           .END    200
```

SYMBOL TABLE

```
ABASE = 176700          AUTSIZ  001326        CHRCNT  060527        ED1     104414        EH71    103361
ACDW1 = 000000          AVECT1= 120254        CKSWR = 104410        ED115   104464        EMS1    072436
ACDW2 = 000000          AVECT2= 000000        CLOCK   001536        ED130   104476        EMS10   073041
ACPUOP= 000000          A16   = 000400        CLR   = 000040        ED2     104424        EMS11   073104
ADDW0 = 000000          A17   = 001000        CMNSTA  006612        ED220   104512        EMS12   073175
ADDW1 = 000000          BADTMO  004562        CNSL01  063115        ED5     104430        EMS13   073253
ADDW10= 000000          BAI   = 000010        CNSL02  063125        ED57    104436        EMS14   073322
ADDW11= 000000          BB00  = 000001        CNSL03  063167        ED65    104444        EMS15   073367
ADDW12= 000000          BB01  = 000002        CNSL04  063176        ED71    104454        EMS16   073445
ADDW13= 000000          BB02  = 000004        CNSL07  063232        EECC  = 000020        EMS17   073526
ADDW14= 000000          BB03  = 000010        CNSL08  063374        EFT1    072410        EMS2    072507
ADDW15= 000000          BB04  = 000020        CNSL09  063375        EFT115  072426        EMS20   073567
ADDW2 = 000000          BB05  = 000040        CNTCLR  055156        EFT130  072430        EMS21   073633
ADDW3 = 000000          BB06  = 000100        COMMA   063061        EFT132  072432        EMS22   073712
ADDW4 = 000000          BB07  = 000200        CONT  = 000100        EFT2    072412        EMS23   073757
ADDW5 = 000000          BB08  = 000400        CPSAVE  057700        EFT220  072434        EMS24   074035
ADDW6 = 000000          BB09  = 001000        CR    = 000015        EFT5    072414        EMS25   074114
ADDW7 = 000000          BIT0  = 000001        CRLF  = 000200        EFT57   072416        EMS250  077015
ADDW8 = 000000          BIT00 = 000001        CYLMSK= 001777        EFT65   072420        EMS251  077053
ADDW9 = 000000          BIT01 = 000002        DBCK  = 100000        EFT71   072422        EMS252  077117
ADEVCT= 000000          BIT02 = 000004        DBEN  = 040000        EFT74   072424        EMS253  077152
ADEVM = 000000          BIT03 = 000010        DBL   = 002000        EF1     104516        EMS254  077205
ADR   = 000001          BIT04 = 000020        DCK   = 100000        EF130   104530        EMS255  077246
AENV  = 000000          BIT05 = 000040        DDISP = 177570        EF2     104521        EMS256  077310
AENVM = 000000          BIT06 = 000100        DEBL  = 020000        EF5     104522        EMS257  077340
AFATAL= 000000          BIT07 = 000200        DISPLA  001156        EF57    104524        EMS26   074172
ALL     063050          BIT08 = 000400        DISPRE  000174        EHT1    072262        EMS260  077374
AMADR1= 000000          BIT09 = 001000        DLT   = 100000        EHT115  072322        EMS261  077425
AMADR2= 000000          BIT1  = 000002        DMD   = 000001        EHT130  072326        EMS262  077464
AMADR3= 000000          BIT10 = 002000        DPE   = 000010        EHT132  072332        EMS27   074251
AMADR4= 000000          BIT11 = 004000        DPEHI = 040000        EHT142  072336        EMS3    072556
AMAMS1= 000000          BIT12 = 010000        DPELO = 020000        EHT145  072342        EMS30   074315
AMAMS2= 000000          BIT13 = 020000        DPR   = 000400        EHT150  072346        EMS300  077527
AMAMS3= 000000          BIT14 = 040000        DRIVES  063416        EHT2    072266        EMS301  077545
AMAMS4= 000000          BIT15 = 100000        DRQ   = 004000        EHT213  072352        EMS302  077570
AMSGAD= 000000          BIT2  = 000004        DRVCLR= 000010        EHT220  072356        EMS303  077615
AMSGLG= 000000          BIT3  = 00001C        DRY   = 000200        EHT5    072272        EMS304  077626
AMSGTY= 000000          BIT4  = 000020        DSWR  = 177570        EHT57   072302        EMS306  077635
AMTYP1= 000000          BIT5  = 000040        DTE   = 010000        EHT65   072306        EMS307  077651
AMTYP2= 000000          BIT6  = 000100        DULPRT= 024026        EHT7    072276        EMS31   074375
AMTYP3= 000000          BIT7  = 000200        DVA   = 004000        EHT71   072312        EMS310  077712
AMTYP4= 000000          BIT8  = 000400        DVC   = 000200        EHT74   072316        EMS311  077727
AOE   = 001000          BIT9  = 001000        EBL   = 020000        EH1     103077        EMS312  077773
APASS = 000000          BLNKS1  063635        ECH   = 000100        EH115   103436        EMS313  100031
APE   = 100000          BLNKS2  063634        ECI   = 004000        EH130   103533        EMS314  100062
APRIOR= 000000          BLNKS3  063633        ECRC  = 001000        EH132   103651        EMS315  100111
APTCSU= 000040          BLNKS4  063632        EDT1    072362        EH142   103747        EMS316  100137
APTENV= 000001          BOTADR  060524        EDT115  072400        EH145   104045        EMS317  100160
APTSIZ= 000200          BOTFLG  060526        EDT130  072402        EH150   104162        EMS32   074446
APTSPO= 000100          BPTVEC= 000014        EDT132  072404        EH2     103155        EMS320  100200
ASWREG= 000000          BSE   = 100000        EDT2    072364        EH213   104260        EMS321  100220
ATA   = 100000          BUFFER  104536        EDT220  072406        EH220   104355        EMS322  100240
ATESTN= 000000          BUFONE  104536        EDT5    072366        EH3     103163        EMS323  100260
ATNMSK= 000377          BUFTWO  105542        EDT57   072370        EH5     103172        EMS324  100277
ATNTBL  063740          CC    = 004000        EDT65   072372        EH57    103247        EMS325  100317
AUNIT = 000000          CH    = 002000        EDT71   072374        EH65    103305        EMS326  100330
AUSWR = 000000          CHGADR  001330        EDT74   072376        EH7     103230        EMS327  100340
```

SYMBOL TABLE

EMS33	074526	EMS43	075136	EMT112	066452	EMT175	070116	EMT257	071552		
EMS330	100346	EMS44	075207	EMT113	066472	EMT176	070136	EMT26	065074		
EMS331	100365	EMS45	075250	EMT114	066516	EMT177	070154	EMT260	071576		
EMS332	100415	EMS46	075325	EMT115	066540	EMT2	064404	EMT261	071622		
EMS333	100433	EMS47	075407	EMT116	066564	EMT20	064744	EMT262	071646		
EMS334	100447	EMS5	072654	EMT117	066604	EMT200	070156	EMT263	071664		
EMS335	100457	EMS50	075447	EMT12	064620	EMT201	070174	EMT264	071702		
EMS336	100502	EMS500	101754	EMT120	066624	EMT202	070212	EMT265	071726		
EMS337	100521	EMS501	102115	EMT121	066650	EMT203	070230	EMT266	071744		
EMS34	074556	EMS502	102142	EMT122	066670	EMT204	070252	EMT267	071762		
EMS340	100535	EMS503	102212	EMT123	066710	EMT205	070272	EMT27	065126		
EMS341	100546	EMS504	102237	EMT124	066734	EMT206	070312	EMT270	071776		
EMS342	100555	EMS505	102272	EMT125	066752	EMT207	070342	EMT271	072022		
EMS343	100607	EMS506	102345	EMT126	066772	EMT21	064764	EMT272	072046		
EMS344	100623	EMS507	102402	EMT127	067010	EMT210	070356	EMT273	072064		
EMS345	100652	EMS51	075516	EMT13	064636	EMT211	070374	EMT274	072102		
EMS346	100700	EMS510	102472	EMT130	067034	EMT212	070412	EMT275	072120		
EMS347	100716	EMS511	102545	EMT131	067052	EMT213	070424	EMT276	072140		
EMS35	074605	EMS52	075565	EMT132	067070	EMT214	070454	EMT277	072156		
EMS350	100737	EMS53	075626	EMT133	067110	EMT215	070466	EMT3	064432		
EMS351	100744	EMS54	075667	EMT134	067130	EMT216	070506	EMT30	065140		
EMS352	100762	EMS55	075744	EMT135	067144	EMT217	070522	EMT300	072202		
EMS353	100776	EMS56	076022	EMT136	067162	EMT22	065004	EMT301	072226		
EMS354	101022	EMS57	076115	EMT137	067174	EMT220	070536	EMT302	072244		
EMS355	101055	EMS6	072724	EMT14	064654	EMT221	070554	EMT31	065154		
EMS356	101077	EMS60	076201	EMT140	067212	EMT222	070572	EMT32	065170		
EMS357	101117	EMS600	102644	EMT141	067232	EMT223	070610	EMT33	065204		
EMS36	074647	EMS601	102674	EMT142	067246	EMT224	070626	EMT34	065222		
EMS360	101141	EMS602	102714	EMT143	067264	EMT225	070646	EMT35	065240		
EMS361	101167	EMS603	102755	EMT144	067300	EMT226	070670	EMT36	065254		
EMS362	101215	EMS604	102776	EMT145	067322	EMT227	070706	EMT37	065270		
EMS363	101236	EMS605	103023	EMT146	067344	EMT23	065020	EMT4	064452		
EMS364	101253	EMS606	103041	EMT147	067362	EMT230	070724	EMT40	065304		
EMS365	101274	EMS607	103061	EMT15	064672	EMT231	070742	EMT41	065324		
EMS366	101301	EMS61	076253	EMT150	067374	EMT232	070756	EMT42	065340		
EMS367	101324	EMS62	076326	EMT151	067416	EMT233	071000	EMT43	065364		
EMS37	074677	EMS63	076407	EMT152	067430	EMT234	071022	EMT44	065376		
EMS370	101374	EMS64	076447	EMT153	067444	EMT235	071050	EMT45	065412		
EMS371	101411	EMS65	076517	EMT154	067464	EMT236	071070	EMT46	065426		
EMS372	101440	EMS66	076560	EMT155	067504	EMT237	071122	EMT47	065442		
EMS373	101472	EMS67	076635	EMT156	067522	EMT24	065040	EMT5	064474		
EMS374	101476	EMS7	072770	EMT157	067544	EMT240	071142	EMT50	065464		
EMS375	101527	EMS70	076747	EMT16	064710	EMT241	071166	EMT51	065506		
EMS376	101543	EMTVEC=	000030	EMT160	067562	EMT242	071212	EMT52	065526		
EMS377	101557	EMT1	064376	EMT161	067612	EMT243	071236	EMT53	065542		
EMS4	072623	EMT10	064564	EMT162	067630	EMT244	071262	EMT54	065556		
EMS40	074730	EMT100	066200	EMT163	067646	EMT245	071300	EMT55	065576		
EMS400	101570	EMT101	066220	EMT164	067670	EMT246	071316	EMT56	065616		
EMS401	101605	EMT102	066240	EMT165	067712	EMT247	071342	EMT57	065632		
EMS402	101622	EMT103	066260	EMT166	067736	EMT25	065060	EMT6	064520		
EMS403	101651	EMT104	066304	EMT167	067756	EMT250	071360	EMT60	065646		
EMS404	101672	EMT105	066324	EMT17	064726	EMT251	071404	EMT61	065662		
EMS405	101711	EMT106	066344	EMT170	070000	EMT252	071430	EMT62	065702		
EMS406	101721	EMT107	066370	EMT171	070012	EMT253	071454	EMT63	065722		
EMS407	101734	EMT11	064602	EMT172	070026	EMT254	071472	EMT64	065736		
EMS41	075006	EMT110	066410	EMT173	070044	EMT255	071510	EMT65	065750		
EMS42	075054	EMT111	066432	EMT174	070066	EMT256	071534	EMT66	065764		

SYMBOL TABLE

```
EMT67   066000   ILF54 = 000054   MUR   = 001000   QUES    063055   RMER1I  001352
EMT7    064542   ILF56 = 000056   MWD   = 000010   RD    = 000070   RMER1O  001426
EMT70   066016   ILF64 = 000064   MWP   = 000010   RDCHR = 104411   RMER2 = 000042
EMT71   066036   ILF66 = 000066   MXF   = 001000   RDLIN = 104412   RMER2I  001400
EMT72   066062   ILF74 = 000074   N       063626   RDOCT = 104413   RMER2O  001454
EMT73   066106   ILF76 = 000076   NDTMSK= 115760   RDY   = 000200   RMHR  = 000036
EMT74   066126   ILR   = 000002   NED   = 010000   READY   007006   RMHRI   001374
EMT75   066136   ILRG50= 000050   NEM   = 004000   READY1  007034   RMHRO   001450
EMT76   066150   ILRG52= 000052   NONE    063445   RECAL = 000006   RMLA  = 000020
EMT77   066164   ILRG54= 000054   NOP   = 000000   RESREG= 104415   RMLAI   001356
ENRGDT  064376   ILRG56= 000056   NOTAVL  063566   RESVEC= 000010   RMLAO   001432
EQUALS  063046   ILRG60= 000060   NOTPRS  063551   REX   = 010000   RMMR1 = 000024
ERR   = 040000   ILRG62= 000062   NOTRM    063517   RG    = 040000   RMMR1I  001362
ERRNMB  060522   ILRG64= 000064   NSA   = 100000   RGDTPT  063750   RMMR1O  001436
ERROR = 104000   ILRG66= 000066   OCC   = 100000   RH    = 000072   RMMR2 = 000040
ERRTYP  057704   ILRG70= 000070   OFD   = 000200   RIP   = 000020   RMMR2I  001376
ERRVEC= 000004   ILRG72= 000072   OFFSET= 000014   RLEASE= 000012   RMMR2O  001452
ERTY00  060530   ILRG74= 000074   OM    = 000001   RMAS  = 000016   RMOF  = 000032
ERTY01  060535   ILRG76= 000076   ONES    064010   RMASI   001354   RMOFI   001370
ERTY02  060545   IOTVEC= 000020   OPE   = 020000   RMASO   001430   RMOFO   001444
ERTY03  060554   IPCK0 = 000001   OPI   = 020000   RMBA  = 000004   RMR   = 000004
ERTY04  060562   IPCK1 = 000002   OR    = 000200   RMBAE = 000050   RMSN  = 000030
ERTY05  060565   IPCK2 = 000004   PACACK= 000022   RMBAEI  001406   RMSNI   001366
ESRC  = 004000   IPCK3 = 000010   PAKACK= 000022   RMBAEO  001462   RMSNO   001442
FER   = 000020   IR    = 000100   PAR   = 000010   RMBAI   001342   RMWC  = 000002
FMT16 = 010000   IRP     054702   PAT   = 000020   RMBAO   001416   RMWCI   001340
FNCDTB  063640   IVC   = 010000   PCLOCK  054562   RMCS1 = 000000   RMWCO   001414
FNCMSK= 000077   LBC   = 002000   PCOUNT  054650   RMCS1I  001336   RQA   = 100000
F0    = 000002   LBT   = 002000   PDA   = 000400   RMCS1O  001412   RQB   = 040000
F1    = 000004   LCLOCK  054600   PFECH   060572   RMCS2 = 000010   RTC   = 000016
F2    = 000010   LCOUNT  054650   PFECH1  060602   RMCS2I  001346   R6    =%000006
F3    = 000020   LF    = 000012   PFECH2  060670   RMCS2O  001422   R7    =%000007
F4    = 000040   LODEV    063534   PFECH3  060706   RMCS3 = 000052   SADMSK= 000377
GETBUF  001336   LS    = 000004   PFECH4  060714   RMCS3I  001410   SAVREG= 104414
GO    = 000001   LSC   = 004000   PGE   = 002000   RMCS3O  001464   SA1   = 000001
GTSWR = 104407   LST   = 000002   PGM   = 001000   RMDA  = 000006   SA16  = 000020
HCE   = 000200   LSTOP    054712   PHA   = 000200   RMDAI   001344   SA2   = 000002
HCI   = 002000   LSTRK    001334   PIP   = 020000   RMDAO   001420   SA4   = 000004
HCRC  = 000400   MCLK  = 004000   PIRQ  = 177772   RMDB  = 000022   SA8   = 000010
HELP    104536   MCPE  = 020000   PIRQVE= 000240   RMDBI   001360   SC    = 100000
HT    = 000011   MDF   = 000100   PLCLK   054606   RMDBO   001434   SCOPE = 000004
IAE   = 002000   MDPE  = 000400   PLFS  = 002000   RMDC  = 000034   SCTMSK= 003700
IBSAVE  057702   MI    = 000004   PLSTP   054716   RMDCI   001372   SC0   = 000100
IDXMSK= 000077   MIXED    063750   PR0   = 000000   RMDCO   001446   SC1   = 000200
IE    = 000100   MOC   = 000400   PR1   = 000040   RMDS  = 000012   SC2   = 000400
ILF   = 000001   MOH   = 020000   PR2   = 000100   RMDSI   001350   SC3   = 001000
ILF02 = 000002   MOL   = 010000   PR3   = 000140   RMDSO   001424   SC4   = 002000
ILF24 = 000024   MRD   = 002000   PR4   = 000200   RMDT  = 000026   SEARCH= 000030
ILF26 = 000026   MR1AAA= 051401   PR5   = 000240   RMDTI   001364   SEEK  = 000004
ILF30 = 000030   MS    = 000040   PR6   = 000300   RMDTO   001440   SETOM   055054
ILF32 = 000032   MSC   = 000002   PR7   = 000340   RMEC1 = 000044   SETVV   054732
ILF34 = 000034   MSDRVS  063452   PS    = 177776   RMEC1I  001402   SHUT    062170
ILF36 = 000036   MSE   = 100000   PSEL  = 002000   RMEC1O  001456   SIZCLK  054322
ILF40 = 000040   MSEN  = 010000   PSTOP   054704   RMEC2 = 000046   SKI   = 040000
ILF42 = 000042   MSER  = 000200   PSW   = 177776   RMEC2I  001404   SNGPRT= 020026
ILF44 = 000044   MSGDRV  063466   PUTBUF  001412   RMEC2O  001460   SSE   = 000040
ILF46 = 000046   MSHELP  063064   PWRVEC= 000024   RMER1 = 000014   SSEI  = 001000
```

SYMBOL TABLE

```
SSF    = 020000        TST100  035746        TST55   031172        $ATYC   062624        $GDDAT  001140
STACK  = 001100        TST101  036100        TST56   031404        $ATY1   062600        $GET42  054272
STANDA  006074         TST102  036270        TST57   031606        $ATY3   062606        $GTSWR  061320
START   004652         TST103  036472        TST6    011262        $ATY4   062616        $GT42P  054266
START1  004642         TST104  036620        TST60   031774        $AUTOB  001150        $HD    = 000000
START2  004656         TST105  037024        TST61   032212        $BASE   001276        $HIBTS  001100
STKLMT= 177774         TST106  037154        TST62   032360        $BDADR  001136        $HIOCT  062312
STOPCL  001540         TST107  037350        TST63   032604        $BDDAT  001142        $ICNT   001120
SWR     001154         TST11   012536        TST64   032720        $BELL   001212        $ILLUP  062562
SWREG   000176         TST110  037546        TST65   033106        $BIN    055360        $INTAG  001151
SW0    = 000001        TST111  040024        TST66   033336        $CDW1   001302        $ITEMB  001130
SW00   = 000001        TST112  040330        TST67   033554        $CDW2   001304        $LF     001220
SW01   = 000002        TST113  041722        TST7    012356        $CHARC  056364        $LFLG   063043
SW02   = 000004        TST114  043450        TST70   034002        $CKSWR  061230        $LLCSR  001522
SW03   = 000010        TST115  045630        TST71   034252        $CMTAG  001114        $LLVEC  001524
SW04   = 000020        TST116  046210        TST72   034460        $CM3   = 000000        $LPADR  001122
SW05   = 000040        TST117  050352        TST73   035004        $CM4   = 000005        $LPCSB  001514
SW06   = 000100        TST12   012776        TST74   035232        $CNTLC  062126        $LPCSR  001512
SW07   = 000200        TST120  052640        TST75   035340        $CNTLG  062140        $LPERR  001124
SW08   = 000400        TST13   013344        TST76   035464        $CNTLU  062133        $LPVEC  001516
SW09   = 001000        TST14   014126        TST77   035614        $CPUOP  001250        $MADR1  001254
SW1    = 000002        TST15   014234        TYPBN  = 104406        $CRLF   001217        $MADR2  001260
SW10   = 002000        TST16   014666        TYPDS  = 104405        $DBLK   055576        $MADR3  001264
SW11   = 004000        TST17   015400        TYPE   = 104401        $DDW0   001306        $MADR4  001270
SW12   = 010000        TST2    007466        TYPOC  = 104402        $DDW1   001310        $MAIL   001222
SW13   = 020000        TST20   015502        TYPON  = 104404        $DDW2   001312        $MAMS1  001252
SW14   = 040000        TST21   015760        TYPOS  = 104403        $DDW3   001314        $MAMS2  001256
SW15   = 100000        TST22   016104        UNS    = 040000        $DDW4   001316        $MAMS3  001262
SW2    = 000004        TST23   016232        UNTMSK= 000007         $DDW5   001320        $MAMS4  001266
SW3    = 000010        TST24   016504        UNTOFF  063605        $DDW6   001322        $MBADR  001102
SW4    = 000020        TST25   017004        UNTON   063616        $DDW7   001324        $MFLG   063042
SW5    = 000040        TST26   017426        UPE    = 020000        $DEVCT  001232        $MNEW   062156
SW6    = 000100        TST27   017522        USE    = 040000        $DEVM   001300        $MSGAD  001236
SW7    = 000200        TST3    007656        U0     = 000001        $DOAGN  054312        $MSGLG  001240
SW8    = 000400        TST30   020010        U1     = 000002        $DTBL   055566        $MSGTY  001222
SW9    = 001000        TST31   020324        U2     = 000004        $ENDAD  054302        $MSWR   062145
SYSTAT  063474         TST32   020614        VV     = 000100        $ENDCT  054140        $MTYP1  001253
TADMSK= 177400         TST33   021332        WATCH   001534        $ENULL  054316        $MTYP2  001257
TAG    = 020000        TST34   021644        WC     = 000040        $ENV    001242        $MTYP3  001263
TAGADR= 001114         TST35   022136        WCD    = 000050        $ENVM   001243        $MTYP4  001267
TAP    = 040000        TST36   022460        WCE    = 040000        $EOP    054104        $MXCNT  057046
TA1    = 000400        TST37   023116        WCEHI  = 010000        $EOPCT  054132        $NULL   001170
TA2    = 001000        TST4    010026        WCELO  = 004000        $ESP    054046        $NWTST= 000001
TA4    = 002000        TST40   023624        WCF    = 000040        $ERFLG  001117        $OCNT   056030
TA8    = 004000        TST41   024144        WCH    = 000052        $ERMAX  001131        $OMODE  056052
TBITVE= 000014         TST42   024462        WD     = 000060        $ERROR  057310        $OVER   057032
TIME    001532         TST43   025064        WH     = 000062        $ERRPC  001132        $PASS   001230
TKVEC  = 000060        TST44   025234        WLE    = 004000        $ERRTB  001542        $PASTM  001106
TPVEC  = 000064        TST45   025614        WRL    = 004000        $ERTTL  001126        $POWER  062570
TRAPVE= 000034         TST46   026324        XNUDC  = 176000        $ESCAP  001210        $PSW    001530
TRE    = 040000        TST47   026620        XNUER2= 001527         $ETABL  001242        $PWRDN  062422
TRTVEC= 000014         TST5    010156        XNUOF  = 160577        $ETEND  001326        $PWRMG  062556
TST    = 010000        TST50   027222        XSIZ    005604        $FATAL  001224        $PWRUP  062474
TSTNMB  060520         TST51   027456        XXDP    001332        $FFLG   063044        $QUES   001216
TSTQUE  001466         TST52   027664        Y       063630        $FILLC  001172        $RDCHR  061572
TST1    007156         TST53   030516        ZEROS   064052        $FILLS  001171        $RDLIN  061662
TST10   012452         TST54   030770        $APTHD  001100        $GDADR  001134        $RDOCT  062212
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SYM OL TABLE

$RDSZ	= 000010	$SWRMK	= 000000	$TMP0	001174	$TRPAD	062366	$UNIT	001234
$RESRE	055250	$SW08T	057050	$TMP1	001176	$TSTM	001104	$UNITM	001110
$RM80	063512	$TESTN	001226	$TMP2	001200	$TSTNM	001116	$USWR	001246
$RTNAD	054314	$TIMES	001206	$TMP3	001202	$TTYIN	062116	$VECT1	001272
$SAVRE	055212	$TKB	001162	$TMP4	001204	$TYPBN	055306	$VECT2	001274
$SAVR6	062566	$TKCNT	060720	$TN	= 000121	$TYPDS	055362	$XOFF	= 000023
$SCOPE	056370	$TKINT	060730	$TPB	001166	$TYPE	056034	$XON	= 000021
$SETUP	= 000137	$TKQEN	= 060727	$TPFLG	001173	$TYPEC	056246	$XTSTR	056406
$STUP	= 177777	$TKQIN	060722	$TPS	001164	$TYPEX	056366	$$GET4	= 000000
$SVLAD	056776	$TKQOU	060724	$TRAP	062314	$TYPOC	055632	$$SW08	= 000121
$SVPC	= 000210	$TKQSR	060726	$TRAP2	062354	$TYPON	055646	$OFILL	056031
$SWR	= 167400	$TKS	001160	$TRP	= 000016	$TYPOS	055606	.$X	= 001100
$SWREG	001244	$TKSRV	061000						

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. ABS.  111166     000
        000000     001
ERRORS DETECTED:  0

VIRTUAL MEMORY USED:  62208 WORDS  ( 243 PAGES)
DYNAMIC MEMORY AVAILABLE FOR  71 PAGES
,A:CZRNBA/C=A:CZRNBA.DOC,CZRNBA,SYSMAC/M
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$$GET4	14-20	14-20#												
$$SW08	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1	24-1
	24-1	24-1	24-1	24-1	24-1	24-1	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#
	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#
	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#
	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#
	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#
	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#	24-1#
	24-1#	24-1#	24-1#											
$0FILL	22-1	22-1#	22-1*	22-1*										
$40CAT	24-1	25-1												
$APTHD	5-13	5-13#												
$ASTAT	31-1	31-1												
$ATY1	31-1#													
$ATY3	23-1	31-1#												
$ATY4	25-1	31-1#												
$ATYC	31-1	31-1#												
$AUTOB	6-0#	9-28*	27-1	27-1	27-1									
$BASE	6-0#	9-76	10-33	10-42*	11-53	13-1	13-67	13-73	13-106	13-137	13-159	13-332	13-524	13-538
	13-549	13-602	13-670	13-774	13-787	13-877	13-986	13-:09	13-:62	13-:90	13-;10	13-;54	13-<16	13-=15
	13-=32	13-=90	13->55	13-?16	13-@18	13-@79	13-A39	13-B20	13-C03	13-D10	13-D69	13-E28	13-F08	13-F43
	13-G64	13-I14	13-I89	13-K28	13-K74	13-L08	13-M40	13-N00	13-N36	13-N84	13-O23	13-O53	13-O93	13-P19
	13-P64	13-P85	13-Q12	13-Q56	13-R33	13-R81	13-S32	13-S69	13-T25	13-T82	13-U00	13-U23	13-U52	13-U81
	13-V11	13-V48	13-V86	13-W06	13-W39	13-W60	13-X09	13-X54	13-Y24	13-Z01	13-\66	13-_58	13-c65	13-d33
	13-h32	13-l08	18-9	26-25										
$BDADR	6-0#	13-14*	13-15*	13-35*	13-36*	13-67*	13-531*	13-532*	13-545*	13-553*	13-554*	13-616*	13-617*	13-629*
	13-630*	13-643*	13-644*	13-663*	13-664*	13-683*	13-684*	13-691*	13-692*	13-699*	13-700*	13-712*	13-713*	13-720*
	13-721*	13-729*	13-730*	13-742*	13-743*	13-766*	13-767*	13-782*	13-783*	13-790*	13-791*	13-880*	13-881*	13-989*
	13-990*	13-:26*	13-:27*	13-;22*	13-;23*	13-;33*	13-;34*	13-;47*	13-;48*	13-;59*	13-;60*	13-<28*	13-<29*	13-<55*
	13-=18*	13-=34*	13-=35*	13-=93*	13-=94*	13->58*	13->59*	13-?20*	13-?21*	13-?42*	13-?43*	13-?59*	13-?60*	13-?75*
	13-?76*	13-@01*	13-@02*	13-@22*	13-@23*	13-@83*	13-@84*	13-A42*	13-A43*	13-B23*	13-B24*	13-C05*	13-C06*	13-D13*
	13-D14*	13-D71*	13-D72*	13-E30*	13-E31*	13-F10*	13-F45*	13-F46*	13-G87*	13-H01*	13-H02*	13-H14*	13-H39*	13-H40*
	13-I17*	13-I91*	13-I92*	13-K30*	13-K31*	13-K76*	13-K77*	13-L28*	13-L29*	13-L49*	13-L50*	13-L70*	13-L71*	13-M04*
	13-M05*	13-M19*	13-M20*	13-M31*	13-M32*	13-M42*	13-M43*	13-N23*	13-N24*	13-N70*	13-N71*	13-O25*	13-O26*	13-O78*
	13-O79*	13-O87*	13-O88*	13-O95*	13-O96*	13-P21*	13-P22*	13-P59*	13-P60*	13-P66*	13-P67*	13-P89*	13-P90*	13-Q16*
	13-Q17*	13-R67*	13-R68*	13-S11*	13-S12*	13-S56*	13-S57*	13-T06*	13-T07*	13-T27*	13-T28*	13-T95*	13-U08*	13-U17*
	13-U18*	13-U47*	13-U48*	13-U76*	13-U77*	13-V05*	13-V06*	13-V43*	13-V44*	13-V68*	13-V69*	13-V81*	13-V82*	13-W00*
	13-W01*	13-W20*	13-W21*	13-W32*	13-W33*	13-W54*	13-W55*	13-W81*	13-W82*	13-X33*	13-X34*	13-X85*	13-X86*	13-Y46*
	13-Y47*	13-Y76*	13-Y77*	13-Z36*	13-Z37*	13-Z74*	13-[04*	13-[05*	13-[47*	13-[48*	13-[89*	13-\04*	13-\29*	13-\30*
	13-]04*	13-]05*	13-]45*	13-]78*	13-]79*	13-^24*	13-^25*	13-^69*	13-^84*	13-_14*	13-_15*	13-_96*	13-_97*	13-`37*
	13-`73*	13-`74*	13-a36*	13-a37*	13-a81*	13-a96*	13-b51*	13-b52*	13-b68*	13-c12*	13-c13*	13-d09*	13-d10*	13-d25*
	13-d26*	13-d69*	13-d70*	13-e18*	13-e19*	13-e46*	13-e47*	13-e62*	13-e93*	13-e94*	13-f20*	13-f21*	13-f50*	13-f51*
	13-f88*	13-f89*	13-g22*	13-g23*	13-g85*	13-g86*	13-h57*	13-h58*	13-h73*	13-h74*	13-i01*	13-i02*	13-i53*	13-i54*
	13-i89*	13-j18*	13-j19*	13-j51*	13-j52*	13-k08*	13-k09*	13-k37*	13-k38*	13-k73*	13-k74*	13-l02*	13-l03*	13-l70*
	13-l71*	13-m01*	13-m02*	13-m59*	13-m60*	13-m91*	13-m92*	16-23*	16-24*	17-22*	17-23*	42-1	42-2	42-4
	42-7	42-8	42-9											

CROSS REFERENCE TABLE (CREF V04.00)

```
$BDDAT   6-0#    13-8*    13-9     13-29*   13-30    13-208*  13-253*  13-315*  13-526*  13-527   13-529   13-541*  13-542*  13-562*
        13-563*  13-573*  13-574*  13-576   13-589*  13-590*  13-591   13-612*  13-613*  13-625*  13-626*  13-638*  13-639*  13-641
        13-658*  13-659*  13-660   13-679*  13-680*  13-687*  13-688*  13-695*  13-696*  13-708*  13-709*  13-716*  13-717*  13-725*
        13-726*  13-738*  13-740   13-756*  13-759*  13-762*  13-763   13-778*  13-779*  13-800*  13-801*  13-808*  13-809*  13-821*
        13-822*  13-829*  13-830*  13-832   13-846*  13-850   13-864*  13-868   13-894*  13-895*  13-902*  13-903*  13-910*  13-911*
        13-923*  13-924*  13-931*  13-932*  13-943*  13-944*  13-951*  13-952*  13-954   13-968*  13-971*  13-974*  13-977   13-998*
        13-999   13-:22*  13-:24*  13-:39*  13-:40*  13-:41   13-:78*  13-:79*  13-;18*  13-;19   13-;29*  13-;30   13-;43*  13-;44
        13-:64*  13-;65*  13-;74*  13-;75*  13-;84*  13-;85*  13-;87   13-<04*  13-<05   13-<24*  13-<25*  13-<59*  13-<60*  13-<61
        13-=24*  13-=25*  13-=40*  13-=41*  13-=50*  13-=51*  13-=61*  13-=62*  13-=76*  13-=77*  13-=99*  13->00*  13->10*  13->11*
        13->22*  13->23*  13->31*  13->32*  13->37   13->65*  13->66*  13->75*  13->76*  13->92*  13->93*  13->98   13-?29*  13-?30*
        13-?38*  13-?39*  13-?40   13-?56*  13-?57*  13-?71*  13-?72*  13-?73   13-?93*  13-?94*  13-?99   13-a28*  13-a29*  13-a40*
        13-a41*  13-a56*  13-a57*  13-a62   13-a89*  13-a90*  13-a99*  13-A00*  13-A16*  13-A17*  13-A22   13-A48*  13-A49*  13-A59*
        13-A60*  13-A69*  13-A70*  13-A86*  13-A87*  13-A90   13-B34*  13-B35*  13-B51   13-B57*  13-B58*  13-B73   13-C33*  13-C34
        13-C43   13-C47   13-C75*  13-C76   13-C84   13-C87   13-D40*  13-D41   13-D52   13-D90*  13-D91*  13-E08*  13-E09*  13-E39*
        13-E40*  13-E49*  13-E50*  13-E65*  13-E66*  13-E90*  13-E91*  13-E96   13-F25*  13-F26   13-F30*  13-F59*  13-F60   13-F62*
        13-F85*  13-F86*  13-F88   13-G82*  13-G83   13-G85*  13-G94   13-G97*  13-G98*  13-G99   13-H12*  13-H13*  13-H20   13-H27
        13-H34   13-H37*  13-H38*  13-H41   13-I33*  13-I34   13-I36*  13-I49*  13-I50*  13-I53   13-I60   13-J04*  13-J05*  13-J30*
        13-J31*  13-J36   13-K41*  13-K42*  13-K56*  13-K57*  13-K60   13-K85*  13-K86*  13-L00*  13-L01*  13-L22*  13-L23*  13-L43*
        13-L44*  13-L64*  13-L65*  13-M06*  13-M07*  13-M11*  13-M12*  13-M16*  13-M17*  13-M28*  13-M29*  13-M53*  13-M54*  13-M71*
        13-M72*  13-N17*  13-N18*  13-N21   13-N61*  13-N62*  13-N67   13-O46*  13-O47*  13-O75*  13-O76   13-O84*  13-O85*  13-P13*
        13-P14*  13-P47*  13-P48*  13-P55*  13-P56*  13-P77*  13-P78*  13-Q05*  13-Q06*  13-Q32*  13-Q33*  13-Q34   13-R61*  13-R62*
        13-R65   13-S07*  13-S08*  13-S52*  13-S53*  13-T03*  13-T04*  13-T46*  13-T47*  13-T49   13-T87*  13-T92*  13-U04*  13-U05*
        13-U13*  13-U14*  13-U44*  13-U45*  13-U73*  13-U74*  13-V02*  13-V03*  13-V30*  13-V31*  13-V35   13-V37   13-V65*  13-V66*
        13-V76*  13-V78*  13-V96*  13-V97*  13-W17*  13-W18*  13-W29*  13-W30*  13-W50*  13-W51*  13-W75*  13-W76*  13-W78   13-X30*
        13-X31*  13-X80*  13-X81*  13-X82   13-Y43*  13-Y44*  13-Y69*  13-Y70*  13-Z32*  13-Z33*  13-Z71*  13-Z72*  13-[01*  13-[02*
        13-[43*  13-[44*  13-[85*  13-[86*  13-\01*  13-\02*  13-\24*  13-\25*  13-\26   13-]00*  13-]01*  13-]42*  13-]43*  13-]75*
        13-]76*  13-^20*  13-^21*  13-^65*  13-^66*  13-^81*  13-^82*  13-_08*  13-_09*  13-_12   13-_92*  13-_93*  13-`34*  13-`35*
        13-`70*  13-`71*  13-a32*  13-a33*  13-a77*  13-a78*  13-a93*  13-a94*  13-b42*  13-b43*  13-b64*  13-b65*  13-c06*  13-c07*
        13-c10   13-d02*  13-d03*  13-d18*  13-d19*  13-d65*  13-d66*  13-e11*  13-e12*  13-e42*  13-e43*  13-e58*  13-e59*  13-e89*
        13-e90*  13-f05*  13-f13*  13-f18   13-f43*  13-f44*  13-f81*  13-f82*  13-g15*  13-g16*  13-g57*  13-g58*  13-g65   13-h50*
        13-h51*  13-h69*  13-h70*  13-h94*  13-h95*  13-i46*  13-i47*  13-i81*  13-i82*  13-j14*  13-j15*  13-j44*  13-j45*  13-k01*
        13-k02*  13-k30*  13-k31*  13-k66*  13-k67*  13-k95*  13-k96*  13-l63*  13-l64*  13-l79*  13-l82   13-l90*  13-l93   13-m14*
        13-m17   13-m28*  13-m50   13-m72*  13-m80*  13-m84   16-20*   16-21*   17-18*   17-19*   42-1     42-3     42-4     42-5
        42-6     42-7     42-8     42-9
$BELL    6-0#    25-1     25-1     25-1     27-1     27-1     27-1
$BIN    20-1     20-1#    20-1*    20-1*
$CDW1    6-0#
$CDW2    6-0#
$CHARC  23-1     23-1#    23-1*    23-1*    23-1*
$CKSWR  27-1#    29-1     29-1
$CM3     6-0      6-0#
$CM4     6-0      6-0      6-0      6-0      6-0      6-0      6-0      6-0      6-0      6-0      6-0#     6-0#     6-0#     6-0#
         6-0#     6-0#
$CMTAG   6-0#     9-23     9-23     9-23     9-23     9-23     9-23     9-23
$CNTLC  27-1     27-1     27-1     27-1     27-1#
$CNTLG  27-1     27-1#
$CNTLU  27-1     27-1     27-1#
$CPUOP   6-0#
$CRLF    6-0#     9-48     9-81     9-131    10-20    10-28    10-70    10-109   11-25    11-59    14-20    23-1     23-1     23-1
        25-1     25-1     25-1     26-20    26-53    26-96    26-106   26-118   26-126   26-146   27-1     27-1     27-1     27-1
$DBLK   21-1     21-1     21-1#
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$DDW1    6-0#
$DDW2    6-0#
$DDW3    6-0#
$DDW4    6-0#
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CROSS REFERENCE TABLE (CREF V04.00)

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$DDW6    6-0#
$DDW7    6-0#
$DEVCT   6-0#
$DEVM    6-0#     9-68*    9-79     9-109*   10-71*   10-78*   10-105*  10-106   11-4     11-38    11-60    27-6*
$DOAGN   14-20    14-20    14-20#
$DTBL    21-1     21-1#
$ENDAD   5-5      9-28     14-20#   25-1
$ENDCT   9-23     14-20#
$ENULL   14-20#
$ENV     6-0#     9-28     23-1     25-1     31-1     31-1
$ENVM    6-0#     9-23     9-72     23-1     23-1     31-1
$EOP     14-20#   27-7
$EOPCT   9-23*    14-20    14-20#
$EOSP    13-69    13-535   14-9#
$ERFLG   6-0#     24-1     24-1     24-1     24-1     24-1     24-1*    25-1     25-1     25-1*
$ERMAX   6-0#     9-23*    24-1     24-1     24-1     24-1*
$ERROR   9-23     25-1#
$ERRPC   6-0#     25-1     25-1     25-1     25-1*    25-1*    26-46
$ERRTB   8-0#     26-64
$ERTTL   6-0#     14-20    14-20    14-20*   25-1     25-1     25-1*
$ESCAP   6-0#     9-23*    24-1*    25-1     25-1     25-1     25-1
$ETABL   6-0#
$ETEND   5-13     6-0#
$FATAL   6-0#     31-1*
$FFLG    31-1     31-1#    31-1*    31-1*    31-1*
$FILLC   6-0#     23-1     23-1     23-1
$FILLS   6-0#     23-1     23-1
$GDADR   6-0#     13-T96*
$GDDAT   6-0#     13-11*   13-12*   13-13*   13-32*   13-33*   13-34*   13-209*  13-254*  13-314*  13-544*  13-565*  13-575*  13-576
         13-593*  13-615*  13-628*  13-640*  13-641   13-662*  13-682*  13-690*  13-698*  13-711*  13-719*  13-728*  13-739*  13-740
         13-765*  13-781*  13-792*  13-831*  13-832   13-848*  13-866*  13-882*  13-953*  13-954   13-975*  13-976*  13-977   13-994*
         13-999   13-:12*  13-:41   13-:56*  13-:66*  13-;21*  13-;32*  13-;46*  13-;58*  13-;86*  13-;87   13-<07*  13-<18*  13-<27*
         13-<61   13-<64   13-<96*  13-=27*  13-=43*  13-=53*  13-=64*  13-=81*  13->02*  13->13*  13->25*  13->40*  13->60*  13->78*
         13-?00*  13-?22*  13-?34*  13-?40   13-?44   13-?53*  13-?63*  13-?67   13-?69*  13-?73   13-?77   13-?95*  13-?98*  13-?99
         13-@31*  13-@43*  13-@58*  13-@61*  13-@62   13-@92*  13-A02*  13-A18*  13-A21*  13-A22   13-A44*  13-A72*  13-A92*  13-B36*
         13-B47   13-B50*  13-B51   13-B59*  13-B72*  13-B73   13-C09*  13-C34   13-C42*  13-C45*  13-C46*  13-C55*  13-C76   13-C83*
         13-C86*  13-D03*  13-D20*  13-D41   13-D48*  13-D49   13-D51*  13-D93*  13-E11*  13-E42*  13-E44*  13-E92*  13-E95*  13-E96
         13-F31*  13-F63*  13-F87*  13-F88   13-G86*  13-G93*  13-G96*  13-G99   13-H15*  13-H29*  13-H33*  13-H36*  13-H41   13-I31*
         13-I62*  13-J07*  13-J32*  13-J35*  13-J36   13-K44*  13-K58*  13-K59*  13-K60   13-K88*  13-L03*  13-L27*  13-L48*  13-L69*
         13-M03*  13-M56*  13-M75*  13-N19*  13-N20*  13-N21   13-N63*  13-N66*  13-N67   13-O27*  13-O55*  13-O97*  13-P50*  13-P58*
         13-P80*  13-Q08*  13-Q14*  13-Q34   13-Q51*  13-R63*  13-R64*  13-R65   13-S10*  13-S55*  13-T08*  13-T48*  13-T49   13-T94*
         13-U07*  13-U16*  13-V70*  13-V80*  13-V99*  13-W22*  13-W34*  13-W53*  13-W77*  13-W78   13-X35*  13-X84*  13-Y48*  13-Y75*
         13-Z35*  13-Z75*  13-[06*  13-[46*  13-[88*  13-\05*  13-\28*  13-]03*  13-]46*  13-]80*  13-^23*  13-^68*  13-^85*  13-_10*
         13-_11*  13-_12   13-_95*  13-`38*  13-`75*  13-a35*  13-a80*  13-a97*  13-b50*  13-b67*  13-c08*  13-c09*  13-c10   13-d08*
         13-d24*  13-d68*  13-e17*  13-e45*  13-e61*  13-e92*  13-f17*  13-f18   13-f49*  13-f87*  13-g21*  13-g59*  13-g62*  13-g65
         13-h56*  13-h72*  13-i00*  13-i52*  13-i87*  13-i88*  13-j17*  13-j50*  13-k07*  13-k36*  13-k72*  13-l01*  13-l69*  13-l91*
         13-l92*  13-l93   13-m29*  13-m36*  13-m39*  13-m40*  13-m46*  13-m50   13-m81*  13-m84   16-25*   17-21*   42-1     42-3
         42-5     42-6     42-7     42-8
$GET42   11-34    11-43    14-20#
$GT42P   14-20    14-20#
$GTSWR   27-1#    29-1     29-1
$HD      4-696    4-696    4-696
$HIBTS   5-13#
$HIOCT   28-1#    28-1*
$ICNT    6-0#     24-1     24-1     24-1     24-1*    24-1*
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CROSS REFERENCE TABLE (CREF V04.00)

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$ILLUP  30-1      30-1      30-1#
$INTAG   6-0#     27-1      27-1      27-1      27-1      27-1*
$ITEMB   6-0#     25-1      25-1      25-1      25-1      25-1*     25-1*     26-41
$LF      6-0#     23-1      23-1      25-1      25-1      27-1      27-1
$LFLG   31-1#     31-1*
$LLCSR   7-0#     15-26     15-55*    15-86*
$LLVEC   7-0#     15-17     15-17*    15-18*    15-29*    15-30*    15-42     15-42*    15-43*
$LPADR   6-0#      9-23*    24-1      24-1      24-1      24-1*     24-1*     24-1*
$LPCSB   7-0#     15-51*
$LPCSR   7-0#     15-12     15-52*    15-83*
$LPERR   6-0#      9-23*    13-Z40*   13-Z78*   13-[09*   13-[51*   13-\08*   13-]08*   13-]49*   13-]83*   13-^28*   13-^88*   13-`00*   13-`44*
        13-`78*   13-a40*   13-b00*   13-b71*   13-d73*   13-e65*   13-f24*   13-f96*   13-h76*   13-i56*   13-j21*   13-k12*   24-1      24-1
        24-1      24-1*     25-1
$LPVEC   7-0#     15-15*    15-16*    15-31     15-31*    15-32*    15-40     15-40*    15-41*
$MADR1   6-0#
$MADR2   6-0#
$MADR3   6-0#
$MADR4   6-0#
$MAIL    5-13      5-13      6-0#      9-23      9-28      13-1      13-73     13-106    13-137    13-159    13-332    13-524    13-538    13-549
        13-602    13-670    13-774    13-787    13-877    13-986    13-:09    13-:62    13-:90    13-;10    13-;54    13-<16    13-=15    13-=32
        13-=90    13->55    13-?16    13-a18    13-a79    13-A39    13-B20    13-C03    13-D10    13-D69    13-E28    13-F08    13-F43    13-G64
        13-I14    13-I89    13-K28    13-K74    13-L08    13-M40    13-N00    13-N36    13-N84    13-023    13-053    13-093    13-P19    13-P64
        13-P85    13-Q12    13-Q56    13-R33    13-R81    13-S32    13-S69    13-T25    13-T82    13-U00    13-U23    13-U52    13-U81    13-V11
        13-V48    13-V86    13-W06    13-W39    13-W60    13-X09    13-X54    13-Y24    13-Z01    13-\66    13-_58    13-c65    13-d33    13-h32
        13-L08    23-1      24-1      25-1
$MAMS1   6-0#
$MAMS2   6-0#
$MAMS3   6-0#
$MAMS4   6-0#
$MBADR   5-13#
$MFLG   31-1      31-1#     31-1*     31-1*
$MNEW   27-1      27-1#
$MSGAD   6-0#     31-1      31-1*
$MSGLG   6-0#     31-1*
$MSGTY   6-0#     31-1      31-1      31-1*     31-1*
$MSWR   27-1      27-1#
$MTYP1   6-0#
$MTYP2   6-0#
$MTYP3   6-0#
$MTYP4   6-0#
$MXCNT  24-1      24-1      24-1      24-1#
$NULL    6-0#     23-1      23-1      23-1
$NWTST  13-1      13-1      13-1#     13-1#     13-73     13-73     13-73#    13-73#    13-106    13-106    13-106#   13-106#   13-137    13-137
        13-137#   13-137#   13-159    13-159    13-159#   13-159#   13-332    13-332    13-332#   13-332#   13-524    13-524    13-524#   13-524#
        13-538    13-538    13-538#   13-538#   13-549    13-549    13-549#   13-549#   13-602    13-602    13-602#   13-602#   13-670    13-670
        13-670#   13-670#   13-774    13-774    13-774#   13-774#   13-787    13-787    13-787#   13-787#   13-877    13-877    13-877#   13-877#
        13-986    13-986    13-986#   13-986#   13-:09    13-:09    13-:09#   13-:09#   13-:62    13-:62    13-:62#   13-:62#   13-:90    13-:90
        13-:90#   13-:90#   13-;10    13-;10    13-;10#   13-;10#   13-;54    13-;54    13-;54#   13-;54#   13-<16    13-<16    13-<16#   13-<16#
        13-=15    13-=15    13-=15#   13-=15#   13-=32    13-=32    13-=32#   13-=32#   13-=90    13-=90    13-=90#   13-=90#   13->55    13->55
        13->55#   13->55#   13-?16    13-?16    13-?16#   13-?16#   13-a18    13-a18    13-a18#   13-a18#   13-a79    13-a79    13-a79#   13-a79#
        13-A39    13-A39    13-A39#   13-A39#   13-B20    13-B20    13-B20#   13-B20#   13-C03    13-C03    13-C03#   13-C03#   13-D10    13-D10
        13-D10#   13-D10#   13-D69    13-D69    13-D69#   13-D69#   13-E28    13-E28    13-E28#   13-E28#   13-F08    13-F08    13-F08#   13-F08#
        13-F43    13-F43    13-F43#   13-F43#   13-G64    13-G64    13-G64#   13-G64#   13-I14    13-I14    13-I14#   13-I14#   13-I89    13-I89
        13-I89#   13-I89#   13-K28    13-K28    13-K28#   13-K28#   13-K74    13-K74    13-K74#   13-K74#   13-L08    13-L08    13-L08#   13-L08#
        13-M40    13-M40    13-M40#   13-M40#   13-N00    13-N00    13-N00#   13-N00#   13-N36    13-N36    13-N36#   13-N36#   13-N84    13-N84
        13-N84#   13-N84#   13-023    13-023    13-023#   13-023#   13-053    13-053    13-053#   13-053#   13-093    13-093    13-093#   13-093#
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        13-Q12#  13-Q12#  13-Q56   13-Q56   13-Q56#  13-Q56#  13-R33   13-R33   13-R33#  13-R33#  13-R81   13-R81   13-R81#  13-R81#
        13-S32   13-S32   13-S32#  13-S32#  13-S69   13-S69   13-S69#  13-S69#  13-T25   13-T25   13-T25#  13-T25#  13-T82   13-T82
        13-T82#  13-T82#  13-U00   13-U00   13-U00#  13-U00#  13-U23   13-U23   13-U23#  13-U23#  13-U52   13-U52   13-U52#  13-U52#
        13-U81   13-U81   13-U81#  13-U81#  13-V11   13-V11   13-V11#  13-V11#  13-V48   13-V48   13-V48#  13-V48#  13-V86   13-V86
        13-V86#  13-V86#  13-W06   13-W06   13-W06#  13-W06#  13-W39   13-W39   13-W39#  13-W39#  13-W60   13-W60   13-W60#  13-W60#
        13-X09   13-X09   13-X09#  13-X09#  13-X54   13-X54   13-X54#  13-X54#  13-Y24   13-Y24   13-Y24#  13-Y24#  13-Z01   13-Z01
        13-Z01#  13-Z01#  13-\66   13-\66   13-\66#  13-\66#  13- 58   13- 58   13- 58#  13- 58#  13-c65   13-c65   13-c65#  13-c65#
        13-d33   13-d33   13-d33#  13-d33#  13-h32   13-h32   13-h32#  13-h32#  13-l08   13-l08   13-l08#  13-l08#
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$OMODE  22-1     22-1#    22-1*    22-1*    22-1*    22-1*
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$POWER  30-1     30-1#
$PSW     7-0#    15-59*   15-89
$PWRDN   9-23    30-1     30-1#
$PWRMG  30-1#
$PWRUP  30-1     30-1#
$QUES    6-0#    23-1     23-1     25-1     25-1     27-1     27-1     27-1     27-1
$R2A    29-1
$RDCHR  27-1#    29-1     29-1
$RDDEC  29-1
$RDLIN  27-1#    29-1     29-1
$RDOCT  28-1#    29-1     29-1
$RDSZ   27-1     27-1#
$RESRE  19-1#    29-1
$RM80    9-92    26-28    32-21#
$RTNAD  14-20#
$SAVR6  30-1     30-1#    30-1*    30-1*    30-1*
$SAVRE  19-1#    29-1     29-1
$SCOPE   9-23    24-1#
$SETUP   4-998    4-998    4-998    4-998    4-998    4-998    4-998#   4-998#   4-998#   4-998#   4-998#   4-998#   4-998#   9-23
         9-23     9-23     9-23     9-23     9-23     9-23     9-23     9-23     9-23     9-23     9-23     9-28     9-28     9-28
        14-20    14-20    24-1     25-1     25-1     25-1     25-1     27-1     27-1     27-1     27-1     27-1
$STUP    4-998    4-998    4-998    4-998    4-998    4-998    4-998#   4-998#   4-998#   4-998#   4-998#   4-998#   4-998#   4-998#
         4-998#   4-998#   4-998#   4-998#
$SVLAD  24-1     24-1#
$SVPC    5-5     5-5#
$SW08T  24-1     24-1#
$SWR     4-685#   4-696    4-697    4-697    4-697    4-697    4-697    4-697    4-697    4-697    6-0      6-0      6-0      9-23
         9-23     9-23     9-23     9-23     13-1     13-73    13-106   13-137   13-159   13-332   13-524   13-538   13-549   13-602
        13-670   13-774   13-787   13-877   13-986   13-:09   13-:62   13-:90   13-;10   13-;54   13-<16   13-=15   13-=32   13-=90
        13->55   13-?16   13-@18   13-@79   13-A39   13-B20   13-C03   13-D10   13-D69   13-E28   13-F08   13-F43   13-G64   13-I14
        13-I89   13-K28   13-K74   13-L08   13-M40   13-N00   13-N36   13-N84   13-O23   13-O53   13-O93   13-P19   13-P64   13-P85
        13-Q12   13-Q56   13-R33   13-R81   13-S32   13-S69   13-T25   13-T82   13-U00   13-U23   13-U52   13-U81   13-V11   13-V48
        13-V86   13-W06   13-W39   13-W60   13-X09   13-X54   13-Y24   13-Z01   13-\66   13- 58   13-c65   13-d33   13-h32   13-l08
        14-20    14-20    14-20    14-20    14-20    24-1     24-1     24-1     24-1     24-1     24-1     24-1     24-1     24-1
        24-1     24-1     24-1     24-1     24-1     24-1     24-1     24-1     24-1     24-1     24-1     25-1     25-1     25-1
        25-1     25-1     25-1     25-1     25-1     25-1     25-1     25-1     30-1
$SWREG   6-0#     9-23
$SWRMK   4-697    4-697    4-697    4-697    4-697    4-697    4-697    4-697    4-697    24-1     24-1     24-1     24-1     24-1
        24-1     24-1     24-1     24-1     24-1
$TESTN   6-0#    13-1*    13-73*   13-106*  13-137*  13-159*  13-332*  13-524*  13-538*  13-549*  13-602*  13-670*  13-774*  13-787*
        13-877*  13-986*  13-:09*  13-:62*  13-:90*  13-;10*  13-;54*  13-<16*  13-=15*  13-=32*  13-=90*  13->55*  13-?16*  13-@18*
        13-@79*  13-A39*  13-B20*  13-C03*  13-D10*  13-D69*  13-E28*  13-F08*  13-F43*  13-G64*  13-I14*  13-I89*  13-K28*  13-K74*
```

CROSS REFERENCE TABLE (CREF V04.00)

```
        13-L08*  13-M40*  13-N00*  13-N36*  13-N84*  13-O23*  13-O53*  13-O93*  13-P19*  13-P64*  13-P85*  13-Q12*  13-Q56*  13-R33*
        13-R81*  13-S32*  13-S69*  13-T25*  13-T82*  13-U00*  13-U23*  13-U52*  13-U81*  13-V11*  13-V48*  13-V86*  13-W06*  13-W39*
        13-W60*  13-X09*  13-X54*  13-Y24*  13-Z01*  13-\66*  13- 58*  13-c65*  13-d33*  13-h32*  13-l08*  24-1*    26-37
$TIMES   6-0#     9-23*   11-47*   13-B20*  13-C03*  13-D10*  13-D69*  13-S69*  14-20*   24-1     24-1     24-1     24-1*    24-1*
$TKB     6-0#    23-1     23-1     27-1     27-1     27-1     27-1     27-1     27-1     27-1
$TKCNT  27-1     27-1     27-1#    27-1*    27-1*    27-1*
$TKINT  10-4     11-48    27-1     27-1     27-1#
$TKQEN  27-1     27-1     27-1#
$TKQIN  27-1     27-1     27-1#    27-1*    27-1*    27-1*    27-1*
$TKQOU  27-1     27-1     27-1#    27-1*    27-1*    27-1*
$TKQSR  27-1     27-1     27-1     27-1#
$TKS     6-0#    23-1     23-1     27-1     27-1     27-1     27-1     27-1     27-1*    27-1*    27-1*    27-1*    27-1*    27-1*
$TKSRV  27-1     27-1#
$TMP0    6-0#    13-<63*  13-=79*  13-=80*  13->39*  13-?01*  13-a03*  13-a64*  13-A24*  13-A93*  13-B53*  13-B75*  13-C25*  13-D31*
        13-D89*  13-E68*  13-E98*  13-F74*  13-J17*  13-K62*  13-M74*  13-N25*  13-N69*  13-Q39*  13-R69*  13-S13*  13-S58*  13-S83*
        13-T51*  13-T86*  13-T90   13-V29*  13-V33   13-W80*  13-X36*  13-X87*  13-Y78*  13-l82*  13-l85*  13-l86   13-m17*  13-m20*
        13-m21   16-28*   42-5     42-7     42-8
$TMP1    6-0#    10-13*   10-14    10-16    10-36*   10-38    10-42    10-50*   10-52    10-61    10-64    10-74*   10-75    10-81
        10-83    10-84    10-86    10-91*   10-92    10-95    10-96    10-98    10-103   13-B31*  13-E69*  13-E99*  13-X88*  42-8
$TMP2    6-0#
$TMP3    6-0#
$TMP4    6-0#
$TN      4-686#   4-696    13-1     13-1     13-1     13-1#    13-73    13-73    13-73    13-73#   13-106   13-106   13-106   13-106#
        13-137   13-137   13-137   13-137#  13-159   13-159   13-159   13-159#  13-332   13-332   13-332   13-332#  13-524   13-524
        13-524   13-524#  13-538   13-538   13-538   13-538#  13-549   13-549   13-549   13-549#  13-602   13-602   13-602   13-602#
        13-670   13-670   13-670   13-670#  13-774   13-774   13-774   13-774#  13-787   13-787   13-787   13-787#  13-877   13-877
        13-877   13-877#  13-986   13-986   13-986   13-986#  13-:09   13-:09   13-:09   13-:09#  13-:62   13-:62   13-:62   13-:62#
        13-:90   13-:90   13-:90   13-:90#  13-;10   13-;10   13-;10   13-;10#  13-;54   13-;54   13-;54   13-;54#  13-<16   13-<16
        13-<16   13-<16#  13-=15   13-=15   13-=15   13-=15#  13-=32   13-=32   13-=32   13-=32#  13-=90   13-=90   13-=90   13-=90#
        13->55   13->55   13->55   13->55#  13-?16   13-?16   13-?16   13-?16#  13-a18   13-a18   13-a18   13-a18#  13-a79   13-a79
        13-a79   13-a79#  13-A39   13-A39   13-A39   13-A39#  13-B20   13-B20   13-B20   13-B20#  13-C03   13-C03   13-C03   13-C03#
        13-D10   13-D10   13-D10   13-D10#  13-D69   13-D69   13-D69   13-D69#  13-E28   13-E28   13-E28   13-E28#  13-F08   13-F08
        13-F08   13-F08#  13-F43   13-F43   13-F43   13-F43#  13-G64   13-G64   13-G64   13-G64#  13-I14   13-I14   13-I14   13-I14#
        13-I89   13-I89   13-I89   13-I89#  13-K28   13-K28   13-K28   13-K28#  13-K74   13-K74   13-K74   13-K74#  13-L08   13-L08
        13-L08   13-L08#  13-M40   13-M40   13-M40   13-M40#  13-N00   13-N00   13-N00   13-N00#  13-N36   13-N36   13-N36   13-N36#
        13-N84   13-N84   13-N84   13-N84#  13-O23   13-O23   13-O23   13-O23#  13-O53   13-O53   13-O53   13-O53#  13-O93   13-O93
        13-O93   13-O93#  13-P19   13-P19   13-P19   13-P19#  13-P64   13-P64   13-P64   13-P64#  13-P85   13-P85   13-P85   13-P85#
        13-Q12   13-Q12   13-Q12   13-Q12#  13-Q56   13-Q56   13-Q56   13-Q56#  13-R33   13-R33   13-R33   13-R33#  13-R81   13-R81
        13-R81   13-R81#  13-S32   13-S32   13-S32   13-S32#  13-S69   13-S69   13-S69   13-S69#  13-T25   13-T25   13-T25   13-T25#
        13-T82   13-T82   13-T82   13-T82#  13-U00   13-U00   13-U00   13-U00#  13-U23   13-U23   13-U23   13-U23#  13-U52   13-U52
        13-U52   13-U52#  13-U81   13-U81   13-U81   13-U81#  13-V11   13-V11   13-V11   13-V11#  13-V48   13-V48   13-V48   13-V48#
        13-V86   13-V86   13-V86   13-V86#  13-W06   13-W06   13-W06   13-W06#  13-W39   13-W39   13-W39   13-W39#  13-W60   13-W60
        13-W60   13-W60#  13-X09   13-X09   13-X09   13-X09#  13-X54   13-X54   13-X54   13-X54#  13-Y24   13-Y24   13-Y24   13-Y24#
        13-Z01   13-Z01   13-Z01   13-Z01#  13-\66   13-\66   13-\66   13-\66#  13- 58   13- 58   13- 58   13- 58#  13-c65   13-c65
        13-c65   13-c65#  13-d33   13-d33   13-d33   13-d33#  13-h32   13-h32   13-h32   13-h32#  13-l08   13-l08   13-l08   13-l08#
        24-1     24-1
$TPB     6-0#    23-1     23-1     23-1*
$TPFLG   6-0#    23-1     23-1     23-1
$TPS     6-0#    23-1     23-1     23-1
$TRAP    9-23    29-1#
$TRAP2  29-1     29-1#
$TRP    29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1
        29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1
        29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1
        29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1     29-1#    29-1#    29-1#    29-1#
        29-1#    29-1#    29-1#    29-1#    29-1#    29-1#    29-1#    29-1#    29-1#    29-1#
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CROSS REFERENCE TABLE (CREF V04.00)

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$TSTM    5-13#
$TSTNM   6-0#    11-46*   14-20*   24-1     24-1     24-1     24-1     24-1     24-1*    24-1*    25-1     25-1     25-1
$TTYIN  27-1     27-1     27-1     27-1     27-1     27-1#
$TYPBN  20-1#    29-1     29-1
$TYPDS  21-1#    29-1     29-1
$TYPE   23-1#    29-1     29-1     31-1
$TYPEC  23-1     23-1     23-1     23-1#    27-1
$TYPEX  23-1     23-1     23-1#
$TYPOC  22-1#    29-1     29-1
$TYPON  22-1     22-1#    29-1
$TYPOS  22-1#    29-1
$UNIT    6-0#    11-50*   11-63    26-22
$UNITM   5-13#
$USWR    6-0#
$VECT1   6-0#    10-46    10-56    10-63    10-64*
$VECT2   6-0#
$XOFF   23-1     23-1
$XON    23-1     23-1     27-1
$XTSTR  24-1#
.$ASTA  31-1     31-1
.$X      5-13     5-13#
A16      4-944#  13-<98
A17      4-943#  13-<98
ABASE    4-995#   6-0      6-0
ACDW1    6-0      6-0
ACDW2    6-0      6-0
ACPUOP   6-0      6-0
ADDW0    6-0      6-0
ADDW1    6-0      6-0
ADDW10   6-0
ADDW11   6-0
ADDW12   6-0
ADDW13   6-0
ADDW14   6-0
ADDW15   6-0
ADDW2    6-0      6-0
ADDW3    6-0      6-0
ADDW4    6-0      6-0
ADDW5    6-0      6-0
ADDW6    6-0      6-0
ADDW7    6-0      6-0
ADDW8    6-0
ADDW9    6-0
ADEVCT   6-0      6-0
ADEVM    6-0      6-0
ADR     13-1     13-1#    13-1#    13-73    13-73#   13-73#   13-106   13-106#  13-106#  13-137   13-137#  13-137#  13-159   13-159#
        13-159#  13-332    13-332#  13-332#  13-524   13-524#  13-524#  13-538   13-538#  13-538#  13-549   13-549#  13-549#  13-602
        13-602#  13-602#   13-670   13-670#  13-670#  13-774   13-774#  13-774#  13-787   13-787#  13-787#  13-877   13-877#  13-877#
        13-986   13-986#   13-986#  13-:09   13-:09#  13-:09#  13-:62   13-:62#  13-:62#  13-:90   13-:90#  13-:90#  13-;10   13-;10#
        13-;10#  13-;54    13-;54#  13-;54#  13-<16   13-<16#  13-<16#  13-=15   13-=15#  13-=15#  13-=32   13-=32#  13-=32#  13-=90
        13-=90#  13-=90#   13->55   13->55#  13->55#  13-?16   13-?16#  13-?16#  13-@18   13-@18#  13-@18#  13-@79   13-@79#  13-@79#
        13-A39   13-A39#   13-A39#  13-B20   13-B20#  13-B20#  13-C03   13-C03#  13-C03#  13-D10   13-D10#  13-D10#  13-D69   13-D69#
        13-D69#  13-E28    13-E28#  13-E28#  13-F08   13-F08#  13-F08#  13-F43   13-F43#  13-F43#  13-G64   13-G64#  13-G64#  13-I14
        13-I14#  13-I14#   13-I89   13-I89#  13-I89#  13-K28   13-K28#  13-K28#  13-K74   13-K74#  13-K74#  13-L08   13-L08#  13-L08#
        13-M40   13-M40#   13-M40#  13-N00   13-N00#  13-N00#  13-N36   13-N36#  13-N36#  13-N84   13-N84#  13-N84#  13-O23   13-O23#
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CROSS REFERENCE TABLE (CREF V04.00)

	13-023#	13-053	13-053#	13-053#	13-093	13-093#	13-093#	13-P19	13-P19#	13-P19#	13-P64	13-P64#	13-P64#	13-P85
	13-P85#	13-P85#	13-Q12	13-Q12#	13-Q12#	13-Q56	13-Q56#	13-Q56#	13-R33	13-R33#	13-R33#	13-R81	13-R81#	13-R81#
	13-S32	13-S32#	13-S32#	13-S69	13-S69#	13-S69#	13-T25	13-T25#	13-T25#	13-T82	13-T82#	13-T82#	13-U00	13-U00#
	13-U00#	13-U23	13-U23#	13-U23#	13-U52	13-U52#	13-U52#	13-U81	13-U81#	13-U81#	13-V11	13-V11#	13-V11#	13-V48
	13-V48#	13-V48#	13-V86	13-V86#	13-V86#	13-W06	13-W06#	13-W06#	13-W39	13-W39#	13-W39#	13-W60	13-W60#	13-W60#
	13-X09	13-X09#	13-X09#	13-X54	13-X54#	13-X54#	13-Y24	13-Y24#	13-Y24#	13-Z01	13-Z01#	13-Z01#	13-\66	13-\66#
	13-\66#	13-_58	13-_58#	13-_58#	13-c65	13-c65#	13-c65#	13-d33	13-d33#	13-d33#	13-h32	13-h32#	13-h32#	13-l08
	13-l08#	13-l08#												
AENV	6-0	6-0												
AENVM	6-0	6-0												
AFATAL	6-0	6-0												
ALL	10-77	32-4#												
AMADR1	6-0	6-0												
AMADR2	6-0	6-0												
AMADR3	6-0	6-0												
AMADR4	6-0	6-0												
AMAMS1	6-0	6-0												
AMAMS2	6-0	6-0												
AMAMS3	6-0	6-0												
AMAMS4	6-0	6-0												
AMSGAD	6-0	6-0												
AMSGLG	6-0	6-0												
AMSGTY	6-0	6-0												
AMTYP1	6-0	6-0												
AMTYP2	6-0	6-0												
AMTYP3	6-0	6-0												
AMTYP4	6-0	6-0												
AOE	4-787#	4-798	13-688	13-717	13-N64	13-T04	13-T08	33-77	33-78	33-81	33-82	33-85	33-86	
APASS	6-0	6-0												
APE	4-973#													
APRIOR	6-0													
APTCSU	23-1	31-1#												
APTENV	23-1	25-1	31-1	31-1#										
APTSIZ	9-23	31-1#												
APTSPO	23-1	31-1	31-1#											
ASWREG	6-0	6-0												
ATA	4-767#	13-V66	13-V97	13-W18	13-W22	13-W30	13-W34	13-W51	13-W53	13-W76	13-W99	13-X31	13-X35	13-[44
	13-[46	13-^21	13-^23	13-a33	13-a35	33-58	33-59	33-60	33-63	33-64	33-67	33-68	33-69	33-70
	33-71	33-72	33-73	33-74	33-75	33-76	33-79	33-80	33-83	33-84	33-87	33-88		
ATESTN	6-0	6-0												
ATNMSK	4-804#	13-V61												
ATNTBL	9-79	9-109	10-105	11-17	13-V60	34-3#								
AUNIT	6-0	6-0												
AUSWR	6-0	6-0												
AUTSIZ	7-0#	9-65*	9-107	10-108*										
AVECT1	4-996#	6-0	6-0											
AVECT2	6-0	6-0												
BADTMO	9-3#	9-25												
BAI	4-962#													
BB00	4-889#													
BB01	4-889#													
BB02	4-889#	13-m40												
BB03	4-889#	13-m36	13-m39											
BB04	4-889#													
BB05	4-889#													
BB06	4-889#	13-\50	13-\51	13-\52	13-\53	13-\54	13-\55	13-\56	13-\57	13-\58	13-\59			

CROSS REFERENCE TABLE (CREF V04.00)

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BB07    4-889#
BB08    4-889#
BB09    4-889#
BIT0    4-700#  13-211  13-567  13-632  13-715  13-723  13-804  13-812  13-825  13-898  13-906  13-914  13-927  13-935
        13-947  13-;25  13-;68  13-;78  13-=55  13->04  13->69  13-?33  13-@33  13-@94  13-A52  13-A63  13-J33
BIT00   4-700   4-700#  4-712   4-759   4-777   4-796   4-833   4-851   4-889   4-965   4-983   24-1    24-1    25-1
        25-1
BIT01   4-700   4-700#  4-711   4-758   4-795   4-832   4-850   4-889   4-965   4-982
BIT02   4-700   4-700#  4-710   4-757   4-794   4-831   4-849   4-889   4-965   4-981
BIT03   4-700   4-700#  4-709   4-756   4-793   4-830   4-848   4-889   4-901   4-962   4-980
BIT04   4-700   4-700#  4-708   4-755   4-792   4-847   4-889   4-961
BIT05   4-700   4-700#  4-707   4-791   4-829   4-846   4-889   4-900   4-960
BIT06   4-700   4-700#  4-776   4-790   4-812   4-828   4-845   4-889   4-946   4-959   4-979
BIT07   4-700   4-700#  4-775   4-789   4-811   4-827   4-844   4-870   4-889   4-899   4-945   4-958
BIT08   4-700   4-700#  4-752   4-774   4-788   4-810   4-826   4-843   4-889   4-944   4-957   24-1
BIT09   4-700   4-700#  4-751   4-773   4-787   4-809   4-825   4-842   4-869   4-889   4-943   4-956   24-1    24-1
        25-1    25-1
BIT1    4-700#  13-256  13-579  13-646  13-745  13-835  13-957  13-;36  13-;90  13-=66  13-=73  13->15  13->80  13-?62
        13-@44  13-A04  13-A74
BIT10   4-700#  4-750   4-772   4-786   4-808   4-824   4-841   4-868   4-886   4-898   4-942   4-955   4-978   25-1
BIT11   4-700#  4-706   4-749   4-771   4-785   4-823   4-840   4-859   4-867   4-885   4-897   4-954   4-977   24-1
BIT12   4-700#  4-770   4-784   4-822   4-839   4-866   4-884   4-896   4-953   4-976
BIT13   4-700#  4-769   4-783   4-821   4-838   4-858   4-883   4-895   4-908   4-941   4-952   4-975   25-1
BIT14   4-700#  4-768   4-782   4-820   4-837   4-857   4-882   4-894   4-907   4-940   4-951   4-974   24-1
BIT15   4-700#  4-767   4-781   4-819   4-836   4-856   4-881   4-893   4-906   4-939   4-950   4-973
BIT2    4-700#
BIT3    4-700#
BIT4    4-700#
BIT5    4-700#
BIT6    4-700#
BIT7    4-700#  9-72
BIT8    4-700#
BIT9    4-700#
BLNKS1  32-33#
BLNKS2  9-123   10-34   10-48   32-32#
BLNKS3  32-31#
BLNKS4  9-83    32-30#
BOTADR  26-73*  26-91*  26-94   26-109  26-153#
BOTFLG  26-54*  26-101* 26-104  26-107* 26-154#
BPTVEC  4-700#
BSE     4-893#
BUFFER  13-S87  13-L20  43-1#   43-5
BUFONE  43-2#
BUFTWO  43-3#
CC      4-885#  13-\50  13-\51  13-\52  13-\53  13-\54  13-\55  13-\56  13-\57  13-\58  13-\59  13-_42  13-_43  13-_44
        13-_45  13-_46  13-_47  13-_48  13-_49  13-_50  13-_51  13-c43  13-c44  13-c45  13-c46  13-c48  13-c49  13-c50
        13-c51  13-c55  13-?17  13-?85  13-?86  13-m20  13-m21  13-m32  13-m80  13-m81  13-n05  13-n06  13-n07  13-n08
        13-n09  13-n10  13-n11  13-n12  13-n13  13-n14  13-n48  13-n49  13-n50  13-n51  13-n52  13-n53  13-n54
CH      4-886#  13-\50  13-\51  13-\52  13-\53  13-\54  13-\55  13-\56  13-\57  13-\58  13-\59  13-f13  13-g93  13-g94
        13-g95  13-g96  13-g98  13-g99  13-h00  13-h01  13-h05  13-l85  13-l86  13-m20  13-m21  13-m30  13-m80  13-m81
        13-n16  13-n17  13-n18  13-n19  13-n20  13-n21  13-n22  13-n23  13-n24  13-n25  13-n48  13-n49  13-n50  13-n51
        13-n52  13-n53  13-n54
CHGADR  7-0#    9-14*   9-17*   10-25   10-27*
CHRCNT  26-55*  26-78*  26-84*  26-85   26-88*  26-92   26-97*  26-108* 26-155#
CKSWR   24-1    25-1    25-1    29-1#
CLOCK   7-0#    13-K93  13-Q30  13-Y68  13-d17  13-f42  13-g14  13-h49  13-h93  13-i80  13-j43  13-k29  13-l62  15-13*
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CROSS REFERENCE TABLE (CREF V04.00)

	15-27*	15-39*												
CLR	4-960#	9-85	11-54	18-10										
CMNSTA	9-132	11-2#												
CNSL01	10-32	32-8#												
CNSL02	10-40	32-9#												
CNSL03	10-44	32-10#												
CNSL04	10-54	32-11#												
CNSL07	10-69	32-12#												
CNSL08	10-100	32-14#												
CNSL09	32-15#													
CNTCLR	13-7	13-28	13-75	13-108	13-116	13-139	13-162	13-213	13-262	13-370	13-386	13-408	13-430	13-447
	13-469	13-485	13-500	13-540	13-551	13-605	13-611	13-677	13-754	13-776	13-889	13-965	13-988	13-:21
	13-:73	13-:92	13-;13	13-;57	13-<23	13-=17	13-=23	13-=39	13-=92	13->61	13-?18	13-@20	13-@81	13-A47
	13-B29	13-C19	13-C63	13-D19	13-D29	13-D85	13-E35	13-E60	13-E84	13-F15	13-F51	13-G71	13-I21	13-I97
	13-K36	13-K80	13-L98	13-M48	13-N87	13-O30	13-O58	13-Q21	13-T33	13-T85	13-U03	13-V51	13-V88	13-W09
	13-W42	13-W66	13-Y42	16-14	18-8#									
COMMA	10-94	11-6	11-14	32-6#										
CONT	4-845#	13-J05	13-J31	13-J35										
CPSAVE	24-1	24-1	24-1	24-1*	24-1*	25-1	25-1	25-1	25-1	25-1	25-1#	25-1*	25-1*	26-172
CR	4-700#	10-81	10-92	23-1	23-1	26-76	40-98	40-147	40-148	40-149	40-150	40-151	40-152	40-153
	40-154	40-155	40-156	40-157	40-158	40-158	40-159							
CRLF	4-700#	9-6	9-28	9-28	9-42	9-53	9-59	11-30	23-1	23-1	32-4	32-7	32-8	32-9
	32-11	32-12	32-13	32-14	32-15	32-16	32-18	32-20	41-1	41-3	41-5	41-8	41-10	41-12
	41-14	41-16	41-18	41-20	41-22	41-25	41-27	41-29	43-8	43-9	43-10	43-11	43-12	43-13
	43-14	43-15	43-16	43-17	43-18	43-19	43-20	43-21	43-22	43-23	43-24	43-25	43-26	43-27
	43-28	43-29	43-30	43-31	43-32	43-33	43-34	43-35	43-36	43-37	43-38	43-39	43-40	43-41
	43-42	43-43	43-44	43-45	43-46	43-47	43-48	43-49	43-50	43-51	43-52	43-53	43-54	43-55
	43-56	43-57	43-58	43-59	43-60	43-61	43-62	43-63	43-64	43-65	43-66	43-67	43-68	43-69
	43-70	43-71	43-72	43-73	43-74	43-75	43-76	43-77	43-78	43-79	43-80	43-81	43-82	43-83
	43-84	43-85	43-86	43-87	43-88	43-89	43-90	43-91	43-92	43-93	43-94	43-95	43-96	43-97
	43-98	43-99	43-100	43-101	43-102	43-103	43-104	43-105	43-106	43-107	43-108	43-109	43-110	43-111
	43-112													
CYLMSK	4-875#	13-80												
DBCK	4-819#	13-F79	13-H10	13-I47	13-J28	13-K54	13-L18	13-L39	13-L60	13-M67	13-N13	13-N55	13-O02	13-O40
	13-O69	13-P07	13-P41	13-Q80	13-R55	13-S01	13-S46	13-S93	13-V23	13-X24	13-X72	13-X74	13-Y61	13-Z18
	13-Z24	13-Z57	13-Z67	13-Z95	13-[25	13-[37	13-[68	13-[79	13-[97	13-\41	13-\86	13-\94	13-]28	13-]38
	13-]69	13-^02	13-^14	13-^48	13-^59	13-^77	13-_26	13-_78	13-_86	13-`20	13-`30	13-`64	13-`98	13-a13
	13-a26	13-a60	13-a71	13-a89	13-b19	13-b34	13-b45	13-b60	13-b98	13-c24	13-c81	13-c92	13-d00	13-d51
	13-d61	13-d91	13-e01	13-e27	13-e54	13-e83	13-f01	13-f61	13-f71	13-g30	13-g48	13-g67	13-h65	13-i09
	13-i19	13-i26	13-i36	13-i96	13-j08	13-j59	13-j71	13-j81	13-j91	13-k45	13-k56	13-k64	13-k83	13-l96
	13-m53	13-m86												
DBEN	4-820#	4-852	13-C26	13-C31	13-C32	13-C67	13-C71	13-C72	13-D34	13-D38	13-D39	13-E06	13-E07	13-F17
	13-F53	13-F79	13-F80	13-G73	13-H10	13-H11	13-I23	13-I47	13-I48	13-I99	13-J28	13-J29	13-K38	13-K54
	13-K55	13-K82	13-L18	13-L19	13-L39	13-L40	13-L60	13-L61	13-M00	13-M50	13-M67	13-M68	13-N09	13-N13
	13-N14	13-N47	13-N55	13-N56	13-N89	13-O02	13-O03	13-O32	13-O40	13-O41	13-O60	13-O69	13-O70	13-P04
	13-P07	13-P08	13-P38	13-P41	13-P42	13-Q01	13-Q03	13-Q04	13-Q23	13-Q70	13-Q80	13-Q81	13-R48	13-R55
	13-R56	13-R97	13-S01	13-S02	13-S43	13-S46	13-S47	13-S81	13-S93	13-S94	13-S99	13-T00	13-T35	13-T43
	13-V20	13-V23	13-V24	13-V92	13-X18	13-X24	13-X25	13-X64	13-Y58	13-Y61	13-Y62	13-Z11	13-Z18	13-Z19
	13-Z24	13-Z26	13-Z27	13-Z49	13-Z57	13-Z58	13-Z63	13-Z67	13-Z68	13-Z87	13-Z95	13-Z96	13-[18	13-[25
	13-[26	13-[31	13-[32	13-[37	13-[38	13-[60	13-[68	13-[69	13-[74	13-[79	13-[80	13-[93	13-[97	13-[98
	13-\17	13-\41	13-\43	13-\77	13-\86	13-\87	13-\92	13-\94	13-\95	13-]18	13-]28	13-]29	13-]34	13-]38
	13-]39	13-]59	13-]69	13-]70	13-]93	13-^02	13-^03	13-^08	13-^09	13-^14	13-^15	13-^38	13-^48	13-^49
	13-^54	13-^59	13-^60	13-^73	13-^77	13-^78	13-^99	13-_26	13-_27	13-_69	13-_78	13-_79	13-_84	13-_86
	13-_87	13-`10	13-`20	13-`21	13-`26	13-`30	13-`31	13-`54	13-`64	13-`65	13-`89	13-`98	13-`99	13-a05
	13-a08	13-a13	13-a14	13-a20	13-a21	13-a22	13-a26	13-a27	13-a50	13-a60	13-a61	13-a66	13-a71	13-a72
	13-a85	13-a89	13-a90	13-b10	13-b19	13-b20	13-b26	13-b29	13-b34	13-b35	13-b45	13-b46	13-b56	13-b60

CROSS REFERENCE TABLE (CREF V04.00)

	13-b61	13-b82	13-b98	13-b99	13-c24	13-c25	13-c72	13-c81	13-c82	13-c87	13-c88	13-c92	13-c93	13-d00
	13-d01	13-d16	13-d42	13-d51	13-d52	13-d57	13-d61	13-d62	13-d82	13-d91	13-d92	13-d97	13-e01	13-e02
	13-e09	13-e10	13-e27	13-e28	13-e35	13-e36	13-e54	13-e55	13-e74	13-e83	13-e84	13-f01	13-f02	13-f34
	13-f61	13-f62	13-f67	13-f71	13-f72	13-f79	13-f80	13-g06	13-g30	13-g31	13-g36	13-g37	13-g48	13-g49
	13-g67	13-g68	13-h41	13-h65	13-h66	13-h85	13-i09	13-i10	13-i15	13-i19	13-i20	13-i26	13-i27	13-i32
	13-i36	13-i37	13-i44	13-i45	13-i74	13-i96	13-i97	13-j03	13-j04	13-j08	13-j09	13-j37	13-j59	13-j60
	13-j66	13-j67	13-j71	13-j72	13-j77	13-j81	13-j82	13-j87	13-j91	13-j92	13-j99	13-k00	13-k21	13-k45
	13-k46	13-k52	13-k56	13-k57	13-k64	13-k65	13-k79	13-k83	13-k84	13-k91	13-k92	13-l56	13-l96	13-l97
	13-m09	13-m10	13-m53	13-m54	13-m67	13-m68	13-m86	13-m87						
DBL	4-978#													
DCK	4-781#	4-798	13-688	13-717										
DDISP	4-700#	6-0	9-23											
DEBL	4-821#	13-A57	13-A68	13-C31	13-C71	13-D38	13-E06	13-Q03	13-S99					
DISPLA	6-0#	9-23*	9-23*	24-1*	25-1*									
DISPRE	5-1#	9-23												
DLT	4-950#													
DMD	4-833#	4-851#	4-852	13-144	13-154	13-=41	13-=48	13-=51	13-=60	13-=62	13-=64	13-=77	13-=98	13->08
	13->09	13->29	13->45	13->47	13->50	13->64	13->73	13->74	13->90	13-?06	13-?08	13-?11	13-?26	13-?54
	13-?55	13-?90	13-@08	13-@10	13-@13	13-@26	13-@37	13-@39	13-@53	13-@69	13-@71	13-@74	13-@87	13-@88
	13-@98	13-A14	13-A29	13-A31	13-A34	13-A56	13-A57	13-A58	13-A67	13-A68	13-A84	13-A98	13-B00	13-B03
	13-C20	13-C26	13-C31	13-C32	13-C66	13-C67	13-C71	13-C72	13-D33	13-D34	13-D38	13-D39	13-E02	13-E06
	13-E07	13-E36	13-E61	13-E85	13-F16	13-F17	13-F52	13-F53	13-F79	13-F80	13-G72	13-G73	13-H10	13-H11
	13-I22	13-I23	13-I47	13-I48	13-I98	13-I99	13-J28	13-J29	13-K37	13-K38	13-K54	13-K55	13-K81	13-K82
	13-K99	13-L18	13-L19	13-L39	13-L40	13-L60	13-L61	13-L99	13-M00	13-M49	13-M50	13-M67	13-M68	13-N09
	13-N13	13-N14	13-N47	13-N55	13-N56	13-N88	13-N89	13-O02	13-O03	13-O31	13-O32	13-O40	13-O41	13-O59
	13-O60	13-O69	13-O70	13-P04	13-P07	13-P08	13-P38	13-P41	13-P42	13-Q01	13-Q03	13-Q04	13-Q22	13-Q23
	13-Q70	13-Q80	13-Q81	13-R48	13-R55	13-R56	13-R97	13-S01	13-S02	13-S43	13-S46	13-S47	13-S81	13-S93
	13-S94	13-S99	13-T00	13-T34	13-T35	13-T43	13-V20	13-V23	13-V24	13-V52	13-V55	13-V89	13-V92	13-W10
	13-W16	13-W28	13-W43	13-W67	13-X18	13-X24	13-X25	13-X64	13-Y58	13-Y61	13-Y62	13-Z11	13-Z18	13-Z19
	13-Z24	13-Z26	13-Z27	13-Z49	13-Z57	13-Z58	13-Z63	13-Z67	13-Z68	13-Z87	13-Z95	13-Z96	13-[18	13-[25
	13-[26	13-[31	13-[32	13-[37	13-[38	13-[60	13-[68	13-[69	13-[74	13-[79	13-[80	13-[93	13-[97	13-[98
	13-\17	13-\41	13-\42	13-\77	13-\86	13-\87	13-\92	13-\94	13-\95	13-]18	13-]28	13-]29	13-]34	13-]38
	13-]39	13-]59	13-]69	13-]70	13-]93	13-^02	13-^03	13-^08	13-^09	13-^14	13-^15	13-^38	13-^48	13-^49
	13-^54	13-^59	13-^60	13-^73	13-^77	13-^78	13-^99	13-_26	13-_27	13-_69	13-_78	13-_79	13-_84	13-_86
	13-_87	13-`10	13-`20	13-`21	13-`26	13-`30	13-`31	13-~54	13-~64	13-~65	13-~89	13-~98	13-~99	13-a05
	13-a08	13-a13	13-a14	13-a20	13-a21	13-a22	13-a26	13-a27	13-a50	13-a60	13-a61	13-a66	13-a71	13-a72
	13-a85	13-a89	13-a90	13-b10	13-b19	13-b20	13-b26	13-b29	13-b34	13-b35	13-b45	13-b46	13-b56	13-b60
	13-b61	13-b82	13-b98	13-b99	13-c24	13-c25	13-c72	13-c81	13-c82	13-c87	13-c88	13-c92	13-c93	13-d00
	13-d01	13-d16	13-d42	13-d51	13-d52	13-d57	13-d61	13-d62	13-d82	13-d91	13-d92	13-d97	13-e01	13-e02
	13-e09	13-e10	13-e27	13-e28	13-e35	13-e36	13-e54	13-e55	13-e74	13-e83	13-e84	13-f01	13-f02	13-f34
	13-f61	13-f62	13-f67	13-f71	13-f72	13-f79	13-f80	13-g06	13-g30	13-g31	13-g36	13-g37	13-g48	13-g49
	13-g67	13-g68	13-h41	13-h65	13-h66	13-h85	13-i09	13-i10	13-i15	13-i19	13-i20	13-i26	13-i27	13-i32
	13-i36	13-i37	13-i44	13-i45	13-i74	13-i96	13-i97	13-j03	13-j04	13-j08	13-j09	13-j37	13-j59	13-j60
	13-j66	13-j67	13-j71	13-j72	13-j77	13-j81	13-j82	13-j87	13-j91	13-j92	13-j99	13-k00	13-k21	13-k45
	13-k46	13-k52	13-k56	13-k57	13-k64	13-k65	13-k79	13-k83	13-k84	13-k91	13-k92	13-l56	13-l96	13-l97
	13-m09	13-m10	13-m53	13-m54	13-m67	13-m68	13-m86	13-m87	16-15	16-16	17-14			
DPE	4-901#	13-911	13-932	13-:28										
DPEHI	4-974#													
DPELO	4-975#													
DPR	4-774#	13-U14	13-U16											
DRIVES	11-3	32-16#												
DRQ	4-859#	13-T90	13-V33											
DRVCLR	4-720#	13-G11	13-J74											
DRY	4-775#	13-G96	13-G98	13-H33	13-H38									
DSWR	4-700#	6-0	9-23											
DTE	4-784#	4-798	13-696	13-726										

CROSS REFERENCE TABLE (CREF V04.00)

CROSS REFERENCE TABLE (CREF V04.00)

EFT130 8-265 8-268 8-304 39-9#
EFT132 8-271 8-274 8-289 8-292 8-295 8-415 39-10#
EFT2 8-6 39-2#
EFT220 8-433 8-436 8-439 8-442 39-11#
EFT5 8-15 8-18 8-22 39-3#
EFT57 8-142 39-4#
EFT65 8-160 8-163 8-193 8-202 8-211 39-5#
EFT71 8-172 8-175 8-178 39-6#
EFT74 8-181 39-7#
EH1 37-1 41-1#
EH115 37-9 41-14#
EH130 37-10 41-16#
EH132 37-11 41-18#
EH142 37-12 41-20#
EH145 37-13 41-22#
EH150 37-14 41-25#
EH2 37-2 41-3#
EH213 37-15 41-27#
EH220 37-16 41-29#
EH3 37-8 41-4#
EH5 37-3 41-5#
EH57 37-5 41-8#
EH65 37-6 41-10#
EH7 37-4 41-7#
EH71 37-7 41-12#
EHT1 8-3 8-49 8-52 8-55 8-58 8-61 8-64 8-70 8-73 8-76 8-79 8-82 8-85 8-88
8-91 8-94 8-97 8-100 8-106 8-109 8-112 8-115 8-118 8-121 8-124 8-127 8-130 8-133
8-136 8-139 8-145 8-148 8-151 8-154 8-157 8-166 8-169 8-184 8-187 8-190 8-196 8-199
8-205 8-208 8-214 8-217 8-220 8-223 8-226 8-229 8-235 8-238 8-244 8-247 8-253 8-256
8-259 8-277 8-280 8-283 8-286 8-298 8-301 8-307 8-310 8-316 8-319 8-322 8-325 8-328
8-334 8-340 8-343 8-346 8-349 8-355 8-358 8-367 8-376 8-379 8-385 8-388 8-391 8-394
8-397 8-424 8-427 8-430 8-445 8-448 8-451 8-454 8-457 8-460 8-473 8-479 8-485 8-488
8-492 8-495 8-498 8-501 8-504 8-508 8-511 8-515 8-518 8-521 8-524 8-527 8-530 8-533
8-537 8-540 8-543 8-546 8-549 8-552 8-555 8-558 8-561 8-564 8-567 8-570 8-573 8-576
8-580 8-583 8-586 8-589 37-1#
EHT115 8-232 8-241 8-250 8-262 8-409 8-412 8-476 37-9#
EHT130 8-265 8-268 37-10#
EHT132 8-271 8-274 8-289 37-11#
EHT142 8-292 8-295 8-415 37-12#
EHT145 8-304 37-13#
EHT150 8-313 8-331 8-337 8-361 8-364 8-370 8-400 8-406 8-467 8-470 8-482 37-14#
EHT2 8-6 37-2#
EHT213 8-418 8-421 8-464 37-15#
EHT220 8-433 8-436 8-439 8-442 37-16#
EHT5 8-15 8-18 37-3#
EHT57 8-142 37-5#
EHT65 8-160 8-163 37-6#
EHT7 8-22 37-4#
EHT71 8-172 8-175 8-178 8-193 8-202 8-211 37-7#
EHT74 8-181 37-8#
EMS1 36-3 36-4 40-3#
EMS10 36-129 36-131 40-10#
EMS11 36-133 40-11#
EMS12 36-118 36-120 36-122 40-13#
EMS13 36-136 36-138 36-140 36-142 40-14#
EMS14 36-144 36-146 36-150 40-15#

CROSS REFERENCE TABLE (CREF V04.00)

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EMS15   36-144  36-146  36-148  36-207  36-327  36-329  36-346  36-348  36-364  36-380  36-400  40-16#
EMS16   36-151  36-153  36-155  36-337  40-17#
EMS17   36-151  36-153  36-157  40-18#
EMS2    36-8    36-187  36-211  36-239  36-243  36-248  36-259  36-339  36-344  40-4#
EMS20   36-158  36-160  36-162  36-164  36-166  36-168  36-172  40-19#
EMS21   36-158  36-160  36-164  36-166  36-168  36-170  36-350  36-366  36-382  36-402  40-20#
EMS22   36-160  36-162  36-166  36-168  40-21#
EMS23   36-173  36-175  36-179  40-22#
EMS24   36-173  36-175  36-177  36-359  36-375  36-391  36-417  40-23#
EMS25   36-180  36-182  36-186  40-24#
EMS250  36-33   36-36   36-39   36-75   36-197  36-199  36-201  36-203  36-271  36-276  36-291  36-296  36-317  40-63#
EMS251  36-41   36-44   36-47   36-302  36-313  40-64#
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EMS253  36-49   36-79   36-81   36-83   36-85   36-88   36-91   36-94   36-221  36-223  40-66#
EMS254  36-49   36-142  36-148  36-155  36-170  36-177  36-184  36-194  40-67#
EMS255  36-68   36-70   36-73   36-75   36-205  36-213  36-271  36-285  36-291  36-298  36-422  40-68#
EMS256  36-96   36-98   36-101  36-104  36-271  36-274  40-69#
EMS257  36-106  40-70#
EMS26   36-180  36-182  36-184  36-353  36-369  36-385  36-415  40-25#
EMS260  36-110  36-113  36-116  36-133  40-71#
EMS261  36-209  40-72#
EMS262  36-302  36-315  36-321  36-323  40-73#
EMS27   36-187  36-189  36-192  36-196  36-287  36-404  36-405  36-407  36-419  40-26#
EMS3    36-77   36-229  36-241  36-245  36-265  36-269  36-289  36-292  36-294  36-337  40-5#
EMS30   36-191  36-192  36-194  36-201  36-203  36-213  36-217  40-27#
EMS300  36-3    36-8    36-52   36-54   36-56   36-77   36-81   36-83   36-118  36-124  36-127  36-136  36-187  36-211
        36-239  36-243  36-248  36-259  36-271  36-274  36-276  36-339  36-344  36-422  40-75#
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EMS303  36-4    36-133  40-78#
EMS304  36-4    40-79#
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EMS317  36-17   36-19   40-89#
EMS32   36-199  40-29#
EMS320  36-21   36-23   40-90#
EMS321  36-25   36-27   40-91#
EMS322  36-29   36-31   40-92#
EMS323  36-36   36-44   36-64   36-70   36-75   36-91   36-101  36-113  40-93#
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EMS326  36-35   36-43   36-69   36-87   36-90   36-100  36-112  40-96#
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36-394 36-396 36-400 36-405 36-407 36-409 36-411 36-413 36-415 36-420 40-143#

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EMS43   36-233  40-38#
EMS44   36-239  36-241  40-39#
EMS45   36-243  36-245  40-40#
EMS46   36-248  36-250  40-41#
EMS47   36-254  36-256  36-259  36-269  40-42#
EMS5    36-108  36-309  40-7#
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        36-293  36-297  36-299  36-301  36-423  40-153#
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EMS506  36-107  40-155#
EMS507  36-109  40-156#
EMS51   36-267  36-283  40-44#
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CROSS REFERENCE TABLE (CREF V04.00)

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EMS60	36-307	40-52#										
EMS600	36-272	36-274	36-276	36-422	40-161#							
EMS601	36-279	40-162#										
EMS602	36-281	36-283	40-163#									
EMS603	36-319	40-164#										
EMS604	36-348	36-350	36-353	36-355	36-357	36-359	36-362	40-165#				
EMS605	36-364	36-366	36-369	36-371	36-373	36-375	36-378	40-166#				
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EMS62	36-313	36-315	36-317	36-319	40-54#							
EMS63	36-321	36-323	36-325	36-327	36-329	36-331	36-333	36-335	36-355	36-371	36-387	40-55#
EMS64	36-337	40-56#										
EMS65	36-339	36-342	40-57#									
EMS66	36-344	36-346	36-348	36-353	36-364	36-369	36-380	36-385	36-398	36-400	36-415	40-58#
EMS67	36-362	36-378	36-396	36-413	40-59#							
EMS7	36-126	36-127	40-9#									
EMS70	36-394	36-420	40-61#									
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EMT101	8-196	36-144#										
EMT102	8-199	36-146#										
EMT103	8-202	36-148#										
EMT104	8-205	36-151#										
EMT105	8-208	36-153#										
EMT106	8-211	36-155#										
EMT107	8-214	36-158#										
EMT11	8-28	36-19#										
EMT110	8-217	36-160#										
EMT111	8-220	36-162#										
EMT112	8-223	36-164#										
EMT113	8-226	36-166#										
EMT114	8-229	36-168#										
EMT115	8-232	36-170#										
EMT116	8-235	36-173#										
EMT117	8-238	36-175#										
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EMT120	8-241	36-177#										
EMT121	8-244	36-180#										
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EMT126	8-259	36-192#										
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EMT132	8-271	36-201#										
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EMT134	8-277	36-205#										
EMT135	8-280	36-207#										

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EMT143 8-298 36-219#
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EMT145 8-304 36-223#
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EMT214 8-421 36-305#
EMT215 8-424 36-307#
EMT216 8-427 36-309#

CROSS REFERENCE TABLE (CREF V04.00)

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EMT237 8-479 8-482 36-344#
EMT24 8-61 36-44#
EMT240 36-346#
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EMT260 8-533 36-382#
EMT261 8-537 36-385#
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EMT264 8-546 36-391#
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EMT271 8-561 36-402#
EMT272 8-564 36-405#
EMT273 8-567 36-407#
EMT274 8-570 36-409#
EMT275 8-573 36-411#
EMT276 8-576 36-413#
EMT277 8-580 36-415#
EMT3 8-9 36-6#

CROSS REFERENCE TABLE (CREF V04.00)

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ERTY02	26-43	26-159#												
ERTY03	26-45	26-160#												
ERTY04	26-144	26-161#												
ERTY05	26-31	26-162#												
ESRC	4-840#	13-b43	13-b50	13-d03	13-d08	13-k67	13-k72							
F0	4-711#													
F1	4-710#													
F2	4-709#													
F3	4-708#													
F4	4-707#													
FER	4-792#	4-798	13-688	13-717										
FMT16	4-866#	13-862	13-872	13-883	13-B37	13-B60	13-B84	13-B86	13-C92	13-C94	13-D56	13-D58	13-E15	13-E17
	13-E80	13-P97	13-T12	13-T14										
FNCDTB	13-K58	13-N19	13-N64	13-R63	33-55#									
FNCMSK	4-713#	13-F30	13-F72	13-G85	13-H13	13-I36	13-I50	13-J15						
GETBUF	7-0#													
GNS	5-1	5-1	9-6	9-28	9-42	9-53	9-59	11-30	14-20	14-20	29-1	29-1	29-1	29-1
	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1
	29-1	29-1	29-1	29-1	29-1	29-1	29-1	29-1						
GO	4-712#	13-=21	13-=25	13-C27	13-C68	13-D35	13-E05	13-F23	13-F26	13-F71	13-G80	13-G83	13-G94	13-H20
	13-H27	13-H29	13-H34	13-I30	13-I34	13-I53	13-I60	13-I62	13-J14	13-K52	13-K92	13-L16	13-L37	13-L58
	13-M63	13-N11	13-N49	13-N99	13-O38	13-O67	13-P05	13-P39	13-Q02	13-Q29	13-Q73	13-R50	13-R98	13-S44
	13-S88	13-T40	13-U30	13-U59	13-U88	13-V21	13-V95	13-X20	13-X69	13-Y59	13-Z14	13-Z52	13-Z72	13-Z90
	13-[21	13-[63	13-[86	13-[88	13-\02	13-\20	13-\82	13-]23	13-]43	13-]64	13-]98	13-^43	13-^66	13-^68
	13-^82	13-_04	13-_74	13-`15	13-`35	13-`59	13-`94	13-a55	13-a78	13-a80	13-a94	13-b15	13-b65	13-b87
	13-c77	13-d47	13-d87	13-e59	13-e79	13-f39	13-g11	13-h46	13-h90	13-i77	13-j40	13-k26	13-l18	16-19
	17-17													
GTSWR	9-28	29-1#												
HCE	4-789#	4-798	13-688	13-717	33-77	33-78	33-81	33-85	33-86					
HCI	4-868#													
HCRC	4-788#	4-798	13-688	13-717										
HELP	10-17	43-7#												
HT	4-700#	23-1	23-1	26-82										
IAE	4-786#	13-688	13-717	13-Q87	13-R62	13-R64	13-S08	13-S10	13-S53	13-S55	33-59	33-69	33-77	33-78
	33-81	33-82	33-85	33-86										
IBSAVE	25-1	25-1	25-1	25-1	25-1	25-1#	25-1*	25-1*	25-1*					
IDXMSK	4-933#													
IE	4-946#	4-979#												
ILF	4-796#	13-680	13-709	13-M29	13-N18	13-N20	33-58	33-67	33-68	33-70	33-71	33-72	33-73	33-74
	33-75	33-76	33-79	33-80	33-83	33-84	33-87	33-88						
ILF02	4-717#	13-H55	13-J62											
ILF24	4-727#	13-H70	13-J98	13-M27										
ILF26	4-728#	13-H73	13-K02											
ILF30	4-732#													
ILF32	4-732#	13-G51	13-I82	13-K10										
ILF34	4-732#	13-H76	13-K14											
ILF36	4-732#	13-H79	13-K18											
ILF40	4-732#													
ILF42	4-732#	13-H82												
ILF44	4-732#	13-H85												
ILF46	4-732#	13-H88												
ILF54	4-735#	13-H91												
ILF56	4-736#	13-H94												

CROSS REFERENCE TABLE (CREF V04.00)

CROSS REFERENCE TABLE (CREF V04.00)

	13-e55	13-e74	13-e83	13-e84	13-f01	13-f02	13-f34	13-f61	13-f62	13-f67	13-f71	13-f72	13-f79	13-f80
	13-g06	13-g30	13-g31	13-g37	13-g48	13-g49	13-g67	13-g68	13-h41	13-h65	13-h66	13-h85	13-i09	13-i10
	13-i44	13-i45	13-i74	13-i96	13-i97	13-j04	13-j08	13-j09	13-j37	13-j59	13-j60	13-j67	13-j71	13-j72
	13-j99	13-k00	13-k21	13-k45	13-k46	13-k56	13-k57	13-k64	13-k65	13-k79	13-k83	13-k84	13-k91	13-k92
	13-l56	13-l96	13-l97	13-m10	13-m53	13-m54	13-m68	13-m86	13-m87					
MOH	4-858#													
MOL	4-770#	9-99	13->00	13->11	13->13	13->32	13->36							
MR1AAA	4-852#													
MRD	4-824#													
MS	4-829#	13-a21												
MSC	4-832#	13-a20	13-a21	13-a22										
MSDRVS	10-72	32-18#												
MSE	4-906#													
MSEN	4-822#	4-852	13-a08	13-a13	13-a14	13-a20	13-a21	13-a22	13-a26	13-a27	13-b29	13-b34	13-b35	13-b45
	13-b46	13-b56	13-b60	13-b61	13-c92	13-c93	13-d00	13-d01						
MSER	4-827#	13-a39	13-a59	13-[93	13-[97	13-[98	13-^73	13-^77	13-^78	13-a85	13-a89	13-a90	13-i32	13-i36
	13-i37													
MSGDRV	11-62	32-19#												
MSHELP	10-11	32-7#												
MUR	4-825#	4-852	13->09	13->34	13-F17	13-F53	13-F79	13-F80	13-G73	13-H10	13-H11	13-I23	13-I47	13-I48
	13-I99	13-J28	13-J29	13-K38	13-K54	13-K55	13-L18	13-L19	13-L39	13-L40	13-L60	13-L61	13-M00	13-M50
	13-M67	13-M68	13-N09	13-N13	13-N14	13-N47	13-N55	13-N56	13-N89	13-O02	13-O03	13-O32	13-O40	13-O41
	13-O60	13-O69	13-O70	13-P04	13-P07	13-P08	13-P38	13-P41	13-P42	13-Q01	13-Q03	13-Q04	13-Q70	13-Q80
	13-Q81	13-R48	13-R55	13-R56	13-R97	13-S01	13-S02	13-S43	13-S46	13-S47	13-S81	13-S93	13-S94	13-S99
	13-T00	13-T35	13-T43	13-V20	13-V23	13-V24	13-V55	13-V92	13-W16	13-X18	13-X24	13-X25	13-X64	13-Y58
	13-Y61	13-Y62	13-Z11	13-Z18	13-Z19	13-Z49	13-Z57	13-Z58	13-Z63	13-Z67	13-Z68	13-Z87	13-Z95	13-Z96
	13-[18	13-[25	13-[26	13-[31	13-[32	13-[37	13-[38	13-[60	13-[68	13-[69	13-[74	13-[79	13-[80	13-[93
	13-[97	13-[98	13-\17	13-\41	13-\42	13-\77	13-\86	13-\87	13-]18	13-]28	13-]29	13-]34	13-]38	13-]39
	13-]59	13-]69	13-]70	13-]93	13-^02	13-^03	13-^08	13-^09	13-^14	13-^15	13-^38	13-^48	13-^49	13-^54
	13-^59	13-^60	13-^73	13-^77	13-^78	13-^99	13-_26	13-_27	13-_69	13-_78	13-_79	13-`10	13-`20	13-`21
	13-`26	13-`30	13-`31	13-`54	13-`64	13-`65	13-~89	13-~98	13-~99	13-a05	13-a08	13-a13	13-a14	13-a20
	13-a21	13-a22	13-a26	13-a27	13-a50	13-a60	13-a61	13-a66	13-a71	13-a72	13-a85	13-a89	13-a90	13-b10
	13-b19	13-b20	13-b26	13-b29	13-b34	13-b35	13-b45	13-b46	13-b56	13-b60	13-b61	13-b82	13-b98	13-b99
	13-c24	13-c25	13-c72	13-c81	13-c82	13-c87	13-c88	13-c92	13-c93	13-d00	13-d01	13-d16	13-d42	13-d5i
	13-d52	13-d82	13-d91	13-d92	13-d97	13-e01	13-e02	13-e09	13-e10	13-e27	13-e28	13-e35	13-e36	13-e54
	13-e55	13-e74	13-e83	13-e84	13-f01	13-f02	13-f34	13-f61	13-f62	13-f67	13-f71	13-f72	13-f79	13-f80
	13-g06	13-g30	13-g31	13-g36	13-g37	13-g48	13-g49	13-g67	13-g68	13-h41	13-h65	13-h66	13-h85	13-i09
	13-i10	13-i15	13-i19	13-i20	13-i26	13-i27	13-i32	13-i36	13-i37	13-i44	13-i45	13-i74	13-i96	13-i97
	13-j03	13-j04	13-j08	13-j09	13-j37	13-j59	13-j60	13-j66	13-j67	13-j71	13-j72	13-j77	13-j81	13-j82
	13-j87	13-j91	13-j92	13-j99	13-k00	13-k21	13-k45	13-k46	13-k52	13-k56	13-k57	13-k64	13-k65	13-k79
	13-k83	13-k84	13-k91	13-k92	13-l56	13-l96	13-l97	13-m09	13-m10	13-m53	13-m54	13-m67	13-m68	13-m86
	13-m87	16-16	17-14											
MWD	4-848#													
MWP	4-830#	13->74	13->95	13-Y04	13-Y12	13-Y16								
MXF	4-956#													
N	10-19	32-28#												
NDTMSK	4-798#													
NED	4-953#	9-88	13-9	13-25	13-30	13-44								
NEM	4-954#													
NONE	11-7	32-17#												
NOP	4-716#	13-G03	13-G07	13-J58										
NOTAVL	9-106	32-25#												
NOTPRS	9-103	32-24#												
NOTRM	9-97	32-22#												
NSA	4-856#													
OCC	4-836#	13-L65	13-M17	13-N62	13-N66									

CROSS REFERENCE TABLE (CREF V04.00)

CROSS REFERENCE TABLE (CREF V04.00)

```
RECAL    4-719#  13-H61  13-J70  13-Z14  13-Z52  13-Z90  13-[21  13-[63  13-\20
RESREG  26-148   29-1#
RESVEC   4-700#
REX      4-839#  13-Y44  13-Y70  13-Y75
RG       4-837#  13-Q33  13-Q51  13-e90  13-e92  13-f44  13-f49  13-g16  13-g21  13-h51  13-h56  13-h95  13-i00  13-i82
        13-i87   13-j45  13-j50  13-k31  13-k36  13-l64  13-l69
RGDTPT  35-3#
RH       4-742#  13-G55  13-R16
RIP      4-724#  13-G27  13-J90  13-L37  13-M89  13-N99  13-038  13-067  13-Y15
RLEASE   4-721#  13-G19  13-I76  13-J78  13-U30  13-U59  13-U88  13-V21
RMAS     4-916#  13-58   13-390* 13-T68  13-U67* 13-V62* 13-V76  13-V82  13-W13* 13-W27* 13-W46* 13-W69* 13-W95
RMASI    7-0#
RMASO    7-0#
RMBA     4-989#  13-54   13-S87* 13-l53*
RMBAE    4-992#
RMBAEI   7-0#    13-<99* 13-=00*
RMBAEO   7-0#
RMBAI    7-0#
RMBAO    7-0#    13-l20* 13-l53
RMCS1    4-912#   4-987#  9-90   13-78*  13-85   13-111* 13-119  13-165* 13-172* 13-180  13-222* 13-230  13-433* 13-541
        13-609*  13-612  13-617  13-623* 13-624* 13-625  13-630  13-636* 13-637* 13-638  13-644  13-656* 13-657* 13-658
        13-664   13-:78  13-<98* 13-=21* 13-=24  13-C27* 13-C68* 13-D35* 13-E05* 13-F24* 13-F25  13-F73* 13-G81* 13-G82
        13-H12   13-I32* 13-I33  13-I49  13-J16* 13-K53* 13-K92* 13-L16* 13-L37* 13-L58* 13-M27* 13-M64* 13-N12* 13-N50*
        13-N99*  13-038* 13-067* 13-P05* 13-P39* 13-Q02* 13-Q31* 13-Q74* 13-R51* 13-R98* 13-S44* 13-S88* 13-T40* 13-U04
        13-U30*  13-U38  13-U59* 13-U88* 13-V21* 13-V95* 13-X01  13-X21* 13-X70* 13-Y59* 13-Z14* 13-Z52* 13-Z71  13-Z90*
        13-[21*  13-[63* 13-[85  13-\01  13-\20* 13-\82* 13-]23* 13-]42  13-]64* 13-]98* 13-^43* 13-^65  13-^81  13-_04*
        13-_74*  13-`15* 13-`34  13-`59* 13-`94* 13-a55* 13-a77  13-a93  13-b15* 13-b64  13-b87* 13-c77* 13-d47* 13-d87*
        13-e58   13-e79* 13-f39* 13-g11* 13-h46* 13-h90* 13-i77* 13-j40* 13-k26* 13-l59* 16-19*  17-17*
RMCS1I   7-0#    13-85*  13-93*  13-119* 13-124* 13-126  13-180* 13-189* 13-193* 13-199  13-230* 13-238* 13-243
RMCS1O   7-0#    13-l18* 13-l59
RMCS2    4-990#   9-85*   9-86*   9-88   11-54*  11-55*  13-8    13-15   13-25   13-29   13-36   13-44   13-56   13-:37*
        13-<42   18-10*  18-12*
RMCS2I   7-0#
RMCS2O   7-0#    13-:13* 13-:14* 13-:37  13-:43  13-:52  13-:55*
RMCS3    4-993#
RMCS3I   7-0#
RMCS3O   7-0#
RMDA     4-913#  13-79*  13-86   13-166* 13-173* 13-181  13-217* 13-223* 13-231  13-265* 13-272  13-387* 13-393  13-409*
        13-415   13-470* 13-474  13-487* 13-491  13-506* 13-560* 13-561* 13-571* 13-572* 13-587* 13-588* 13-:95* 13-:97*
        13-:99   13-;16* 13-;17* 13-;18  13-;23  13-;27* 13-;28* 13-;29  13-;34  13-;41* 13-;42* 13-;43  13-;48  13-B32*
        13-C06   13-C23* 13-C33  13-C65* 13-C75  13-D32* 13-D87* 13-N94* 13-008  13-063* 13-075  13-079  13-P98* 13-Q65*
        13-R43*  13-R93* 13-S40* 13-S85* 13-T74  13-U96* 13-W98  13-Y56* 13-\78* 13-]19* 13-]60* 13-]94* 13-^39* 13-_00*
        13-_70*  13-`11* 13-`55* 13-`90* 13-a51* 13-b11* 13-b83* 13-c76* 13-d45* 13-d85* 13-e77* 13-f37* 13-g09* 13-h44*
        13-h89*  13-i66* 13-j30* 13-k24* 13-l43*
RMDAI    7-0#    13-86*  13-95   13-181* 13-194* 13-200  13-231* 13-244  13-272* 13-281  13-393* 13-396  13-415* 13-418
        13-474*  13-476  13-491* 13-494  13-:99* 13-;01
RMDAO    7-0#    13-C54* 13-C65  13-C87* 13-C89* 13-D16* 13-D17* 13-D32  13-D59* 13-D65* 13-D75* 13-D76* 13-D87  13-E18*
        13-E24*  13-P87* 13-P88* 13-P98  13-R83* 13-R84* 13-R93  13-S13  13-S19  13-S21* 13-S22  13-S24* 13-S26* 13-S27
        13-S72*  13-S73* 13-S85  13-T15* 13-T21* 13-l15* 13-l16* 13-l43  13-m45
RMDB     4-991#  13-60
RMDBI    7-0#
RMDBO    7-0#
RMDC     4-922#  13-80*  13-87   13-176* 13-184  13-219* 13-225* 13-233  13-267* 13-274  13-372* 13-376  13-432* 13-436
        13-450*  13-456  13-488* 13-502* 13-508  13-:96* 13-:98* 13-;00  13-;60  13-;63* 13-;64  13-;72* 13-;73* 13-;74
        13-;82*  13-;83* 13-;84  13-<00* 13-<01* 13-<04  13-D14  13-D21* 13-D40  13-D86* 13-N95* 13-O11  13-O64* 13-O84
        13-O88   13-P01* 13-P76* 13-Q66* 13-R44* 13-R92* 13-S39* 13-S84* 13-Y57* 13-\79* 13-]20* 13-]61* 13-]95* 13-^40*
```

CROSS REFERENCE TABLE (CREF V04.00)

	13- 01*	13- 71*	13-`12*	13-`56*	13-`91*	13-a52*	13-b12*	13-b84*	13-c75*	13-d46*	13-d86*	13-e78*	13-f38*	13-g10*
	13-h45*	13-h88*	13-i67*	13-j31*	13-k25*	13-l44*								
RMDCI	7-0#	13-87*	13-97*	13-184*	13-191*	13-197*	13-203	13-?33*	13-240*	13-246	13-274*	13-291	13-376*	13-379*
	13-380	13-436*	13-440*	13-441	13-456*	13-462*	13-463	13-508*	13-512	13-513	13-;00*	13-;03*	13-;04	
RMDCO	7-0#	13-S34*	13-S39	13-S58	13-S64*	13-S65	13-l14*	13-l44	13-l92					
RMDS	4-914#	9-87	9-99	13-472*	13-504*	13-=94	13-=99	13->10	13->22	13->31	13->59	13->65	13->75	13->92
	13-a84	13-a89	13-a99	13-A16	13-D72	13-D90	13-E08	13-E31	13-E39	13-E49	13-E65	13-E90	13-G97	13-H02
	13-H37	13-H40	13-L22	13-L29	13-L43	13-L50	13-M05	13-M06	13-M11	13-M43	13-M53	13-M71	13-096	13-P13
	13-P22	13-P47	13-P67	13-P77	13-P90	13-Q05	13-T87	13-T96	13-U13	13-U18	13-U41	13-U70	13-U99	13-V65
	13-V69	13-V96	13-W01	13-W17	13-W21	13-W29	13-W33	13-W50	13-W55	13-W75	13-W82	13-X30	13-X34	13-[43
	13-[48	13-^20	13-^25	13-a32	13-a37	16-20	16-24	17-18	17-23					
RMDSI	7-0#													
RMDSO	7-0#													
RMDT	4-919#	9-93	9-95	13-451*	13-526	13-532	13-T86	13-V29	26-26					
RMDTI	7-0#													
RMDTO	7-0#													
RMEC1	4-926#	13-453*												
RMEC1I	7-0#													
RMEC1O	7-0#													
RMEC2	4-927#	13-62	13-414*	13-<53										
RMEC2I	7-0#													
RMEC2O	7-0#													
RMER1	4-915#	13-112*	13-120	13-142*	13-147	13-167*	13-174*	13-182	13-226*	13-234	13-268*	13-275	13-371*	13-375
	13-431*	13-435	13-448*	13-454	13-486*	13-490	13-505*	13-675*	13-678	13-684	13-692	13-700	13-705*	13-706*
	13-707	13-713	13-721	13-730	13-736*	13-737*	13-738	13-743	13-755*	13-756	13-767	13-:22	13-:27	13-:39
	13-<24	13-<29	13-<59	13-?28*	13-?38	13-?43	13-?71	13-?76	13-C21*	13-E03*	13-E37*	13-E47*	13-E62*	13-E64*
	13-E86*	13-F18*	13-F54*	13-G74*	13-I24*	13-J00*	13-K39*	13-K83*	13-L15*	13-L36*	13-L57*	13-M01*	13-M28	13-M32
	13-M51*	13-N17	13-N24	13-N90*	13-O33*	13-O61*	13-O62*	13-Q24*	13-Q86	13-R61	13-R68	13-S07	13-S12	13-S52
	13-S57	13-T03	13-T07	13-T28	13-T36*	13-T46	13-V53*	13-V90*	13-W11*	13-W44*	13-W49*	13-W68*	13-X80	13-X86
	13-Y67*	13-Z12*	13-Z32	13-Z37	13-Z50*	13-Z88*	13-[01	13-[05	13-[19*	13-[6.*	13-\18*	13-\80*	13-]00	13-]05
	13-]21*	13-]62*	13-]75	13-]79	13-]96*	13-^41*	13- 02*	13- 72*	13- 92	13- 97	13-`13*	13-`57*	13-`70	13-`74
	13-`92*	13-a53*	13-b13*	13-b85*	13-c73*	13-d18	13-d26	13-d43*	13-d65	13-d70	13-d83*	13-e75*	13-f35*	13-g07*
	13-h42*	13-h69	13-h74	13-h86*	13-i75*	13-j14	13-j19	13-j38*	13-k22*	13-l57*	16-17*	17-15*		
RMER1I	7-0#	13-120*	13-128	13-147*	13-150*	13-182*	13-195*	13-201	13-234*	13-247	13-275*	13-297	13-375*	13-377
	13-435*	13-437*	13-438	13-454*	13-457	13-490*	13-492	13-678*	13-679	13-687	13-695	13-707*	13-708	13-716
	13-725													
RMER1O	7-0#	13-L10*	13-L15	13-L25	13-L36	13-L46	13-L57	13-L67	13-L77	13-L86*				
RMER2	4-925#	13-113*	13-121	13-143*	13-148	13-169*	13-177*	13-185	13-227*	13-235	13-269*	13-276	13-389*	13-395
	13-411*	13-417	13-452*	13-471*	13-475	13-489*	13-503*	13-509	13-881	13-887*	13-891	13-918*	13-919*	13-920
	13-939*	13-940*	13-941	13-967*	13-968	13-:23	13-?21	13-?27*	13-?29	13-?56	13-?60	13-?91*	13-?93	13-a02
	13-a23	13-a27*	13-a28	13-a38*	13-a40	13-a54*	13-a56	13-C22*	13-E04*	13-E38*	13-E48*	13-E63*	13-E87*	13-E88*
	13-F19*	13-F55*	13-G75*	13-I25*	13-J01*	13-K31	13-K40*	13-K41	13-K56	13-K77	13-K84*	13-K85	13-L00	13-M02*
	13-M52*	13-N91*	13-O34*	13-Q25*	13-T37*	13-V54*	13-V91*	13-W12*	13-W45*	13-Z13*	13-Z51*	13-Z89*	13-[20*	13-[62*
	13-\19*	13-\81*	13-]22*	13-]63*	13-]97*	13-^42*	13- 03*	13- 73*	13-`14*	13-`58*	13-`93*	13-a54*	13-b14*	13-b86*
	13-c74*	13-d44*	13-d84*	13-e76*	13-f36*	13-g08*	13-h43*	13-h87*	13-i76*	13-j39*	13-k23*	13-l58*	16-18*	17-16*
RMER2I	7-0#	13-121*	13-125*	13-130	13-148*	13-152*	13-185*	13-192*	13-198*	13-204	13-235*	13-241*	13-248	13-276*
	13-301	13-395*	13-401*	13-402	13-417*	13-423*	13-424	13-475*	13-478*	13-479	13-509*	13-515*	13-516	13-891*
	13-894	13-902	13-910	13-920*	13-923	13-931	13-941*	13-943	13-951	13-:23*	13-:28			
RMER2O	7-0#													
RMHR	4-923#	13-374*	13-413*	13-554	13-562	13-573	13-589	13-:38*	13-:74*	13-:77				
RMHRI	7-0#	13-:77*												
RMHRO	7-0#	13-:15*	13-:17*	13-:38	13-:50	13-:57*	13-:65*	13-:71*	13-:74	13-:86	42-6			
RMLA	4-917#	13-412*												
RMLAI	7-0#													
RMLAO	7-0#													
RMMR1	4-918#	13-144*	13-149	13-373*	13-=35	13-=40	13-=48*	13-=49*	13-=50	13-=59*	13-=60*	13-=61	13-=74*	13-=75*

CROSS REFERENCE TABLE (CREF V04.00)

13-=76	13-=98*	13->08*	13->09*	13->29*	13->30*	13->64*	13->73*	13->74*	13->90*	13->91*	13-?26*	13-?54*	13-?55*
13-?90*	13-?92*	13-a26*	13-a37*	13-a39*	13-a53*	13-a55*	13-a87*	13-a88*	13-a98*	13-A14*	13-A15*	13-A43	13-A48
13-A56*	13-A57*	13-A58*	13-A59	13-A67*	13-A68*	13-A69	13-A84*	13-A85*	13-A86	13-B24	13-B33	13-C20*	13-C26*
13-C31*	13-C32*	13-C66*	13-C67*	13-C71*	13-C72*	13-D33*	13-D34*	13-D38*	13-D39*	13-E02*	13-E06*	13-E07*	13-E36*
13-E61*	13-E85*	13-F16*	13-F17*	13-F52*	13-F53*	13-F79*	13-F80*	13-G72*	13-G73*	13-H10*	13-H11*	13-I22*	13-I23*
13-I47*	13-I48*	13-I92	13-I98*	13-I99*	13-J04	13-J28*	13-J29*	13-J30	13-K37*	13-K38*	13-K54*	13-K55*	13-K81*
13-K82*	13-K99*	13-L18*	13-L19*	13-L39*	13-L40*	13-L60*	13-L61*	13-L64	13-L71	13-L99*	13-M00*	13-M16	13-M20
13-M49*	13-M50*	13-M67*	13-M68*	13-N09*	13-N13*	13-N14*	13-N47*	13-N55*	13-N56*	13-N61	13-N71	13-N88*	13-N89*
13-O02*	13-O03*	13-O31*	13-O32*	13-O40*	13-O41*	13-O59*	13-O60*	13-O69*	13-O70*	13-P04*	13-P07*	13-P08*	13-P38*
13-P41*	13-P42*	13-Q01*	13-Q03*	13-Q04*	13-Q17	13-Q22*	13-Q23*	13-Q32	13-Q70*	13-Q80*	13-Q81*	13-R48*	13-R55*
13-R56*	13-R97*	13-S01*	13-S02*	13-S43*	13-S46*	13-S47*	13-S81*	13-S93*	13-S94*	13-S99*	13-T00*	13-T34*	13-T35*
13-T71	13-V20*	13-V23*	13-V24*	13-V52*	13-V55*	13-V89*	13-V92*	13-W10*	13-W16*	13-W28*	13-W43*	13-W67*	13-X18*
13-X24*	13-X25*	13-X65*	13-X73*	13-X75*	13-Y43	13-Y47	13-Y58*	13-Y61*	13-Y62*	13-Y69	13-Y77	13-Z11*	13-Z18*
13-Z19*	13-Z24*	13-Z26*	13-Z27*	13-Z49*	13-Z57*	13-Z58*	13-Z63*	13-Z67*	13-Z68*	13-Z87*	13-Z95*	13-Z96*	13-[18*
13-[25*	13-[26*	13-[31*	13-[32*	13-[37*	13-[38*	13-[60*	13-[68*	13-[69*	13-[74*	13-[79*	13-[80*	13-[93*	13-[97*
13-[98*	13-\17*	13-\41*	13-\42*	13-\77*	13-\86*	13-\87*	13-\92*	13-\94*	13-\95*	13-]18*	13-]28*	13-]29*	13-]34*
13-]38*	13-]39*	13-]59*	13-]69*	13-]70*	13-]93*	13-^02*	13-^03*	13-^08*	13-^09*	13-^14*	13-^15*	13-^38*	13-^48*
13-^49*	13-^54*	13-^59*	13-^60*	13-^73*	13-^77*	13-^78*	13-^99*	13-_26*	13-_27*	13-_69*	13-_78*	13-_79*	13-_84*
13-_86*	13-_87*	13-`10*	13-`20*	13-`21*	13-`26*	13-`30*	13-`31*	13-~54*	13-~64*	13-~65*	13-~89*	13-~98*	13-~99*
13-a05*	13-a08*	13-a13*	13-a14*	13-a20*	13-a21*	13-a22*	13-a26*	13-a27*	13-a50*	13-a60*	13-a61*	13-a66*	13-a71*
13-a72*	13-a85*	13-a89*	13-a90*	13-b10*	13-b19*	13-b20*	13-b26*	13-b29*	13-b34*	13-b35*	13-b42	13-b45*	13-b46*
13-b52	13-b56*	13-b60*	13-b61*	13-b82*	13-b98*	13-b99*	13-c24*	13-c25*	13-c72*	13-c81*	13-c82*	13-c87*	13-c88*
13-c92*	13-c93*	13-d00*	13-d01*	13-d02	13-d10	13-d16*	13-d42*	13-d51*	13-d52*	13-d57*	13-d61*	13-d62*	13-d82*
13-d91*	13-d92*	13-d97*	13-e01*	13-e02*	13-e09*	13-e10*	13-e11	13-e19	13-e27*	13-e28*	13-e35*	13-e36*	13-e42
13-e47	13-e54*	13-e55*	13-e74*	13-e83*	13-e84*	13-e89	13-e94	13-f01*	13-f02*	13-f34*	13-f43	13-f51	13-f61*
13-f62*	13-f67*	13-f71*	13-f72*	13-f79*	13-f80*	13-f81	13-f89	13-g06*	13-g15	13-g23	13-g30*	13-g31*	13-g36*
13-g37*	13-g48*	13-g49*	13-g67*	13-g68*	13-h41*	13-h50	13-h58	13-h65*	13-h66*	13-h85*	13-h94	13-i02	13-i09*
13-i10*	13-i15*	13-i19*	13-i20*	13-i26*	13-i27*	13-i32*	13-i36*	13-i37*	13-i44*	13-i45*	13-i46	13-i54	13-i74*
13-i81	13-i89	13-i96*	13-i97*	13-j03*	13-j04*	13-j08*	13-j09*	13-j37*	13-j44	13-j52	13-j59*	13-j60*	13-j66*
13-j67*	13-j71*	13-j72*	13-j77*	13-j81*	13-j82*	13-j87*	13-j91*	13-j92*	13-j99*	13-k00*	13-k01	13-k09	13-k21*
13-k30	13-k38	13-k45*	13-k46*	13-k52*	13-k56*	13-k57*	13-k64*	13-k65*	13-k66	13-k74	13-k79*	13-k83*	13-k84*
13-k91*	13-k92*	13-k95	13-l03	13-l56*	13-l63	13-l71	13-l96*	13-l97*	13-m09*	13-m10*	13-m53*	13-m54*	13-m67*
13-m68*	13-m86*	13-m87*	16-15*	16-16*	17-14*								
RMMR1I	7-0#	13-149*	13-154	13-B33*	13-B34	13-B57							
RMMR10	7-0#												
RMMR2	4-924#	13-392*	13-F46	13-F59	13-F85	13-U33	13-U44	13-U48	13-U62	13-U73	13-U77	13-U91	13-V02	13-V06
	13-V30	13-V44	13-\24	13-\30	13-_08	13-_15	13-c06	13-c13	13-f05	13-f21	13-g57	13-g86	13-l79	13-m02
	13-m14	13-m60	13-m72	13-m92										
RMMR2I	7-0#													
RMMR20	7-0#													
RMOF	4-921#	13-81*	13-81*	13-88	13-168*	13-168*	13-175*	13-183	13-218*	13-224*	13-224*	13-232	13-266*	13-266*
	13-273	13-388*	13-388*	13-394	13-410*	13-410*	13-416	13-449*	13-449*	13-455	13-473*	13-473*	13-501*	13-501*
	13-507	13-777*	13-777*	13-778	13-783	13-791	13-795*	13-795*	13-796*	13-797	13-816*	13-817*	13-817*	13-818
	13-844*	13-845*	13-845*	13-846	13-861*	13-863*	13-863*	13-864	13-890*	13-966*	13-B30*	13-B31	13-C24*	13-C25
	13-C64*	13-D00*	13-D31	13-D88*	13-D89	13-E89*	13-N96*	13-N96*	13-014	13-026	13-035*	13-035*	13-046	13-P29*
	13-P55	13-P60	13-P97*	13-Q67*	13-R45*	13-R94*	13-S82*	13-S83	13-l45*					
RMOFI	7-0#	13-88*	13-99*	13-183*	13-190*	13-196*	13-202	13-232*	13-239*	13-245	13-273*	13-285	13-394*	13-398*
	13-399	13-416*	13-420*	13-421	13-455*	13-459*	13-460	13-507*	13-510*	13-797*	13-800	13-808	13-818*	13-821
	13-829													
RMOFO	7-0#	13-883*	13-890	13-966	13-B25*	13-B30	13-B37	13-B39	13-B60	13-B62	13-B84	13-B86*	13-B90	13-B92*
	13-C07*	13-C24	13-C64	13-C92	13-C94*	13-C98	13-D00*	13-D15*	13-D30	13-D56	13-D58*	13-D62	13-D64*	13-D74*
	13-D88	13-E15	13-E17*	13-E21	13-E23*	13-E80*	13-E89	13-S71*	13-S82	13-T12	13-T14*	13-T18	13-T20*	13-l17*
	13-l27*	13-l45	13-m37											
RMR	4-794#	13-680	13-709	13-T47	13-T52	13-T75	13-Y96							
RMSN	4-920#	13-391*	13-434*	13-990	13-994	13-998								
RMSNI	7-0#													

CROSS REFERENCE TABLE (CREF V04.00)

```
RMSNO    7-0#
RMWC     4-988#  13-52   13-S86*  13-L52*
RMWCI    7-0#
RMWCO    7-0#    13-L19*  13-L52
RQA      4-881#  13-U34   13-U45   13-U63   13-U74   13-U92   13-V03   13-V31   13-V35   13-\25   13-_09   13-c07   13-f13   13-g58
        13-L90   13-m28
RQB      4-882#  13-U34   13-U45   13-U63   13-U74   13-U92   13-V03   13-V31   13-V37   13-\25   13-_09   13-c07   13-f13   13-g58
        13-L90   13-m28
RTC      4-723#  13-H67   13-J86   13-P39   13-X50
SA1      4-759#
SA16     4-755#
SA2      4-758#
SA4      4-757#
SA8      4-756#
SADMSK   4-763#
SAVREG  26-13    29-1#
SC       4-939#
SC0      4-812#
SC1      4-811#
SC2      4-810#
SC3      4-809#
SC4      4-808#
SCOPE    4-700#  13-1     13-73    13-106   13-137   13-159   13-332   13-524   13-538   13-549   13-602   13-670   13-774   13-787
        13-877   13-986   13-:09   13-:62   13-:90   13-;10   13-;54   13-<16   13-=15   13-=32   13-=90   13->55   13-?16   13-@18
        13-@79   13-A39   13-B20   13-C03   13-D10   13-D69   13-E28   13-F08   13-F43   13-G64   13-I14   13-I89   13-K28   13-K74
        13-L08   13-M40   13-N00   13-N36   13-N84   13-O23   13-O53   13-O93   13-P19   13-P64   13-P85   13-Q12   13-Q56   13-R33
        13-R81   13-S32   13-S69   13-T25   13-T82   13-U00   13-U23   13-U52   13-U81   13-V11   13-V48   13-V86   13-W06   13-W39
        13-W60   13-X09   13-X54   13-Y24   13-Z01   13-\66   13-_58   13-c65   13-d33   13-h32   13-l08   14-9
SCTMSK   4-814#
SEARCH   4-729#  13-G43   13-I79   13-K06   13-R04   13-R98   13-S44   13-_74   13-`15   13-`59   13-`94   13-a55   13-b15   13-b87
        13-c77
SEEK     4-718#  13-H58   13-J66   13-R07   13-\82   13-]23   13-]64   13-]98   13-^43   13-_04
SETOM   13-P31   13-P72   13-P95   13-i69   13-j33   13-l47   17-13#
SETVV   13-N04   13-N42   13-O99   13-P24   13-P35   13-P69   13-P92   13-Q60   13-R37   13-R86   13-S36   13-S78   13-U25   13-U54
        13-U83   13-V15   13-X13   13-X58   13-Y51   13-Z06   13-Z44   13-Z82   13-[13   13-[55   13-\12   13-\71   13-]12   13-]53
        13-]87   13-^32   13-^93   13-_63   13-`04   13-`48   13-`83   13-a44   13-b04   13-b76   13-c67   13-d37   13-d77   13-e69
        13-f29   13-g01   13-h36   13-h80   13-i61   13-j25   13-k16   13-l38   16-13#
SHUT    27-1     27-1     27-3#
SIZCLK  11-28    15-5#
SKI      4-894#  13-152   13-969   13-971   13-a29   13-a41   13-a43   13-a57   13-a61
SNGPRT   4-861#  15-527
SSE      4-900#
SSEI     4-869#  13-849   13-B39   13-B62   13-B90   13-B92   13-C98   13-D00   13-D62   13-D64   13-E21   13-E23   13-T18   13-T20
SSF      4-908#
STACK    4-700#   9-23    13-1     13-73    13-106   13-137   13-159   13-332   13-524   13-538   13-549   13-602   13-670   13-774
        13-787   13-877   13-986   13-:09   13-:62   13-:90   13-;10   13-;54   13-<16   13-=15   13-=32   13-=90   13->55   13-?16
        13-@18   13-@79   13-A39   13-B20   13-C03   13-D10   13-D69   13-E28   13-F08   13-F43   13-G64   13-I14   13-I89   13-K28
        13-K74   13-L08   13-M40   13-N00   13-N36   13-N84   13-O23   13-O53   13-O93   13-P19   13-P64   13-P85   13-Q12   13-Q56
        13-R33   13-R81   13-S32   13-S69   13-T25   13-T82   13-U00   13-U23   13-U52   13-U81   13-V11   13-V48   13-V86   13-W06
        13-W39   13-W60   13-X09   13-X54   13-Y24   13-Z01   13-\66   13-_58   13-c65   13-d33   13-h32   13-l08
STANDA   9-67    10-3#
START    5-1      9-17#   11-33    11-42    27-5
START1   5-3      9-14#
START2   9-15     9-18#
STKLMT   4-700#
STOPCL   7-0#    13-K96   13-Q38   13-Q43   13-Y74   13-Y84   13-d23   13-d29   13-f48   13-f54   13-g20   13-g26   13-h55   13-h61
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CROSS REFERENCE TABLE (CREF V04.00)

	13-h99	13-i05	13-i86	13-i92	13-j49	13-j55	13-k35	13-k41	13-l68	13-l74	15-14*	15-28*		
SW0	4-700#													
SW00	4-700	4-700#												
SW01	4-700	4-700#												
SW02	4-700	4-700#												
SW03	4-700	4-700#												
SW04	4-700	4-700#												
SW05	4-700	4-700#												
SW06	4-700	4-700#												
SW07	4-700	4-700#												
SW08	4-700	4-700#												
SW09	4-700	4-700#												
SW1	4-700#													
SW10	4-700#													
SW11	4-700#													
SW12	4-700#													
SW13	4-700#	26-14												
SW14	4-700#													
SW15	4-700#													
SW2	4-700#													
SW3	4-700#													
SW4	4-700#													
SW5	4-700#													
SW6	4-700#													
SW7	4-700#													
SW8	4-700#													
SW9	4-700#													
SWR	6-0#	9-23	9-23	9-23*	9-23*	9-23*	9-28	24-1	24-1	24-1	24-1	24-1	24-1	24-1*
	24-1*	24-1*	24-1*	25-1	25-1	25-1	25-1	25-1	26-14	27-1	27-1	27-1*	30-1	30-1*
SWREG	5-1#	9-23	9-28	27-1	27-1	27-1								
SYSTAT	9-77	32-20#												
TA1	4-752#	11-56	13-C55	13-g78										
TA2	4-751#													
TA4	4-750#	11-56												
TA8	4-749#	11-56												
TADMSK	4-762#													
TAG	4-883#	13-\52	13-\53	13-\54	13-\55	13-\56	13-\57	13-_44	13-_45	13-_46	13-_47	13-_48	13-_49	13-c45
	13-c46	13-c48	13-c49	13-c50	13-c51	13-f13	13-g95	13-g96	13-g98	13-g99	13-h00	13-h01	13-n07	13-n08
	13-n09	13-n10	13-n11	13-n12	13-n18	13-n19	13-n20	13-n21	13-n22	13-n23	13-n50	13-n51	13-n52	13-n53
	13-n54													
TAGADR	5-14#	6-0												
TAP	4-857#													
TBITVE	4-700#													
TIME	7-0#	15-57*	15-69*	15-71*										
TKVEC	4-700#	27-1*	27-1*											
TPVEC	4-700#													
TRAPVE	4-700#	9-23*	9-23*											
TRE	4-940#													
TRTVEC	4-700#													
TST	4-884#	13-F60	13-F62	13-F63	13-F86	13-G13	13-G21	13-G29	13-G37	13-G45	13-G53	13-\25	13-_09	13-c07
	13-g58	13-l90	13-m28											
TST1	13-1#	24-1												
TST10	13-538#	24-1												
TST100	13-U81#	24-1												
TST101	13-V11#	24-1												
TST102	13-V48#	24-1												

CROSS REFERENCE TABLE (CREF V04.00)

TST103 13-V86# 24-1
TST104 13-W06# 24-1
TST105 13-W37# 24-1
TST106 13-W60# 24-1
TST107 13-X09# 24-1
TST11   13-549# 24-1
TST110 13-X54# 24-1
TST111 13-Y24# 24-1
TST112 13-Z01# 24-1
TST113 13-\66# 24-1
TST114 13-_58# 24-1
TST115 13-c65# 24-1
TST116 13-d33# 24-1
TST117 13-h32# 24-1
TST12   13-602# 24-1
TST120 13-l08# 24-1
TST13   13-670# 24-1
TST14   13-774# 24-1
TST15   13-787# 24-1
TST16   13-877# 24-1
TST17   13-986# 24-1
TST2   13-73#   24-1
TST20   13-:09# 24-1
TST21   13-:62# 24-1
TST22   13-:90# 24-1
TST23   13-;10# 24-1
TST24   13-;54# 24-1
TST25   13-<16# 24-1
TST26   13-=15# 24-1
TST27   13-=32# 24-1
TST3   13-106# 24-1
TST30   13-=90# 24-1
TST31   13->55# 24-1
TST32   13-?16# 24-1
TST33   13-@18# 24-1
TST34   13-@79# 24-1
TST35   13-A39# 24-1
TST36   13-B20# 24-1
TST37   13-C03# 24-1
TST4   13-137# 24-1
TST40   13-D10# 24-1
TST41   13-D69# 24-1
TST42   13-E28# 24-1
TST43   13-F08# 24-1
TST44   13-F43# 24-1
TST45   13-G64# 24-1
TST46   13-I14# 24-1
TST47   13-I89# 24-1
TST5   13-159# 24-1
TST50   13-K28# 24-1
TST51   13-K74# 24-1
TST52   13-L08# 24-1
TST53   13-M40# 24-1
TST54   13-N00# 24-1
TST55   13-N36# 24-1
TST56   13-N84# 24-1

CROSS REFERENCE TABLE (CREF V04.00)

CROSS REFERENCE TABLE (CREF V04.00)

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WCF       4-791#   4-798    13-688   13-717
WCH       4-734#   13-G23   13-R13
WD        4-737#   13-G31   13-R19   13-S88   13-Y03   13-Y07   13-Y59
WH        4-738#   13-G39   13-R10
WLE       4-785#   4-798    13-X81   13-Y05   33-81    33-82
WRL       4-771#   13->66   13->76   13->78   13->93   13->97
XNUDC     4-876#   13-97    13-191   13-225   13-240   13-292   13-295   13-379   13-440   13-462   13-512   13-;03   13-;65   13-;75
          13-;85   13-<03   13-012   13-085
XNUER2    4-902#   13-125   13-192   13-227   13-241   13-302   13-305   13-401   13-423   13-478   13-515   13-895   13-944   13-952
          13-953   13-976   13-E93
XNUOF     4-871#   13-81    13-81    13-99    13-190   13-224   13-224   13-239   13-286   13-289   13-398   13-420   13-459   13-510
          13-801   13-809   13-822   13-830   13-831   13-849   13-867   13-015   13-047
XSIZ      9-71#    10-79    10-110
XXDP      7-0#     9-33*    9-36*    9-37     9-39*    9-44     9-55     9-115    9-117
Y         32-29#
ZEROS     35-38#
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CROSS REFERENCE TABLE (CREF V04.00)

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$$CMTM   5-15#    6-0      6-0      6-0      6-0      6-0
$$ESCA   4-700#
$$NEWT   4-700#  13-1     13-73    13-106   13-137   13-159   13-332   13-524   13-538   13-549   13-602   13-670   13-774   13-787
        13-877   13-986   13-:09   13-:62   13-:90   13-;10   13-;54   13-<16   13-=15   13-=32   13-=90   13->55   13-?16   13-@18
        13-@79   13-A39   13-B20   13-C03   13-D10   13-D69   13-E28   13-F08   13-F43   13-G64   13-I14   13-I89   13-K28   13-K74
        13-L08   13-M40   13-N00   13-N36   13-N84   13-O23   13-O53   13-O93   13-P19   13-P64   13-P85   13-Q12   13-Q56   13-R33
        13-R81   13-S32   13-S69   13-T25   13-T82   13-U00   13-U23   13-U52   13-U81   13-V11   13-V48   13-V86   13-W06   13-W39
        13-W60   13-X09   13-X54   13-Y24   13-Z01   13-\66   13-^58   13-c65   13-d33   13-h32   13-l08
$$SET.   29-1     29-1     29-1     29-1     29-1     29-1     29-T     29-1     29-1     29-1     29-1     29-1     29-1     29-1#
$$SETM   9-23     9-23#
$$SKIP   4-700#
.$ACT1   4-692#   5-5
.$APTB   4-692#   6-0      6-0#
.$APTH   4-692#   5-13
.$APTY   4-692#  31-1
.$CATC   4-688#   5-1
.$CMTA   4-689#   5-15
.$EOP    4-689#  14-20
.$ERRO   4-689#  25-1
.$POWE   4-691#  30-1
.$RDDE   4-690#
.$RDOC   4-690#  28-1
.$READ   4-690#  27-1
.$SAVE   4-691#  19-1
.$SCOP   4-689#  24-1
.$SIZE   4-691#
.$TRAP   4-691#  29-1
.$TYPB   4-690#  20-1
.$TYPD   4-690#  21-1
.$TYPE   4-689#  23-1
.$TYPO   4-690#  22-1
.EQUAT   4-688#   4-700
.HEADE   4-688#   4-696
.SETUP   4-688#   4-998
.SWRHI   4-688#   4-697
.SWRLO   4-688#   4-697#   4-698
CLEAR    4-497#  13-7     13-28    13-75    13-108   13-116   13-139   13-162   13-213   13-262   13-370   13-386   13-408   13-430
        13-447   13-469   13-485   13-500   13-540   13-551   13-605   13-611   13-677   13-754   13-776   13-889   13-965   13-988
        13-:21   13-:73   13-:92   13-;13   13-;57   13-<23   13-=17   13-=23   13-=39   13-=92   13->61   13-?18   13-@20   13-@81
        13-A47   13-B29   13-C19   13-C63   13-D19   13-D29   13-D85   13-E35   13-E60   13-E84   13-F15   13-F51   13-G71   13-I21
        13-I97   13-K36   13-K80   13-L98   13-M48   13-N87   13-O30   13-O58   13-Q21   13-T33   13-T85   13-U03   13-V51   13-V88
        13-W09   13-W42   13-W66   13-Y42   16-14
CLKOFF   4-612#  13-K96   13-Q38   13-Q43   13-Y74   13-Y84   13-d23   13-d29   13-f48   13-f54   13-g20   13-g26   13-h55   13-h61
        13-h99   13-i05   13-i86   13-i92   13-j49   13-j55   13-k35   13-k41   13-l68   13-l74
CLKON    4-603#  13-K93   13-Q30   13-Y68   13-d17   13-f42   13-g14   13-h49   13-h93   13-i80   13-j43   13-k29   13-l62
CLKSNC   4-672#
COMMEN   4-700#
ENBSCH   4-638#
ENDCOM   4-700#
ERR      4-568#   8-3      8-6      8-9      8-12     8-15     8-18     8-22     8-25     8-28     8-31     8-34     8-37     8-40
         8-43     8-46     8-49     8-52     8-55     8-58     8-61     8-64     8-67     8-70     8-73     8-76     8-79     8-82
         8-85     8-88     8-91     8-94     8-97     8-100    8-103    8-106    8-109    8-112    8-115    8-118    8-121    8-124
         8-127    8-130    8-133    8-136    8-139    8-142    8-145    8-148    8-151    8-154    8-157    8-160    8-163    8-166
         8-169    8-172    8-175    8-178    8-181    8-184    8-187    8-190    8-193    8-196    8-199    8-202    8-205    8-208
         8-211    8-214    8-217    8-220    8-223    8-226    8-229    8-232    8-235    8-238    8-241    8-244    8-247    8-250
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CROSS REFERENCE TABLE (CREF V04.00)

	8-253	8-256	8-259	8-262	8-265	8-268	8-271	8-274	8-277	8-280	8-283	8-286	8-289	8-292
	8-295	8-298	8-301	8-304	8-307	8-310	8-313	8-316	8-319	8-322	8-325	8-328	8-331	8-334
	8-337	8-340	8-343	8-346	8-349	8-352	8-355	8-358	8-361	8-364	8-367	8-370	8-373	8-376
	8-379	8-382	8-385	8-388	8-391	8-394	8-397	8-400	8-403	8-406	8-409	8-412	8-415	8-418
	8-421	8-424	8-427	8-430	8-433	8-436	8-439	8-442	8-445	8-448	8-451	8-454	8-457	8-460
	8-464	8-467	8-470	8-473	8-476	8-479	8-482	8-485	8-488	8-492	8-495	8-498	8-501	8-504
	8-508	8-511	8-515	8-518	8-521	8-524	8-527	8-530	8-533	8-537	8-540	8-543	8-546	8-549
	8-552	8-555	8-558	8-561	8-564	8-567	8-570	8-573	8-576	8-580	8-583	8-586	8-589	
ERROR	4-700#	13-16	13-37	13-68	13-103	13-134	13-156	13-210	13-255	13-316	13-382	13-404	13-426	13-443
	13-465	13-481	13-496	13-518	13-533	13-546	13-566	13-578	13-594	13-618	13-631	13-645	13-665	13-685
	13-693	13-701	13-714	13-722	13-731	13-744	13-768	13-784	13-803	13-811	13-824	13-834	13-852	13-870
	13-897	13-905	13-913	13-926	13-934	13-946	13-956	13-979	13-:01	13-:30	13-:32	13-:45	13-:47	13-:81
	13-:06	13-:24	13-:35	13-:49	13-:67	13-:77	13-:89	13-<08	13-<30	13-<56	13-<66	13-<68	13-=28	13-=44
	13-=54	13-=65	13-=82	13->03	13->14	13->26	13->41	13->68	13->79	13-?02	13-?32	13-?46	13-?49	13-?61
	13-?79	13-?82	13-@04	13-@32	13-@65	13-@93	13-A03	13-A25	13-A51	13-A62	13-A73	13-A94	13-B54	13-B76
	13-C36	13-C78	13-D43	13-D94	13-E12	13-E43	13-E52	13-E70	13-F00	13-F32	13-F64	13-F90	13-G88	13-H03
	13-H22	13-H30	13-H43	13-I37	13-I55	13-I63	13-J08	13-J38	13-K45	13-K63	13-K89	13-L04	13-L30	13-L51
	13-L72	13-L81	13-M09	13-M14	13-M21	13-M33	13-M57	13-M76	13-N04	13-N26	13-N42	13-N72	13-O19	13-O49
	13-O80	13-O89	13-O99	13-P16	13-P24	13-P31	13-P35	13-P51	13-P61	13-P69	13-P72	13-P81	13-P92	13-P95
	13-Q09	13-Q40	13-Q60	13-Q98	13-R37	13-R70	13-R86	13-S14	13-S36	13-S59	13-S78	13-T09	13-T54	13-T56
	13-T97	13-U09	13-U19	13-U25	13-U49	13-U54	13-U78	13-U83	13-V07	13-V15	13-V45	13-V71	13-V83	13-W02
	13-W23	13-W35	13-W56	13-W83	13-X13	13-X37	13-X58	13-X89	13-Y49	13-Y51	13-Y79	13-Z06	13-Z38	13-Z44
	13-Z76	13-Z82	13-[07	13-[13	13-[49	13-[55	13-[90	13-\06	13-\12	13-\31	13-\71	13-]06	13-]12	13-]47
	13-]53	13-]81	13-]87	13-^26	13-^32	13-^70	13-^86	13-^93	13- _16	13- _63	13- _98	13- `04	13- `39	13- `48
	13- `76	13- `83	13-a38	13-a44	13-a82	13-a98	13-b04	13-b53	13-b69	13-b76	13-c14	13-c67	13-d11	13-d27
	13-d37	13-d71	13-d77	13-e20	13-e48	13-e63	13-e69	13-e95	13-f22	13-f29	13-f52	13-f90	13-g01	13-g24
	13-g87	13-h36	13-h59	13-h75	13-h80	13-i03	13-i55	13-i61	13-i69	13-i90	13-j20	13-j25	13-j33	13-j53
	13-k10	13-k16	13-k39	13-k75	13-l04	13-l38	13-l47	13-l72	13-m03	13-m61	13-m93	24-1		
FSCAPE	4-700#													
GETAS	4-274#	13-V76												
GETBA	4-138#													
GETBAE	4-282#													
GETCS1	4-122#	13-85	13-119	13-180	13-230	13-541	13-612	13-625	13-638	13-658	13-:78	13-=24	13-F25	13-G82
	13-H12	13-I33	13-I49	13-U04	13-U38	13-Z71	13-[85	13-\01	13-]42	13-^65	13-^81	13- `34	13-a77	13-a93
	13-b64	13-e58												
GETCS2	4-154#	13-8	13-29											
GETDA	4-178#	13-86	13-181	13-231	13-272	13-393	13-415	13-474	13-491	13-:99	13-;18	13-;29	13-;43	13-C33
	13-C75	13-008	13-075											
GETDB	4-146#													
GETDC	4-186#	13-87	13-184	13-233	13-274	13-376	13-436	13-456	13-508	13-;00	13-;64	13-;74	13-;84	13-<04
	13-D40	13-011	13-084											
GETDS	4-162#	13-=99	13->10	13->22	13->31	13->65	13->75	13->92	13-@89	13-@99	13-A16	13-D90	13-E08	13-E39
	13-E49	13-E65	13-E90	13-G97	13-H37	13-L22	13-L43	13-M06	13-M11	13-M53	13-M71	13-P13	13-P47	13-P77
	13-Q05	13-T87	13-U13	13-U41	13-U70	13-U99	13-V65	13-V96	13-W17	13-W29	13-W50	13-W75	13-X30	13-[43
	13-^20	13-a32	16-20	17-18										
GETDT	4-210#	13-526	13-T86	13-V29										
GETEC1	4-226#													
GETEC2	4-234#													
GETER1	4-170#	13-120	13-147	13-182	13-234	13-275	13-375	13-435	13-454	13-490	13-678	13-707	13-738	13-756
	13-:22	13-:39	13-<24	13-<59	13-?38	13-?71	13-M28	13-N17	13-Q86	13-R61	13-S07	13-S52	13-T03	13-T46
	13-X80	13-Z32	13-[01	13-]00	13-]75	13- 92	13- `70	13-d18	13-d65	13-h69	13-j14			
GETER2	4-202#	13-121	13-148	13-185	13-235	13-276	13-395	13-417	13-475	13-509	13-891	13-920	13-941	13-968
	13-:23	13-?29	13-?56	13-?93	13-@28	13-@40	13-@56	13-K41	13-K56	13-K85	13-L00			
GETHR	4-242#	13-562	13-573	13-589	13-:77									
GETLA	4-194#													
GETMR1	4-250#	13-149	13-=40	13-=50	13-=61	13-=76	13-A48	13-A59	13-A69	13-A86	13-B33	13-J04	13-J30	13-L64

CROSS REFERENCE TABLE (CREF V04.00)

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        13-M16  13-N61  13-Q32  13-Y43  13-Y69  13-b42  13-d02  13-e11  13-e42  13-e89  13-f43  13-f81  13-g15  13-h50
        13-h94  13-i46  13-i81  13-j44  13-k01  13-k30  13-k66  13-k95  13-l63
GETMR2   4-258#  13-F59  13-F85  13-U33  13-U44  13-U62  13-U73  13-U91  13-V02  13-V30  13-\24  13-_08  13-c06  13-f05
        13-g57  13-l79  13-m14  13-m72
GETOF    4-266#  13-88   13-183  13-232  13-273  13-394  13-416  13-455  13-507  13-778  13-797  13-818  13-846  13-864
        13-B31  13-C25  13-D31  13-D89  13-O14  13-O46  13-P55  13-S83
GETPRI   4-700#  15-58
GETSN    4-218#  13-994  13-998
GETSWR   4-700#   9-28    9-28#
GETWC    4-130#
GETX     4-114#
MSG      4-8#    13-1    13-73   13-106  13-137  13-159  13-326#  13-332  13-521#  13-524  13-538  13-549  13-602  13-670
        13-774  13-787  13-877  13-986  13-:09  13-:62  13-:90  13-;10  13-;54  13-<16  13-=15  13-=32  13-=90  13->55
        13-?16  13-@18  13-@79  13-A39  13-B08#  13-B20  13-C00#  13-C03  13-D10  13-D69  13-E28  13-F08  13-F43  13-G64
        13-I14  13-I89  13-K28  13-K74  13-L08  13-M40  13-N00  13-N36  13-N84  13-O23  13-O53  13-O93  13-P19  13-P64
        13-P85  13-Q12  13-Q56  13-R33  13-R81  13-S32  13-S69  13-T25  13-T82  13-U00  13-U23  13-U52  13-U81  13-V11
        13-V48  13-V86  13-W06  13-W39  13-W60  13-X09  13-X54  13-Y24  13-Z01  13-\66  13-_58  13-c65  13-d33  13-h32
        13-l08
MULT     4-700#
NEWTST   4-700#  13-1    13-73   13-106  13-137  13-159  13-332  13-524  13-538  13-549  13-602  13-670  13-774  13-787
        13-877  13-986  13-:09  13-:62  13-:90  13-;10  13-;54  13-<16  13-=15  13-=32  13-=90  13->55  13-?16  13-@18
        13-@79  13-A39  13-B20  13-C03  13-D10  13-D69  13-E28  13-F08  13-F43  13-G64  13-I14  13-I89  13-K28  13-K74
        13-L08  13-M40  13-N00  13-N36  13-N84  13-O23  13-O53  13-O93  13-P19  13-P64  13-P85  13-Q12  13-Q56  13-R33
        13-R81  13-S32  13-S69  13-T25  13-T82  13-U00  13-U23  13-U52  13-U81  13-V11  13-V48  13-V86  13-W06  13-W39
        13-W60  13-X09  13-X54  13-Y24  13-Z01  13-\66  13-_58  13-c65  13-d33  13-h32  13-l08
NWTST    4-511#  13-1    13-73   13-106  13-137  13-159  13-332  13-524  13-538  13-549  13-602  13-670  13-774  13-787
        13-877  13-986  13-:09  13-:62  13-:90  13-;10  13-;54  13-<16  13-=15  13-=32  13-=90  13->55  13-?16  13-@18
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        13-R81  13-S32  13-S69  13-T25  13-T82  13-U00  13-U23  13-U52  13-U81  13-V11  13-V48  13-V86  13-W06  13-W39
        13-W60  13-X09  13-X54  13-Y24  13-Z01  13-\66  13-_58  13-c65  13-d33  13-h32  13-l08
POP      4-700#  13-<46  13-<47  13-<51  13-<52  15-45   15-46   18-13   19-1    21-1    28-1    30-1    30-1    31-1
        31-1
PUSH     4-700#  13-<37  13-<38  13-<80  13-<81  15-6    15-7    18-8    19-1    21-1    28-1    30-1    30-1    31-1
        31-1    31-1
PUTAS    4-470#  13-390  13-U67  13-V62  13-W13  13-W27  13-W46  13-W69
PUTBA    4-329#  13-S87  13-l53
PUTBAE   4-478#
PUTCS1   4-314#  13-78   13-111  13-165  13-172  13-222  13-433  13-609  13-623  13-624  13-636  13-637  13-656  13-657
        13-=21  13-C27  13-C68  13-D35  13-E05  13-F24  13-F73  13-G81  13-I32  13-J16  13-K53  13-K92  13-L16  13-L37
        13-L58  13-M27  13-M64  13-N12  13-N50  13-N99  13-O38  13-O67  13-P05  13-P39  13-Q02  13-Q31  13-Q74  13-R51
        13-R98  13-S44  13-S88  13-T40  13-U30  13-U59  13-U88  13-V21  13-V95  13-X21  13-X70  13-Y59  13-Z14  13-Z52
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        13-l59  16-19   17-17
PUTCS2   4-345#  13-:37
PUTDA    4-369#  13-79   13-166  13-173  13-217  13-223  13-265  13-387  13-409  13-470  13-487  13-506  13-560  13-561
        13-571  13-572  13-587  13-588  13-:95  13-:97  13-;16  13-;17  13-;27  13-;28  13-;41  13-;42  13-B32  13-C23
        13-C65  13-D32  13-D87  13-N94  13-O63  13-P98  13-Q65  13-R43  13-R93  13-S40  13-S85  13-U96  13-Y56  13-\78
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PUTDB    4-337#
PUTDC    4-377#  13-80   13-176  13-219  13-225  13-267  13-372  13-432  13-450  13-488  13-502  13-:96  13-:98  13-;63
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        13-a52  13-b12  13-b84  13-c75  13-d46  13-d86  13-e78  13-f38  13-g10  13-h45  13-h88  13-i67  13-j31  13-k25
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CROSS REFERENCE TABLE (CREF V04.00)

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PUTDS    4-353#  13-472  13-504
PUTDT    4-401#  13-451
PUTEC1   4-417#  13-453
PUTEC2   4-425#  13-414
PUTER1   4-361#  13-112  13-142  13-167  13-174  13-226  13-268  13-371  13-431  13-448  13-486  13-505  13-675  13-705
        13-706  13-736  13-737  13-755  13-?28  13-C21  13-E03  13-E37  13-E47  13-E62  13-E64  13-E86  13-F18  13-F54
        13-G74  13-I24  13-J00  13-K39  13-K83  13-L15  13-L36  13-L57  13-M01  13-M51  13-N90  13-033  13-061  13-062
        13-Q24  13-T36  13-V53  13-V90  13-W11  13-W44  13-W49  13-W68  13-Y67  13-Z12  13-Z50  13-Z88  13-[19  13-[61
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        13-c73  13-d43  13-d83  13-e75  13-f35  13-g07  13-h42  13-h86  13-i75  13-j38  13-k22  13-l57  16-17   17-15
PUTER2   4-39_#  13-113  13-143  13-169  13-177  13-227  13-269  13-389  13-411  13-452  13-471  13-489  13-503  13-887
        13-918  13-919  13-939  13-940  13-967  13-?27  13-?91  13-a27  13-a38  13-a54  13-C22  13-E04  13-E38  13-E48
        13-E63  13-E87  13-E88  13-F19  13-F55  13-G75  13-I25  13-J01  13-K40  13-K84  13-M02  13-M52  13-N91  13-034
        13-Q25  13-T37  13-V54  13-V91  13-W12  13-W45  13-Z13  13-Z51  13-Z89  13-[20  13-[62  13-\19  13-\81  13-]22
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        13-C26  13-C31  13-C32  13-C66  13-C67  13-C71  13-C72  13-D33  13-D34  13-D38  13-D39  13-E02  13-E06  13-E07
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        13-Q80  13-Q81  13-R48  13-R55  13-R56  13-R97  13-S01  13-S02  13-S43  13-S46  13-S47  13-S81  13-S93  13-S94
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        13-a85  13-a89  13-a90  13-b10  13-b19  13-b20  13-b26  13-b29  13-b34  13-b35  13-b45  13-b46  13-b56  13-b60
        13-b81  13-b82  13-b98  13-b99  13-c24  13-c25  13-c72  13-c81  13-c82  13-c87  13-c88  13-c92  13-c93  13-d00
        13-d01  13-d16  13-d42  13-d51  13-d52  13-d57  13-d61  13-d62  13-d82  13-d91  13-d92  13-d97  13-e01  13-e02
        13-e09  13-e10  13-e27  13-e28  13-e35  13-e36  13-e54  13-e55  13-e74  13-e83  13-e84  13-f01  13-f02  13-f34
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        13-k46  13-k52  13-k56  13-k57  13-k64  13-k65  13-k79  13-k83  13-k84  13-k91  13-k92  13-l56  13-l96  13-l97
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        13-796  13-816  13-817  13-844  13-845  13-861  13-863  13-890  13-966  13-B30  13-C24  13-C64  13-D30  13-D88
        13-F89  13-N96  13-035  13-Q67  13-R45  13-R94  13-S82  13-l45
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PUTWC    4-322#  13-S86  13-l52
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REPORT   4-700#
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CROSS REFERENCE TABLE (CREF V04.00)

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SETUP    4-700#    9-23
SETVV    4-616#   13-N04    13-N42    13-O99    13-P24    13-P35    13-P69    13-P92    13-Q60    13-R37    13-R86    13-S36    13-S78    13-U25
        13-U54    13-U83    13-V15    13-X13    13-X58    13-Y51    13-Z06    13-Z44    13-Z82    13-[13    13-[55    13-\12    13-\7'    13-]12
        13-]53    13-]87    13-^32    13-^93    13-_63    13-`04    13-`48    13-`83    13-a44    13-b04    13-b76    13-c67    13-d37    13-d77
        13-e69    13-f29    13-g01    13-h36    13-h80    13-i61    13-j25    13-k16    13-l38
SKIP     4-700#
SLASH    4-700#
STARS    4-700#    5-5       5-13      5-13      5-13      6-0       6-0       6-0       13-1      13-1      13-73     13-73     13-106    13-106
        13-137    13-137    13-159    13-159    13-332    13-332    13-524    13-524    13-538    13-538    13-549    13-549    13-602    13-602
        13-670    13-670    13-774    13-774    13-787    13-787    13-877    13-877    13-986    13-986    13-:09    13-:09    13-:62    13-:62
        13-:90    13-:90    13-;10    13-;10    13-;54    13-;54    13-<16    13-<16    13-=15    13-=15    13-=32    13-=32    13-=90    13-=90
        13->55    13->55    13-?16    13-?16    13-@18    13-@18    13-@79    13-@79    13-A39    13-A39    13-B20    13-B20    13-C03    13-C03
        13-D10    13-D10    13-D69    13-D69    13-E28    13-E28    13-F08    13-F08    13-F43    13-F43    13-G64    13-G64    13-I14    13-I14
        13-I89    13-I89    13-K28    13-K28    13-K74    13-K74    13-L08    13-L08    13-L91    13-L93    13-M40    13-M40    13-N00    13-N00
        13-N36    13-N36    13-NR4    13-N84    13-O23    13-O23    13-O53    13-O53    13-O93    13-O93    13-P19    13-P19    13-P64    13-P64
        13-P85    13-P85    13-Q12    13-Q12    13-Q56    13-Q56    13-R33    13-R33    13-R81    13-R81    13-S32    13-S32    13-S69    13-S69
        13-T25    13-T25    13-T82    13-T82    13-U00    13-U00    13-U23    13-U23    13-U52    13-U52    13-U81    13-U81    13-V11    13-V11
        13-V48    13-V48    13-V86    13-V86    13-W06    13-W06    13-W39    13-W39    13-W60    13-W60    13-X09    13-X09    13-X54    13-X54
        13-Y24    13-Y24    13-Z01    13-Z01    13-\66    13-\66    13-_58    13-_58    13-b89    13-c03    13-c65    13-c65    13-d33    13-d33
        13-f07    13-f15    13-g39    13-g53    13-h32    13-h32    13-[08    13-[08    13-l33    13-l35    13-l81    13-l88    13-m16    13-m26
        13-m74    13-m82    14-20     19-1      20-1      21-1      22-1      23-1      24-1      25-1      27-1      27-1      27-1      27-1
        27-1      28-1      29-1      30-1      30-1      31-1
SWRSU    4-700#    9-23      9-23#
TAGS     4-46#     6-0
TRMTRP  29-1#
TYPBIN   4-700#
TYPDEC   4-700#   14-20     14-20
TYPNAM   4-688#    4-700#    9-28
TYPNUM   4-700#
TYPOCS   4-700#    9-82     11-16     11-63     26-22     26-39     26-44     26-46
TYPOCT   4-700#   10-33     27-1
TYPTXT   4-700#    9-6       9-42      9-53      9-59      11-30     14-20     14-20
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