KD11-K

11/6X SERIES CPU EXER

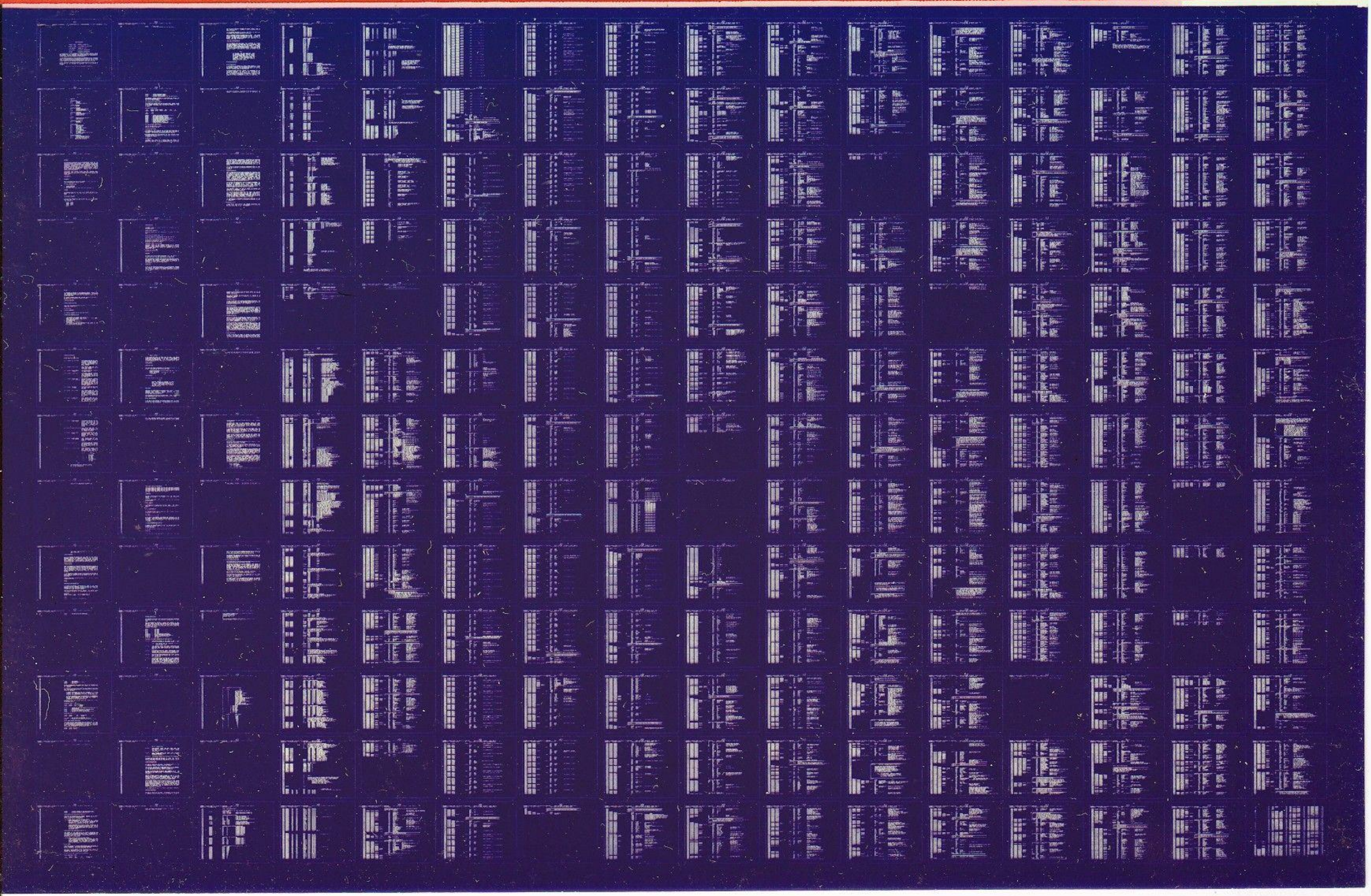
MD-11-DQKDC-A

EP-DQKDC-A-DL-A

FICHE 1 OF 2

APR 1977

MADE IN USA



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1.1/6X SERIES CPU EXER

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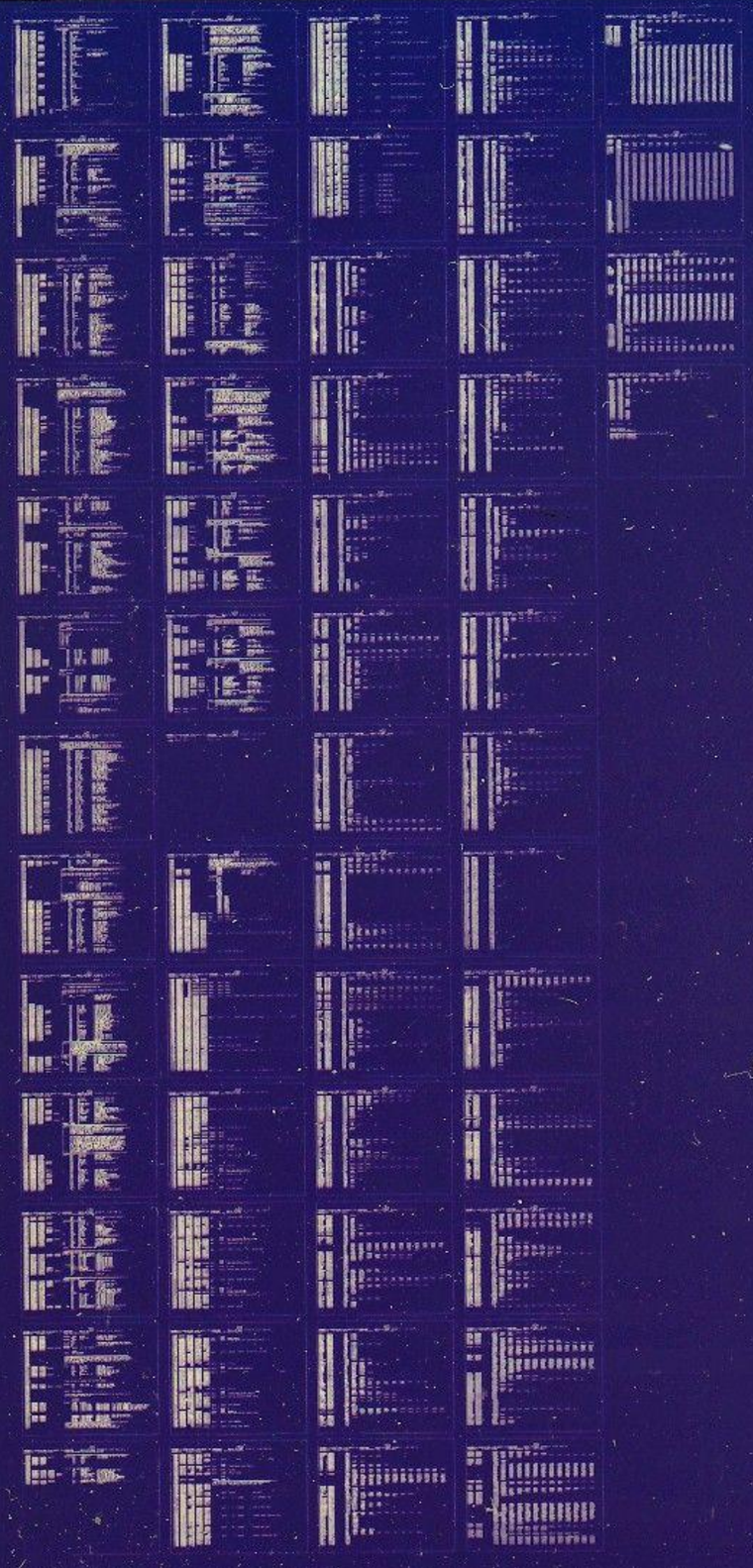

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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DQKDC-A-D

PRODUCT NAME: 11/6X SERIES CPU EXERCISER

DATE CREATED: JANUARY 24, 1977

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHOR: DIAGNOSTIC ENGINEERING

CONTENTS

1.0 ABSTRACT

THIS PROGRAM IS DESIGNED TO BE A COMPREHENSIVE CHECK OF THE PDP-11/6X SERIES CPU CLUSTER. THE PROGRAM EXECUTES EACH INSTRUCTION IN ALL ADDRESS MODES AND INCLUDES TESTS FOR TRAPS, INTERRUPTS, FLOATING POINT, MEMORY MANAGEMENT, MEMORY, THE UNIBUS, AND THE MASS BUS. IF NOT DESELECTED, THE PROGRAM RELOCATES THE TEST CODE THROUGHOUT MEMORY (0-124K). ALSO, IF NOT DESELECTED, THE PROGRAM WILL RELOCATE USING AVAILABLE DISKS (RP03,RK05,RP04,RS03/4). SEE SECTION 9.4 FOR A DESCRIPTION OF RELOCATION.

SINCE WORST CASE TESTING OCCURS WITH ALL SWITCHES DOWN, PRECAUTIONS MUST BE TAKEN TO ENSURE THE PROTECTION OF USER DISKS. REFER TO SECTION 7.0 FOR A DESCRIPTION OF WARNINGS AND EXCEPTIONS.

2.0 REQUIREMENTS

2.1 EQUIPMENT

PDP-11/6X SERIES CPU WITH 16K OF MEMORY, A LINE CLOCK, AND AN LA30 (OR EQUIVALENT) CONSOLE TERMINAL.

2.1.1 OPTIONAL EQUIPMENT USED

1. UNIBUS EXERCISER
2. MASS BUS TESTER
3. RP11/RP03, RK11/RK05, RH11/RP04, RH11/RS03/RS04

2.2 STORAGE

THE PROGRAM LOADS INTO THE FIRST 12K OF MEMORY AND RUNS IN ALL MEMORY (EXCLUSIVE OF THE XXDP MONITOR IF RUNNING IN CHAIN MODE).

2.3 PRELIMINARY PROGRAMS

ALTHOUGH THIS PROGRAM IS A TEST OF THE CPU, IT IS ADVISABLE THAT THE CPU (AND FLOATING POINT) DIAGNOSTICS RUN FIRST. THESE CONSIST OF:

DQKDA	DQFPA
DQKDB	DQFPB
DQKKA	DQFPC
DQKTA	DQFPD
DQKUA	

```
                                3.0     LOADING PROCEDURE
                                        ------------------
```

3.1 METHOD

THE PROGRAM IS SUPPLIED ON THE DIAGNOSTIC MEDIA. REFER TO THE XXDP OPERATING MANUAL FOR FURTHER INFORMATION. THE PROGRAM CAN ALSO BE DIRECTLY LOADED USING THE ABSOLUTE LOADER AND THE BINARY PAPER TAPE.

IF LOADING A BINARY PAPER TAPE, BE SURE THE SWITCH REGISTER IS CLEARED AFTER THE ABSOLUTE LOADER IS LOADED.

4.0 STARTING PROCEDURE

4.1 CONSOLE SWITCH SETTINGS

CHECK THAT THE SWITCH REGISTER WAS ZERO IF THE PROGRAM WAS LOADED FROM PAPER TAPE.

SEE SECTION 5.1

4.2 STARTING ADDRESSES

THE STARTING ADDRESS FOR THE EXERCISER IS 200.

4.3 PROGRAM AND OPERATOR ACTION

1. LOAD PROGRAM INTO MEMORY (SEE SECTION 3)
2. CHECK FOR ANY SYSTEM DISK PACKS OR CONFIGURATION EXCEPTIONS AS DESCRIBED IN SECTION 7.0.
3. LOAD ADDRESS 200
4. SET SWITCHES (SEE SECTION 5.1)
5. PRESS START
6. THE PROGRAM WILL LOOP AND MESSAGES WILL BE TYPED AT THE END OF EACH SUB-PASS AND EACH PASS. (SEE SECTION 8.4 FOR A DESCRIPTION OF THE MESSAGES)

5.0 OPERATING PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

SW15 (100000) HALT ON ERROR	THIS SWITCH WHEN SET WILL HALT THE PROCESSOR WHEN AN ERROR IS DETECTED. AN ERROR MESSAGE IS TYPED AND THE PROCESSOR WILL HALT. PRESSING CONTINUE WILL RESUME TESTING.
SW14 (040000) LOOP ON TEST	THIS SWITCH WHEN SET WILL CAUSE THE PROGRAM TO LOOP ON THE CURRENT SUBTEST.
SW13 (020000) INHIBIT ERROR TYPEOUT	THIS SWITCH WHEN SET INHIBITS THE ERROR TYPEOUT.
SW12 (010000) INHIBIT UBE	THIS SWITCH WHEN SET INHIBITS THE INITIALIZATION OF THE UNIBUS EXERCISER. SEE SECTION 9.1 FOR A DESCRIPTION OF THE UBE FUNCTION.
SW11 (004000) INHIBIT SUB-TEST ITERATION	THIS SWITCH WHEN SET INHIBITS SUBTEST ITERATION AFTER THE FIRST PASS. EACH SUBTEST IS EXECUTED 10 TIMES BEFORE THE NEXT SUBTEST IS RUN. SETTING SW11 CAUSES EACH TEST TO BE EXECUTED ONCE BEFORE STARTING THE NEXT SUBTEST.
SW10 (002000) RING BELL ON ERROR	THIS SWITCH WHEN SET WILL RING THE BELL WHEN AN ERROR IS DETECTED.
SW9 (001000) LOOP ON ERROR	THIS SWITCH WHEN SET WILL CAUSE THE PROGRAM TO LOOP ON THE FIRST FAILURE EVEN IF THE FAILURE IS INTERMITTANT. SEE SECTION 6.1 FOR A DESCRIPTION OF LOOPING ON RELOCATION ERRORS.
SW8 (000400) RELOCATE WITH CPU ONLY	THIS SWITCH WHEN SET WILL CAUSE RELOCATION TO BE DONE BY THE CPU INSTEAD OF A DISK. SEE SECTION 9.4 FOR A DESCRIPTION OF RELOCATION.

SW7 (000200)	INHIBIT SYSTEM SIZE TYPEOUT	THIS SWITCH WHEN SET WILL INHIBIT THE TYPEOUT OF THE SWITCH DEFINITIONS AND THE DISKS THAT WILL BE USED FOR RELOCATION. (TYPEOUT ONLY OCCURS WHEN THE PROGRAM IS DUMPED)
SW6 (000100)	INHIBIT RELOCATION	THIS SWITCH WHEN SET WILL INHIBIT ALL RELOCATION. DO NOT CHANGE THIS SWITCH WHILE THE PROGRAM IS RUNNING.
SW5 (000040)	INHIBIT ROUND ROBIN	THIS SWITCH WHEN SET WILL ONLY RELOCATE USING THE DEVICE SELECTED BY SWITCHES <2:0> RATHER THAN ALL AVAILABLE DEVICES.
SW4 (000020)	INHIBIT RANDOM DISK ADDRESS	THIS SWITCH WHEN SET WILL CAUSE RELOCATION TO ALWAYS START AT ADDRESS 0 ON THE DISK(S).
SW3 (000010)	INHIBIT MBT	THIS SWITCH WHEN SET INHIBITS THE INITIALIZATION OF THE MASS BUS TESTER. SEE SECTION 9.2 FOR A DESCRIPTION OF THE MBT FUNCTION.
SW2-SW0 (0 - 7)	DEVICE CODES	THESE SWITCHES (ALONG WITH SW5) CAUSE THE PROGRAM TO RELOCATE THE TEST CODE USING THE DEVICE SPECIFIED BELOW:

VALUE	DEVICE
0	RP11/RP03
1	RK11/RK05
2	NOT USED
3	NOT USED
4	RH11/RP04
5	RH11/RS03/RS04
6	NOT USED
7	NOT USED

NOTE

WHEN RELOCATING VIA A SPECIFIC DEVICE, SET IN THE VALUE(SW<2:0>) TO SELECT THE DEVICE THEN SET SWITCH 5.

```
309                                     UNIT 0 OF THE LOAD DEVICE IS MARKED  NOT
310                                     PRESENT  IF  PROGRAM WAS LOADED IN CHAIN
```

MODE (XXDP), AND THEREFORE WILL NOT BE USED TO RELOCATE.

5.2 DISPLAY REGISTER

WHILE THE PROGRAM IS RUNNING, THE LOW BYTE OF THE DISPLAY REGISTER CONTAINS THE SUBTEST NUMBER AND THE HIGH BYTE CONTAINS BITS (11:4) OF KERNEL PAR0. THESE BITS, OF KERNEL PAR0, CORRESPOND TO BITS (17:10) OF THE PHYSICAL ADDRESS OF THE RELOCATED CODE. WHEN AN ERROR IS DETECTED AND LOOP ON ERROR IS SELECTED, THE HIGH BYTE CONTAINS THE ERROR COUNT.

5.3 OPERATOR ACTION

WHEN THE PROGRAM IS LOADED* AND STARTED WITH SWITCH 7 EQUAL TO ZERO THE PROGRAM WILL TYPEOUT THE DISKS AND UNIT NUMBERS THAT WILL BE USED FOR RELOCATION AND THEN WAIT FOR THE OPERATOR TO TYPE A CHARACTER. THIS IS TO ALLOW THE OPERATOR TO WRITE PROTECT ANY DRIVE THAT IS NOT TO BE USED. IF THERE ARE NO DEVICES AVAILABLE FOR RELOCATION, OPERATOR ACTION IS NOT REQUIRED.

IF THE PROGRAM IS LOADED VIA ACT11 IN QV OR AA OR WITH XXDP IN CHAIN MODE NO OPERATOR ACTION IS REQUIRED AND ALL DISKS NOT WRITE PROTECTED (EXCEPT FOR THE XXDP MEDIA) WILL BE USED FOR RELOCATION.

*EXCEPT CHAIN MODE, QV(MANUFACTURING ONLY), OR AUTO ACCEPT (MANUFACTURING ONLY)

6.0 ERRORS

6.1 ERROR HALTS AND DESCRIPTION

IF AN ERROR IS DETECTED, THE PROGRAM WILL TRAP TO THE ERROR HANDLING ROUTINE ($ERROR). IF HALT ON ERROR IS ENABLED, THE PROCESSOR WILL TYPE THE ERROR MESSAGE AND THEN HALT. PRESSING CONTINUE WILL CAUSE TESTING TO RESUME.

THERE ARE MANY DIFFERENT TYPES OF ERRORS. NO MATTER WHICH TYPE OCCURS A MINIMUM SET OF INFORMATION IS TYPED AS FOLLOWS:

```
HHH:MM:SS
ERRORPC PHYSC PC  PSW    TEST NO SUBPAS-PASS CNT
UUUUUU  VVVVVV  WWWWWW   YYYYYY  SSSSSS  PPPPPP
```

WHERE:

UUUUUU = VIRTUAL PC OF THE ERROR CALL.

```
367                                     VVVVVV      = PHYSICAL PC OF THE ERROR CALL.
368                                     WWWWWW      = PSW AT THE TIME OF THE ERROR CALL.
```

YYYYYY = TEST NUMBER.
SSSSSS = SUB-PASS COUNT (0 THRU 3)
PPPPPP = PASS COUNT

HHH:MM:SS REPRESENTS THE ELAPSED RUN TIME OF THE PROGRAM SINCE THE MOST RECENT START, WHERE: HHH = HOURS, MM = MINUTES, AND SS = SECONDS.

THE VIRTUAL PC IS THE 16 BIT WORD THAT WAS PUSHED ON THE STACK WHEN THE ERROR CALL WAS MADE. THE PHYSICAL PC IS CALCULATED IN ONE OF TWO WAYS:

1. IF MEMORY MANAGEMENT IS OFF THE CONTENTS OF LOCATION "FACTOR" IS SUBTRACTED FROM THE VIRTUAL PC. THIS GENERATES THE CORRESPONDING PC FOR THE NON-RELOCATED CODE.

2. IF MEMORY MANAGEMENT IS ON THE CONTENTS OF THE APPROPRIATE PAR IS SHIFTED AND ADDED TO THE VIRTUAL PC TO GENERATE A PHYSICAL 18 BIT ADDRESS. IN THIS CASE THE VIRTUAL PC CORRESPONDS TO THE NON-RELOCATED CODE.

DEPENDING ON THE TYPE OF ERROR ADDITIONAL INFORMATION IS TYPED AS DESCRIBED BELOW.

6.1.1 UNEXPECTED TRAP TO 4

```
VIRTPC   PHYSPC    PSW       CPUERR
VVVVVV  PPPPPP    YYYYYY     ZZZZZZ
```

VVVVVV = VIRTUAL PC THAT WAS PUSHED ON THE STACK WHEN THE TRAP OCCURRED.
PPPPPP = PHYSICAL PC CALCULATED AS DESCRIBED ABOVE.
YYYYYY = PSW THAT WAS PUSHED ON THE STACK.
ZZZZZZ = CONTENTS OF THE CPU ERROR REGISTER(777766).

6.1.2 UNEXPECTED TRAP TO 114

```
VIRTPC   PHYSPC        PSW     MEM ERR REG
VVVVVV   PPPPPP      YYYYYY    ZZZZZZ
```

V, P, AND Y = ARE THE SAME AS DESCRIBED IN 6.1.1.
ZZZZZZ = CONTENTS OF THE MEMORY ERROR REGISTER (777744).

6.1.3 PARITY ERROR DURING DATA CHECK

THIS ERROR CAN ONLY OCCUR DURING THE DATA CHECK THAT IS MADE ON THE RELOCATED TEST CODE BEFORE IT IS EXECUTED. THIS CHECK IS MADE BY COMPARING THE UNRELOCATED CODE WITH THE RELOCATED CODE. THE SOURCE ADDRESS REFERS TO THE UNRELOCATED CODE AND THE DESTINATION ADDRESS TO THE RELOCATED CODE.

```
SRCADR   DSTADR  MEM ERR REG
SSSSSS   DDDDDD  ZZZZZZ
```

```
425
426                                     SSSSSS      = VIRTUAL ADDRESS OF THE SOURCE DATA.
```

DDDDDD = PHYSICAL ADDRESS OF THE DESTINATION DATA.
ZZZZZZ = CONTENTS OF MEMORY ERROR REGISTER (777744).

6.1.4 ERROR DURING DATA CHECK-RELOC WAS BY CP

THIS ERROR IS SIMILAR TO 6.1.3 EXCEPT INSTEAD OF A PARITY ERROR, IT IS A DATA COMPARISON ERROR. REFER TO SECTION 9.4.3 FOR A DESCRIPTION OF CP RELOCATION.

LOOP ON ERROR (SW<9>) HAS THE FOLLOWING EFFECT:

1. MEMORY MANAGEMENT OFF- IF SWITCH<9> IS SET, LOOPING WILL BE PERFORMED ON THE SECTION RELOCATION (SEE SECTION 9.4.1). IF SW<9> IS NOT SET, EXECUTION WILL CONTINUE AT THE BEGINNING OF THE NEXT SECTION.

2. MEMORY MANAGEMENT ON- IF SW<9> IS SET, LOOPING WILL BE PERFORMED ON THE PROGRAM RELOCATION (SEE SECTION 9.4.2) TO THE SAME MEMORY SPACE THAT FAILED. IF SW<9> IS NOT SET, PROGRAM RELOCATION WILL BE RETRIED IN THE SAME MEMORY SPACE.

6.1.5 ERROR DURING DATA CHECK-RELOC WAS BY I/O

THIS ERROR IS THE SAME AS 6.1.4 EXCEPT RELOCATION WAS PERFORMED VIA A DISK RATHER THAN THE CP. THE ERROR PRINTOUT WILL IDENTIFY WHICH DEVICE AND DRIVE NUMBER TRANSFERRED THE PARTICULAR WORD THAT FAILED. REFER TO SECTION 9.4.4 FOR A DESCRIPTION OF I/O RELOCATION.

LOOP ON ERROR (SW<9>) HAS THE FOLLOWING EFFECT:

1. IF SW<9> IS SET, THE DEVICE THAT RELOCATED THE WORD (THAT CAUSED THE DATA CHECK ERROR) IS INITIATED TO DO THE SAME TRANSFER WITH THE SAME DISK ADDRESS AND MEMORY ADDRESSES. THIS TRANSFER WILL CONTINUALLY BE INITIATED AND CHECKED UNTIL SW<9> IS NOT SET.

6.1.6 DEVICE ERROR

THIS ERROR OCCURS IF A DEVICE ERROR OCCURS WHILE THE DEVICE IS DOING A TRANSFER. THE DEVICE AND DRIVE NUMBER ARE IDENTIFIED AND THE CONTENTS OF THE DEVICE REGISTERS ARE TYPED.

WHEN SW<9> (LOOP ON ERROR) IS SET, THE DEVICE THAT FAILED IS CONTINUALLY RESTARTED WITH THE SAME DISK ADDRESS, MEMORY ADDRESS, AND FUNCTION THAT CAUSED THE ERROR.

IF SW<9> IS NOT SET, RELOCATION IS RESTARTED.

6.1.7 UNIBUS EXERCISER FAILED

CC	BUSADR	CR2	CR1	PHYS BUS ADR
XXXXXX	VVVV'V	WWWWWW	YYYYYY	ZZZZZZ

```
   483                                          XXXXXX      = CYCLE COUNT.
   484                                          VVVVVV      = VIRTUAL BUS ADDRESS THAT THE UBE FAILED AT
```

```
                        WWWWWW      = CONTROL REGISTER NUMBER 2
                        YYYYYY      = CONTROL REGISTER NUMBER 1
                        ZZZZZZ      = PHYSICAL MEMORY ADDRESS THAT THE UBE FAILED AT

                        THE PHYSICAL MEMORY ADDRESS IS CALCULATED BY ADDING THE
                        APPROPRIATE MAP REGISTER TO THE VIRTUAL BUS ADDRESS, FORMING A
                        REAL 18 BIT MEMORY ADDRESS.

                6.1.8   UBE NON-EXISTANT MEMORY ERROR

                        THIS ERROR ONLY OCCURS WHEN THE "NO SLAVE SYNC" ERROR OCCURS
                        IN THE UNIBUS EXERCISER.  ONLY THE PHYSICAL ADDRESS THAT TIMED
                        OUT IS TYPED.  THIS ERROR MIGHT INDICATE THAT THERE IS A HOLE
                        IN MEMORY.

                6.1.9   MASS BUS TESTER FAILED

                          CS1     WRDCNT  BUSADR  BADREX    MR2      CS2      ST
                        AAAAAA    BBBBBB  CCCCCC  DDDDDD  EEEEEF    FFFFFF  GGGGGG

                          ER       CS3
                        HHHHHH    JJJJJJ

                        AAAAAA      = CONTROL AND STATUS REGISTER #1 (760100).
                        BBBBBB      = WORD COUNT REGISTER (760102).
                        CCCCCC      = BUS ADDRESS REGISTER (760104).
                        DDDDDD      = BUS ADDRESS EXTENDED REGISTER (760174).
                        EEEEEE      = MAINTENANCE REGISTER #2 (760106).
                        FFFFFF      = CONTROL AND STATUS REGISTER #2 (760110).
                        GGGGGG      = STATUS REGISTER (760112).
                        HHHHHH      = ERROR REGISTER (760114).
                        JJJJJJ      = CONTROL AND STATUS REGISTER #3 (760176).

                6.1.10  MBT NON-EXISTANT MEMORY ERROR

                        THIS IS THE SAME AS 6.1.8 EXCEPT THAT IT IS DETECTED BY THE
                        NEXM BIT IN CS2 OF THE MBT.

                6.1.11  FLOATING POINT ERROR

                        THIS ERROR WILL ONLY OCCUR IF THE LEFT AND RIGHT HAND SIDES OF
                        THE FLOATING POINT IDENTITIES DO NOT AGREE WITHIN THE EXPECTED
                        TOLERANCE.  THE VALUE OF THE CALCULATIONS ARE TYPED OUT.

                        THIS ERROR SHOULD ONLY BE A FUNCTION OF THE FLOATING POINT
                        PROCESSOR AND THE FPP DIAGNOSTICS (DQFPA-DQFPD) SHOULD BE USED
                        TO ISOLATE THE PROBLEM.

                6.1.12  DEVICE HUNG

                        THIS ERROR WILL OCCUR IF A DEVICE DOES NOT FINISH ITS
                        RELOCATION FUNCTION WITHIN 2 SECONDS AFTER ITS INITIATION.
                        REFER TO SECTION 9.4.4.4 TO DETERMINE WHICH DEVICE AND DRIVE
```

541 IS HUNG.

6.2 ERROR RECOVERY

DIFFERENT TYPES OF ERRORS RECOVER IN DIFFERENT WAYS AS DESCRIBED BELOW.

6.2.1 ERRORS WITHIN SUBTESTS

EXECUTION STARTS WITH THE INSTRUCTION FOLLOWING THE ERROR CALL.

6.2.2 RELOCATION WITH MEMORY MGMT. OFF

EXECUTION STARTS AT THE BEGINNING OF THE NEXT SECTION.

6.2.3 DEVICE ERROR OR CP RELOCATION WITH MEMORY MGMT. ON

RELOCATION IS RESTARTED AT THE BEGINNING OF WHATEVER TYPE OF RELOCATION THE ERROR WAS FOUND IN.

6.2.4 UNEXPECTED TRAPS (4,10,114,250)

EXECUTION STARTS AT THE ADDRESS POINTED TO BY LOCATION "$LPERR". THIS LOCATION CONTAINS THE ADDRESS+2 OF THE MOST RECENTLY EXECUTED "SCOPE" INSTRUCTION. HOWEVER, IF A SECOND TRAP OCCURS BEFORE THE FIRST IS COMPLETELY SERVICED, THE PROGRAM WILL HALT.

7.0 WARNINGS AND EXCEPTIONS

7.1 WARNINGS

ANY DRIVE THAT IS NOT "WRITE PROTECTED" WILL BE WRITTEN ON (EXCEPT UNIT 0 OF THE XXDP LOAD DEVICE IN CHAIN MODE).

WHEN THE PROGRAM IS DUMPED (SEE SECTION 5.3) AND SW(7) IS SET, THE DEVICES AND DRIVES THAT ARE NOT WRITE PROTECTED WILL BE IDENTIFIED ON THE TERMINAL. BEFORE TYPING A CHARACTER TO CONTINUE, A DRIVE CAN BE WRITE PROTECTED WITHOUT CAUSING AN ERROR BECAUSE, THE SYSTEM IS SIZED AGAIN.

7.2 EXCEPTIONS

IF ANY OF THE DEVICES IS LOCATED AT A NON-STANDARD ADDRESS (SEE BELOW), THE DEVICE REGISTER ADDRESS TABLES (IN "COMMON TAGS") SHOULD BE CHANGED TO THE CORRECT ADDRESSES. FOLLOWING IS THE DEFAULT ADDRESS OF THE CONTROL AND STATUS REGISTER OF EACH DEVICE:

RP03----176714

```
598                                                     RK05----177404
599                                                     RP04----176700
```

RS03/4--172040

IF THE SYSTEM HAS BOTH AN RP03 AND AN RP04, THE BRANCH INSTRUCTION AT 1005, IN THE "SIZE ROUTINE" MUST BE REPLACED BY A NOP (240) FOR BOTH DEVICES TO BE USED. THIS BRANCH IS APPROXIMATELY AT ADDRESS 4706. ALSO, THE OPERATER MUST CHANGE THE RP04 ADDRESSES IN THE TABLE IN THE "COMMON TAGS" AREA.

8.0 MISCELLANEOUS

8.1 EXECUTION TIME

THE EXECUTION TIME IS DEPENDENT ON THE AMOUNT OF MEMORY ON THE SYSTEM. FOLLOWING ARE TWO TYPICAL RUN TIMES:

1. MANUFACTURING BASIC LINE-16K MEMORY,UBE, MBT, AND NO DISKS---3 MINUTES.
2. SYSTEM-128K MEMORY, 2 RK05'S, RP04, AND 2 RS04'S --15 MINUTES.

8.2 STACK POINTER

THE STACK POINTER IS SET TO 700.

NOTE

WHEN THE PROGRAM IS RUNNING IN USER MODE, THE USER STACK POINTER IS SET TO 700 AND THE KERNEL STACK POINTER IS SET TO 1200. THE KERNEL STACK POINTER IS USED ONLY FOR THE ERROR AND INTERRUPT SERVICE ROUTINES.

8.3 PASS COUNT

THERE ARE TWO WORDS USED FOR EFFECTIVE PASS COUNT. LOCATION "SUBPASS" AND "SPASS". SUBPASS CONTAINS THE ASCII REPRESENTATION OF THE SUBPASS COUNT. THIS IS USED TO INDEX THE PSW TABLE (SEE SECTION 8.8).

FOUR SUBPASSES ARE EXECUTED FOR EACH PASS. THIS ALLOWS ALL PSW COMBINATIONS TO BE TESTED BEFORE REPORTING END OF PASS.

8.4 END OF PASS MESSAGES

AT THE END OF EACH SUBPASS THE SUBPASS NUMBER (THAT IS BEING STARTED) IS TYPED FOLLOWED BY "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 0123456789". IF RUNNING ON ACT11 QV OR AA,

```
                ONLY  THE  SUB-PASS  NUMBER IS TYPED.  AT THE END OF EACH PASS
                THE ELAPSED RUN TIME AND THE MESSAGE "END PASS X TOTAL  ERRORS
                SINCE  LAST  REPORT  Y" IS TYPED.  A SAMPLE OF WHAT A COMPLETE
```

PASS LOOKS LIKE IS SHOWN BELOW:

```
0THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 0123456789
1THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 0123456789
2THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 0123456789
3THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 0123456789
END PASS 1 TOTAL ERRORS SINCE LAST REPORT 0
```

8.5 ITERATIONS

SUB-TEST ITERATIONS ARE NOT PERFORMED UNTIL THE PASS COUNT ($PASS) IS NON-ZERO. THIS MAKES A QV PASS AS SHORT AS POSSIBLE.

AFTER THE FIRST PASS, FULL 10 OCTAL ITERATIONS ARE PERFORMED ON EACH SUBTEST.

8.6 T-BIT TRAPPING

T BIT TRAPPING IS CONTROLLED BY THE PSW TABLE. THE DEFAULT CONDITION IS TO RUN WITH THE T-BIT ON DURING SUBPASSES 2, 4, AND 6.

8.7 ACT-11 COMPATABILITY

THE PROGRAM IS FULLY ACT-11 COMPATABLE. THE PROGRAM OPERATES IN THE ACT-11 MODE UNDER APT.

8.8 PSW TABLE

AT THE END OF THE PROGRAM, JUST BEFORE THE MESSAGES, IS THE PSW TABLE. THIS TABLE CONTROLS WHAT MODE WILL BE EXECUTED ON A SUBPASS. REFER TO SECTION 9.4.2 FOR A DESCRIPTION OF HOW THIS TABLE IS USED BY THE PROGRAM. THIS TABLE MAY BE MODIFIED IF DESIRED.

8.9 I/O DEVICE ADDRESS MODIFICATION

TO MODIFY THE PROGRAM ADDRESS OF THE I/O DEVICES PATCH THE APPROPRIATE DEVICE TABLE (IN THE COMMON TAGS AREA) TO THE DESIRED ADDRESSES.

IF YOU ARE PATCHING THE RP03 OR RP04 SEE SECTION 7.2.

8.10 POWER FAIL

IF A POWER FAIL OCCURS (FOLLOWED BY A POWER UP),, THE WORD

```
   715                                  "POWER" IS TYPED ON THE TERMINAL AND THE PROGRAM RESTARTS.
```

9.0 PROGRAM DESCRIPTION

THE PROGRAM IS DIVIDED INTO 9 SECTIONS OF POSITION INDEPENDENT RELOCATABLE TEST CODE. EACH SECTION IS APPROXIMATELY 1K WORDS LONG.

WHEN THE PROGRAM IS INITIALLY LOADED AND STARTED IT WILL IDENTIFY ITSELF AND TYPE THE FUNCTION OF THE SWITCH REGISTER AND THE DEVICES AND DRIVES THAT WILL BE USED FOR RELOCATION, IF SW7=0. IT WILL ALSO TYPE THE CP OPTIONS AVAILABLE INDICATOR WORD (OPT.CP). THE CONTENTS OF OPT.CP CONTAIN THE FOLLOWING INDICATORS:

```
BIT15       =    NOT USED
BIT14       =    NOT USED
BIT13       =    NOT USED
BIT12       =    NOT USED
BIT11       =    NOT USED
BIT10=1/0   =    MBT AVAILABLE/NOT AVAILABLE
BIT09=1/0   =    KW11-L AVAILABLE/NOT AVAILABLE
BIT08=1/0   =    CONSOLE TTY AVAILABLE/NOT AVAILABLE
BIT07=1/0   =    UBE AVAILABLE/NOT AVAILABLE
BITS06-00   =    NOT USED
```

FOLLOWING IS A BRIEF DESCRIPTION OF EACH SECTION:

SECTION 0 THIS SECTION CAUSES A 256 WORD 3 XOR 9 TEST PATTERN TO BE RELOCATED THROUGHOUT MEMORY 0 - 28K.

NOTE: THIS SHOULD NOT BE CONSTRUED TO BE A COMPLETE MEMORY TEST.

SECTION 1 THIS SECTION TESTS THE UNARY INSTRUCTION SET EXECUTING EACH UNARY INSTRUCTION IN EACH ADDRESS MODE (EXCLUDING UNARY INSTRUCTIONS USING ADDRESS MODE 7).

SECTION 2 THIS SECTION TESTS THE UNARY INSTRUCTIONS USING ADDRESS MODE 7 AND BINARIES IN ALL ADDRESS MODES (EXCLUDING BINARY BYTE OPS USING ADDRESS MODE 7).

SECTION 3 THIS SECTION TESTS BINARY BYTE OPS USING ADDRESS MODE 7, JMP, JSR AND PROGRAM TRAP (IOT, TRAP, AND EMT) INSTRUCTION.

SECTION 4 THIS SECTION CHECKS THAT EACH BIT IN THE PROCESSOR STATUS WORD (PSW) CAN BE SET CLEARED, RESERVED INSTRUCTIONS, AND ODD ADDRESS TRAPS. NOTE THAT BITS 12 AND 14 IN THE PSW ARE COPIES OF BITS 13 AND 15 RESPECTIVELY. THE WCS IS TURNED OFF AT THE BEGINNING OF THE PROGRAM BY INITIALIZING THE WHAMI REGISTER SO THAT THE RESERVED INSTRUCTIONS TRAP.

```
772
773                                    SECTION 5   THIS SECTION CHECKS THE SXT, XOR, SOB,  MARK,  RTT
```

AND RTT INSTRUCTIONS.

SECTION 6 THIS SECTION CHECKS THE ASH, ASHC, MUL, DIV INSTRUCTIONS. ALSO CHECKED IN THIS SECTION ARE THE MED INSTRUCTION AND ERROR LOGGING CAPABILITIES.

SECTION 7 THIS SECTION CHECKS THE STACK LIMIT REGISTER MEMORY MANAGEMENT ABORT LOGIC AND THE MEMORY MANAGEMENT REGISTERS.

SECTION 8 THIS SECTION CHECKS THE FLOATING POINT PROCESSOR.

FOLLOWING SECTION 8 ARE TWO ROUTINES TO CHECK THE TELETYPE PRINTER LOGIC AND A ROUTINE TO START THE KW11-L CLOCK. IF THE KW11-L IS AVAILABLE THE PRIORITY ARBITRATION LOGIC IS TESTED.

9.1 UNIBUS EXERCISER(UBE)

ANY ONE OF 4 UBE'S WILL BE USED. THE PROGRAM LOOKS FOR A UBE AT ADDRESSES 770000, 770020, 770040, AND 770060.

TEST 106 WILL INITIATE THE UNIBUS EXERCISER IF IT IS PRESENT. THIS IS ONLY DONE ON PASS 1 - SUPPASS 1, SINCE FROM THAT POINT ON, THE SERVICE ROUTINE TAKES CARE OF RESTARTING IT.

THE UBE IS INITIALLY SET UP WITH A BUS ADDRESS OF 0. THE FUNCTION THAT IS LOADED IS "DATA IN PAUSE-DATA OUT BYTE". THE WORD COUNT IS SET FOR 4K BYTES. IT IS ALSO SET TO INTERRUPT ON LEVEL 5.

WHEN AN INTERRUPT OCCURS A CHECK IS MADE TO SEE IF IT WAS CAUSED BY AN ERROR. IF THERE WAS NO ERROR, 776 IS LOADED AS THE BUS ADDRESS AND THE UBE IS STARTED AGAIN. ON THE NEXT INTERRUPT 1774 (776+776) IS LOADED AS THE BUS ADDRESS. THIS SEQUENCE CONTINUES UNTIL A MEMORY TIMEOUT ERROR OCCURS.

WHEN AN ERROR OCCURS A CHECK IS MADE TO SEE IF IT WAS CAUSED BY A MEMORY TIMEOUT. IF IT WAS, THE ADDRESS IN THE UBE BUS ADDRESS REGISTER IS COMPARED WITH THE LAST ADDRESS IN THE SYSTEM (MXMMHI AND MXMMLO). IF THEY ARE THE SAME (NO HOLES IN MEMORY) THE UBE IS RESTARTED AT ADDRESS 0 AND THE ABOVE SEQUENCE IS REPEATED. IF THE ADDRESSES ARE NOT THE SAME A MEMORY-HOLE ERROR IS REPORTED.

IF THE ERROR WAS NOT DUE TO A TIMEOUT A UBE ERROR IS REPORTED.

9.2 MASS BUS TESTER(MBT)

ANY ONE OF 4 MBT'S WILL BE USED. THE PROGRAM LOOKS FOR AN MBT AT ADDRESSES 772100, 772200, 772300, AND 772400. IF AN MBT IS

```
830                                     FOUND, THE DRIVE TYPE REGISTER (770X26)  IS  CHECKED  TO  MAKE
831                                     SURE THAT IT REALLY IS AN MBT.
```

TEST 106 ALSO INITIATES THE MASS BUS TESTER. AGAIN, THIS IS ONLY DONE ON PASS 1 - SUBPASS 1 SINCE THE SERVICE ROUTINE KEEPS IT RUNNING.

THE BUS ADDRESS REGISTER IS INITIALLY SET TO 0, THE WORD COUNT TO 2K WORDS, AND A READ FUNCTION IS INITIATED.

WHEN AN INTERRUPT OCCURS AN ERROR CHECK IS MADE. THIS ERROR CHECK IS THE SAME AS THAT DESCRIBED FOR THE UBE. IF THERE WAS NO ERROR, THE MBT RD COUNT IS RELOADED AND THE FUNCTION IS ISSUED. THE BUS ADDRESS REGISTER IS NOT CHANGED SO IT WILL CONTINUE FROM WHERE IT LEFT OFF.

9.3 LINE CLOCK INITIALIZATION

TEST 106 TURNS ON THE LINE CLOCK. TWO LOCATIONS IN "COMMON TAGS" KEEP TRACK OF THE ELAPSED RUN TIME OF THE PROGRAM. WHEN THE CLOCK INTERRUPTS, THE LOW BYTE OF LOCATION "LTICKS" IS INCREMENTED. WHEN THIS BYTE GETS TO 60(DECIMAL) IT IS CLEARED AND THE HIGH BYTE IS INCREMENTED(SECONDS). WHEN THE SECOND COUNT GETS TO 60(DECIMAL) LOCATION "MTICKS" IS INCREMENTED AND LTICKS IS CLEARED. THIS GIVES THE TIMER A 64K DECIMAL MINUTE RANGE.

NOTE

FOR THE UBE, MBT, AND LINE CLOCK, WHEN AN INTERRUPT OCCURS, PROGRAM EXECUTION RETURNS TO KERNEL MODE AND THE KERNEL PAR'S ARE MAPPED DOWN TO THE 0-12K BANK OF MEMORY. UPON RETURNING FROM THE INTERRUPT THE PAR'S ARE MAPPED BACK TO WHERE THEY WERE AND THE PREVIOUS PROCESSOR MODE IS RESTORED.

9.4 RELOCATION ALGORITHM

9.4.1 SECTION RELOCATION

AS EACH SECTION IS ENTERED THE VIRTUAL START ADDRESS IS SAVED IN LOCATION "FRSTAD" AND THE RELOCATION FACTOR (BYTE OFFSET FROM NON-RELOCATED CODE) IS CALCULATED AND SAVED IN LOCATION "FACTOR". THE TEST CODE IS THEN EXECUTED.

AT THE END OF EACH SECTION, CONTROL IS TRANSFERED TO THE "RELOCATION ROUTINE". IF SW<8> IS SET, THIS ROUTINE WILL RELOCATE THE SECTION VIA THE CP (SEE 9.4.3). IF SW<8> IS NOT SET, THE LENGTH OF THE SECTION IS CALCULATED, SAVED AS A WORD COUNT, AND CONTROL IS TRANSFERED TO THE "I/O MONITOR" (SEE SECTION 9.4.4) WHICH RELOCATES THE SECTION BY USING A DISK.

```
888                                     EACH SECTION IS INITIALLY RELOCATED TO THE END ADDRESS OF  THE
889                                     PROGRAM.   SUBSEQUENT  RELOCATIONS  START  AT  THE  END OF THE
```

PREVIOUS RELOCATION. FOR EXAMPLE: IF SECTION 0 IS 1000 BYTES LONG AND THE END ADDRESS OF THE PROGRAM IS 60000, THE FIRST RELOCATION STARTS AT ADDRESS 60000, THE SECOND AT 61000, THE THIRD AT 62000, ETC. THIS CONTINUES UNTIL 28K OR THE END OF MEMORY HAS BEEN REACHED AT WHICH TIME EXECUTION GOES TO THE START OF THE NEXT SECTION AND THE PROCESS REPEATS WITH THE NEW SECTION.

EACH SECTION IS WRITTEN IN POSITION INDEPENDENT CODE SO THAT IT CAN BE RELOCATED AND EXECUTED WITHOUT THE USE OF MEMORY MANAGEMENT.

9.4.2 PROGRAM RELOCATION

WHEN ALL NINE SECTIONS HAVE BEEN RELOCATED AND EXECUTED THRU 28K (SEE SECTION 9.4.1), MEMORY MANAGEMENT IS SETUP ACCORDING TO THE VALUE IN LOCATION "NEXPAR" (MEMORY MANAGEMENT WILL NOT BE TURNED ON IF THERE IS LESS THAN 28K OF MEMORY). THIS VALUE IS INITIALIZED TO 600 (OR 1600 IF RUNNING UNDER THE XXDP MONITOR), MAKING RELOCATION START AT ADDRESS 60000 (OR 160000). THE "I/O MONITOR" IS THEN ENTERED (SEE SECTION 9.4.4) TO RELOCATE THE PROGRAM. WHEN THE I/O MONITOR COMPLETES THE RELOCATION, EXECUTION IS TRANSFERED TO THE START OF THE PROGRAM AT THE RELOCATED POSITION.

EACH SECTION IS EXECUTED ONLY ONCE WITH MEMORY MANAGEMENT ON. AT THE END OF SECTION 8, 77 IS ADDED TO "NEXPAR" AND RELOCATION IS PERFORMED AGAIN. THIS CAUSES THE NEXT RELOCATION TO MOVE UP BY 7700 BYTES. FOR EXAMPLE: IF NEXPAR=1600 THE FIRST RELOCATION STARTS AT ADDRESS 160000, THE SECOND AT ADDRESS 167700, THE THIRD AT 177600, ETC.

THIS CONTINUES UNTIL THE END OF MEMORY IS REACHED AND CONSTITUTES A SUB-PASS. THE PSW IS THEN SETUP FOR THE NEXT SUB-PASS AND THE PROGRAM RESTARTS.

THE VALUE FOR THE PSW IS TAKEN FROM THE TABLE (SEE SECTION 8.8). THE PARTICULAR ENTRY THAT IS USED IS OBTAINED BY INDEXING THE TABLE BY THE SUB-PASS NUMBER (SEE SECTION 8.3). FOR EXAMPLE, SUB-PASS 3 USES WORD 3 (THE FIRST WORD IS COUNTED AS ZERO) OF EACH TABLE. THEREFORE, TO CHANGE THE VALUE IN THE PSW ONLY REQUIRES CHANGING THE VALUE IN THE TABLE.

THE COMPLETION OF 4 SUB-PASSES CONSTITUTES A PASS AND AN END OF PASS MESSAGE IS TYPED. THE PROGRAM THEN RESTARTS IN PASS 2, SUB-PASS 0.

9.4.3 RELOCATION VIA CP

IF SW<8> IS SET, BOTH SECTION AND PROGRAM RELOCATION (SEE SECTIONS 9.4.1 AND 9.4.2), ARE PERFORMED BY AN INSTRUCTION MOVE LOOP RATHER THAN A DISK. FOR EXAMPLE:

```
946
947
                1$:  MOV (R0)+,(R2)+
                     CMP R0,R3
```

BNE 1$

WHERE R0 IS THE ADDRESS OF THE CODE BEING MOVED, R2 IS THE ADDRESS THAT IT IS BEING MOVED TO, AND R3 IS THE LAST ADDRESS THAT IS TO BE MOVED.

WHEN THIS IS FINISHED, THE RELOCATED DATA IS CHECKED BY AN INSTRUCTION COMPARE LOOP TO ENSURE THAT THE RELOCATION WAS PERFORMED CORRECTLY.

9.4.4 RELOCATION VIA I/O

IF SW<8> IS NOT SET, BOTH SECTION AND PROGRAM RELOCATION (SEE SECTION 9.4.1 AND 9.4.2), ARE PERFORMED BY WRITING THE DATA TO A DISK AND READING IT BACK TO THE RELOCATED POSITION. THIS RELOCATION IS CONTROLLED BY THE "I/O MONITOR".

9.4.4.1 SECTION RELOCATION

WHEN THE I/O MONITOR IS ENTERED FROM THE "RELOCATION ROUTINE" (SEE SECTION 9.4.1) A DEVICE IS SELECTED (SEE 9.4.4.3), THE MEMORY ADDRESSES (FROM AND TO) AND WORD COUNT ARE PASSED TO THE DEVICE HANDLER (SEE SECTION 9.4.4.4), AND THE HANDLER IS CALLED. WHEN THE HANDLER FINISHES, THE I/O MONITOR CHECKS THE RELOCATED DATA WITH AN INSTRUCTION COMPARE LOOP TO ENSURE THE RELOCATED DATA IS CORRECT, AND RETURNS TO THE "RELOCATION ROUTINE" (SEE 9.4.1).

9.4.4.2 PROGRAM RELOCATION

WHEN THE I/O MONITOR IS ENTERED FOR PROGRAM RELOCATION (SEE SECTION 9.4.2) THE BASE ADDRESS FOR THE RELOCATION IS CALCULATED FROM THE CONTENTS OF KERNEL PAR3 WHICH WAS SET UP WITH MEMORY MANAGEMENT (SEE 9.4.2). IF SW<8> IS SET, RELOCATION IS PERFORMED VIA THE CP (SEE SECTION 9.4.3).

IF SW<8> IS NOT SET, A DEVICE IS SELECTED (SEE 9.4.4.3), THE WORD COUNT IS SET TO 2K, AND THE MEMORY ADDRESSES (FROM AND TO) AND WORD COUNT ARE PASSED TO THE DEVICE HANDLER (SEE 9.4.4.4), AND THE HANDLER IS CALLED. THE I/O MONITOR THEN ADDS 2K TO THE MEMORY ADDRESSES, SELECTS ANOTHER DEVICE, PASSES THE ADDRESSES TO THE DEVICE HANDLER, AND CALLS THE HANDLER. THIS CONTINUES UNTIL ALL 12K HAS BEEN RELOCATED. THE RELOCATED DATA IS THEN CHECKED WITH AN INSTRUCTION COMPARE LOOP. THE RELOCATED PROGRAM IS THEN EXECUTED AS DESCRIBED IN 9.4.2.

9.4.4.3 DEVICE SELECTION

IF SW<5> IS NOT SET, AN INDEX IS PICKED UP FROM LOCATION "DEVINDX". THIS INDEX IS USED TO INDEX THE SYSTEM SIZE TABLE. THE SYSTEM SIZE TABLE CONSISTS OF 8 WORDS (ONE FOR EACH DEVICE TYPE). BITS <7:0> OF EACH WORD ARE USED TO INDICATE THE DRIVE

```
1004                                    NUMBERS THAT ARE AVAILABLE ON THE DEVICE, AND ARE  INITIALIZED
1005                                    IN  THE  SIZE  ROUTINE.   BITS <15:8> OF EACH WORD ARE USED TO
```

INDICATE WHETHER THE DRIVE HAS BEEN USED FOR A DATA TRANSFER (UNIT USED BIT).

THE SYSTEM SIZE TABLE IS THEN SEARCHED, USING THE INDEX DESCRIBED ABOVE, FOR A DRIVE THAT HAS NOT BEEN USED. WHEN A DRIVE IS FOUND, THE "UNIT USED BIT" IS SET, THE CURRENT INDEX IS PUT BACK IN LOCATION DEVINDX, AND EXECUTION CONTINUES AS DESCRIBED IN 9.4.4.1 OR 9.4.4.2.

IF AN UNUSED UNIT IS NOT FOUND, ALL THE "UNIT USED" BITS ARE CLEARED AND THE SEARCH IS RESTARTED. IF THE SEARCH FINDS THE SYSTEM SIZE TABLE EMPTY (NO DEVICES ON THE SYSTEM), THE MESSAGE "NO I/O DEVICES" IS TYPED AND RELOCATION IS PERFORMED VIA THE CP AS DESCRIBED IN 9.4.3.

IF SW<5> IS SET, SW'S<2:0> ARE USED TO INDEX THE SYSTEM SIZE TABLE. IN THIS CASE ONLY ONE WORD OF THE TABLE IS USED CORRESPONDING TO THE DEVICE BEING SELECTED BY SW'S<2:0> (SEE SECTION 5.1). IN THIS MODE, A ROUND ROBIN SELECTION IS PERFORMED ON THE DRIVES OF THE SELECTED DEVICE.

9.4.4.4 DEVICE HANDLERS

EACH DEVICE THAT IS USED FOR RELOCATION HAS A HANDLER. THESE HANDLERS ARE FUNCTIONALLY THE SAME.

THE HANDLER IS CALLED BY THE I/O MONITOR (SEE SECTION 9.4.4). IT FIRST CLEARS THE DONE BIT (BIT 7) IN THE HANDLER STATUS WORD. THIS PREVENTS THE MONITOR FROM CALLING THIS HANDLER AGAIN BEFORE IT IS FINISHED.

IF A "DEVICE HUNG" ERROR (SEE SECTION 6.1.12) IS DETECTED, THE HANDLER STATUS WORDS CAN BE EXAMINED TO DETERMINE WHICH DEVICE DID NOT FINISH (SET BIT 7). THE DRIVE CAN THEN BE DETERMINED BY LOOKING IN THE "DEVICE HANDLER UNIT NUMBER" TABLE. THE HANDLER STATUS WORDS AND DEVICE HANDLER UNIT NUMBER TABLES, ARE LOCATED IN THE "COMMON TAGS" AREA OF THE LISTING.

THEN THE HANDLER CALCULATES A DISK ADDRESS. THIS ADDRESS IS EITHER GENERATED FROM A RANDOM NUMBER (SW4=0) OR IS SET TO ZERO (SW4=1). THE DEVICE ID, UNIT NUMBER, AND CYLINDER ADDRESS ARE COMBINED AND PLACED IN THE "RUN TABLE" (RUNTBL). THE POSITION IN THE RUN TABLE CORRESPONDS TO WHICH 2K BLOCK OF THE PROGRAM IS BEING TRANSFERED (I.E. THE FIRST 2K BLOCK IS IDENTIFIED BY WORD 1, THE SECOND 2K BY WORD 2, ETC.). THE BIT CONFIGURATION OF EACH WORD IN THE RUN TABLE IS AS FOLLOWS:

```
<15:13> = DEVICE ID
<12:10> = UNIT NUMBER
    <9> = NOT USED
  <8:0> = CYLINDER ADDRESS
```

THE TRACK-SECTOR ADDRESS OF THE TRANSFER IS SAVED IN THE "RUN

```
1062                                    TRACK  TABLE"  (RUNTRAK).   THE  POSITION  IN THIS TABLE IS AS
1063                                    DESCRIBED ABOVE.  THE BIT CONFIGURATION OF EACH  WORD  IS  THE
```

SAME AS THAT FOR THE DISK ADDRESS REGISTER FOR THE PARTICULAR DEVICE. BIT 15 IS USED TO INDICATE A DEVICE ERROR. IT IS SET BY THE DEVICE SERVICE ROUTINE.(SEE SECTION 9.4.4.5)

THE HANDLER THEN INITIALIZES THE DEVICE REGISTERS WITH ALL THE APPROPRIATE INFORMATION AND STARTS A WRITE FUNCTION. EXECUTION THEN RETURNS TO THE I/O MONITOR AT THE POINT WHERE THE HANDLER WAS CALLED.

9.4.4.5 DEVICE SERVICE ROUTINES

EACH DEVICE THAT IS USED FOR RELOCATION HAS A SERVICE ROUTINE. THESE ROUTINES ARE ALL FUNCTIONALLY THE SAME.

THE ROUTINE IS ENTERED BY A DEVICE INTERRUPT. THE DEVICE IS CHECKED FOR ANY ERRORS. IF NO ERROR OCCURRED THE DEVICE REGISTERS ARE LOADED AND THE NEXT FUNCTION TO PERFORM IS INITIATED. THREE FUNCTIONS ARE EXECUTED: WRITE, WRITE CHECK, AND READ. ALL THE NECESSARY BUS ADDRESS INFORMATION IS CALCULATED BY THE I/O MONITOR, SO THE SERVICE ROUTINE JUST TAKES CARE OF THE DEVICE.

WHEN THE READ FUNCTION HAS BEEN COMPLETED SUCCESSFULLY, THE DONE BIT (BIT 7) IN THE HANDLER STATUS WORD IS SET.

UPON INITIATION OF A FUNCTION, OR COMPLETION OF ALL THREE FUNCTIONS, THE SERVICE ROUTINE RETURNS EXECUTION TO WHERE IT WAS WHEN IT WAS INTERRUPTED.

IF AN ERROR IS DETECTED, THE FUNCTION THAT FAILED IS RETRIED TWO MORE TIMES. IF THE ERROR IS STILL PRESENT THE DONE BIT AND THE ERROR BIT (BIT 15) IS SET IN THE HANDLER STATUS WORD ALONG WITH BIT 15, IN THE APPROPRIATE ENTRY, IN THE RUN TRACK TABLE, AND THE ROUTINE EXITS AS DESCRIBED ABOVE.

```
1104                            .TITLE  MAINDEC-11-DQKDC-A PDP 11/6X SERIES CPU EXERCISER
1105                            ;*COPYRIGHT (C) JANUARY,1977
1106                            ;*DIGITAL EQUIPMENT CORP.
1107                            ;*MAYNARD, MASS. 01754
1108                            ;*
1109                            ;*
1110                            ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
1111                            ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
1112                            ;*
```

```
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123                            .SBTTL  OPERATIONAL SWITCH SETTINGS
1124                            ;*
1125                            ;*      SWITCH                  USE
1126                            ;*      ------          --------------------
1127                            ;*        15            HALT ON ERROR
1128                            ;*        14            LOOP ON TEST
1129                            ;*        13            INHIBIT ERROR TYPEOUTS
1130                            ;*        12            INHIBIT UBE
1131                            ;*        11            INHIBIT ITERATIONS
1132                            ;*        10            BELL ON ERROR
1133                            ;*         9            LOOP ON ERROR
1134                            ;*         8            INHIBIT RELOCATION VIA I/O DEVICE
1135                            ;*         7            INHIBIT SYSTEM SIZE TYPEOUT
1136                            ;*         6            INHIBIT RELOCATION
1137                            ;*         5            INHIBIT ROUND ROBIN
1138                            ;*         4            INHIBIT RANDOM DISK ADDRESS
1139                            ;*         3            INHIBIT MBT
1140                            ;*         2            THESE THREE SWITCHES
1141                            ;*         1            ARE ENCODED TO SELECT RELOCATION
1142                            ;*         0            ON THE FOLLOWING DEVICES:
1143                            ;*                  0...RP11/RP03
1144                            ;*                  1...RK11/RK05
1145                            ;*                  2...NOT USED
1146                            ;*                  3...NOT USED
1147                            ;*                  4...RH11/RP04
1148                            ;*                  5...RH11/RS04
1149                            ;*                  6...NOT USED
1150                            ;*                  7...NOT USED
1151
1152                            ;*      SWITCH          OCTAL VALUE
1153                            ;*      ------          -----------
1154                            ;*        15            100000
1155                            ;*        14             40000
1156                            ;*        13             20000
1157                            ;*        12             10000
1158                            ;*        11              4000
1159                            ;*        10              2000
1160                            ;*         9              1000
1161                            ;*         8               400
1162                            ;*         7               200
1163                            ;*         6               100
1164                            ;*         5                40
1165                            ;*         4                20
1166                            ;*         3                10
1167                            ;*         2                 4
1168                            ;*         1                 2
```

```
 1169                                   ;*        0                 1
```

```
                                .SBTTL  BASIC DEFINITIONS

                                ;*INITIAL ADDRESS OF THE STACK POINTER *** 1200 ***
001200                          STACK=  1200
                                .EQUIV  EMT,ERROR       ;;BASIC DEFINITION OF ERROR CALL
                                .EQUIV  IOT,SCOPE       ;;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
                                .EQUIV  PS,PSW
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
000005                          R5=     %5              ;;GENERAL REGISTER
000006                          R6=     %6              ;;GENERAL REGISTER
000007                          R7=     %7              ;;GENERAL REGISTER
000006                          SP=     %6              ;;STACK POINTER
000007                          PC=     %7              ;;PROGRAM COUNTER

                                ;*PRIORITY LEVEL DEFINITIONS
000000                          PR0=    0               ;;PRIORITY LEVEL 0
000040                          PR1=    40              ;;PRIORITY LEVEL 1
000100                          PR2=    100             ;;PRIORITY LEVEL 2
000140                          PR3=    140             ;;PRIORITY LEVEL 3
000200                          PR4=    200             ;;PRIORITY LEVEL 4
000240                          PR5=    240             ;;PRIORITY LEVEL 5
000300                          PR6=    300             ;;PRIORITY LEVEL 6
000340                          PR7=    340             ;;PRIORITY LEVEL 7

                                ;*"SWITCH REGISTER" SWITCH DEFINITIONS
100000                          SW15=   100000
040000                          SW14=   40000
020000                          SW13=   20000
010000                          SW12=   10000
004000                          SW11=   4000
002000                          SW10=   2000
001000                          SW09=   1000
000400                          SW08=   400
000200                          SW07=   200
000100                          SW06=   100
000040                          SW05=   40
000020                          SW04=   20
000010                          SW03=   10
000004                          SW02=   4
```

```
1226            000002                  SW01=   2
1227            000001                  SW00=   1
1228                                    .EQUIV  SW09,SW9
1229                                    .EQUIV  SW08,SW8
1230                                    .EQUIV  SW07,SW7
1231                                    .EQUIV  SW06,SW6
1232                                    .EQUIV  SW05,SW5
1233                                    .EQUIV  SW04,SW4
1234                                    .EQUIV  SW03,SW3
1235                                    .EQUIV  SW02,SW2
1236                                    .EQUIV  SW01,SW1
1237                                    .EQUIV  SW00,SW0
1238
1239                                    ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
1240            100000                  BIT15=  100000
1241            040000                  BIT14=  40000
1242            020000                  BIT13=  20000
1243            010000                  BIT12=  10000
1244            004000                  BIT11=  4000
1245            002000                  BIT10=  2000
1246            001000                  BIT09=  1000
1247            000400                  BIT08=  400
1248            000200                  BIT07=  200
1249            000100                  BIT06=  100
1250            000040                  BIT05=  40
1251            000020                  BIT04=  20
1252            000010                  BIT03=  10
1253            000004                  BIT02=  4
1254            000002                  BIT01=  2
1255            000001                  BIT00=  1
1256                                    .EQUIV  BIT09,BIT9
1257                                    .EQUIV  BIT08,BIT8
1258                                    .EQUIV  BIT07,BIT7
1259                                    .EQUIV  BIT06,BIT6
1260                                    .EQUIV  BIT05,BIT5
1261                                    .EQUIV  BIT04,BIT4
1262                                    .EQUIV  BIT03,BIT3
1263                                    .EQUIV  BIT02,BIT2
1264                                    .EQUIV  BIT01,BIT1
1265                                    .EQUIV  BIT00,BIT0
1266
1267                                    ;*BASIC "CPU" TRAP VECTOR ADDRESSES
1268            000004                  ERRVEC= 4               ;;TIME OUT AND OTHER ERRORS
1269            000010                  RESVEC= 10              ;;RESERVED AND ILLEGAL INSTRUCTIONS
1270            000014                  TBITVEC=14              ;;"T" BIT
1271            000014                  TRTVEC= 14              ;;TRACE TRAP
1272            000014                  BPTVEC= 14              ;;BREAKPOINT TRAP (BPT)
1273            000020                  IOTVEC= 20              ;;INPUT/OUTPUT TRAP (IOT) **SCOPE**
1274            000024                  PWRVEC= 24              ;;POWER FAIL
1275            000030                  EMTVEC= 30              ;;EMULATOR TRAP (EMT) **ERROR**
1276            000034                  TRAPVEC=34              ;;"TRAP" TRAP
1277            000060                  TKVEC=  60              ;;TTY KEYBOARD VECTOR
1278            000064                  TPVEC=  64              ;;TTY PRINTER VECTOR
1279            000240                  PIRQVEC=240             ;;PROGRAM INTERRUPT REQUEST VECTOR
1280                                    .SBTTL  MEMORY MANAGEMENT DEFINITIONS
1281
```

```
1282                                    ;*KT11 VECTOR ADDRESS
1283
1284            000250                  MMVEC=  250
1285
1286                                    ;*KT11 STATUS REGISTER ADDRESSES
1287
1288            177572                  SR0=    177572
1289            177574                  SR1=    177574
1290            177576                  SR2=    177576
1291            172516                  SR3=    172516
1292
1293                                    ;*USER "I" PAGE DESCRIPTOR REGISTERS
1294
1295            177600                  UIPDR0= 177600
1296            177602                  UIPDR1= 177602
1297            177604                  UIPDR2= 177604
1298            177606                  UIPDR3= 177606
1299            177610                  UIPDR4= 177610
1300            177612                  UIPDR5= 177612
1301            177614                  UIPDR6= 177614
1302            177616                  UIPDR7= 177616
1303
1304                                    ;*USER "I" PAGE ADDRESS REGISTERS
1305
1306            177640                  UIPAR0= 177640
1307            177642                  UIPAR1= 177642
1308            177644                  UIPAR2= 177644
1309            177646                  UIPAR3= 177646
1310            177650                  UIPAR4= 177650
1311            177652                  UIPAR5= 177652
1312            177654                  UIPAR6= 177654
1313            177656                  UIPAR7= 177656
1314
1315                                    ;*KERNEL "I" PAGE DESCRIPTOR REGISTERS
1316
1317            172300                  KIPDR0= 172300
1318            172302                  KIPDR1= 172302
1319            172304                  KIPDR2= 172304
1320            172306                  KIPDR3= 172306
1321            172310                  KIPDR4= 172310
1322            172312                  KIPDR5= 172312
1323            172314                  KIPDR6= 172314
1324            172316                  KIPDR7= 172316
1325
1326                                    ;*KERNEL "I" PAGE ADDRESS REGISTERS
1327
1328            172340                  KIPAR0= 172340
1329            172342                  KIPAR1= 172342
1330            172344                  KIPAR2= 172344
1331            172346                  KIPAR3= 172346
1332            172350                  KIPAR4= 172350
1333            172352                  KIPAR5= 172352
1334            172354                  KIPAR6= 172354
1335            172356                  KIPAR7= 172356
1336
1337            000700                          USESTK  =STACK-300
```

```
1338    000200                  CRLF    =200
1339    076600                  MED     =76600          ;OPCODE FOR "MED" INSTRUCTION
1340    000114                  CACHVEC =114            ;CACHE ERROR INTERRUPT VECTOR
1341    177744                  MEMERR  =177744         ;CACHE ERROR REGISTER
1342    177746                  CCR     =177746         ;MEMORY CONTROL REGISTER
1343    177752                  HITMIS  =177752         ;HIT-MISS REGISTER, A "1"
1344                                                    ;IMPLIES A HIT IN CACHE
1345    177766                  CPUERR  =177766         ;CPU ERROR REGISTER HOLDS CONDITION
1346                                                    ;THAT CAUSED TRAP TO ERRVEC (004)
1347    177770                  UBREAK  =177770         ;ADDRESS OF MICROBREAK REG.
1348
1349                            .EQUIV  SP,KSP
1350                            .EQUIV  SP,USP
1351                            .EQUIV  STACK,KERSTK
1352                            .EQUIV  SR0,MMR0
1353                            .EQUIV  SR2,MMR2
1354    000000                  AC0=    %0
1355    000001                  AC1=    %1
1356    000002                  AC2=    %2
1357    000003                  AC3=    %3
1358    000004                  AC4=    %4
1359    000005                  AC5=    %5
1360                    ;LINE CLOCK AND PROGRAMMABLE LINE CLOCK REGISTERS
1361    172540                  PLKCSR=172540
1362    172542                  PLKCSB=172542
1363    000104                  PLKVEC=104
1364    177546                  LKS=177546
1365    000100                  LKVEC=100
1366
1367                    ;UNIBUS EXERCISOR REGISTER
1368    170000                  UBEDB=  170000          ;DATA BUFFER
1369    170002                  UBECC=  170002          ;CYCLE COUNT
1370    170004                  UBEBA=  170004          ;BUS ADDRESS
1371    170006                  UBECR1= 170006          ;CONTROL REGISTER 1
1372    170010                  UBECLR= 170010          ;ERROR CLEAR
1373    170014                  UBEGO=  170014          ;MULTI-EXERCISOR GO
1374    170016                  UBECR2= 170016          ;CONTROL REGISTER 2
1375    000510                  UBEVEC= 510             ;INTERRUPT VECTOR
1376
1377                    ;MASS BUS TESTER REGISTERS
1378    160100                  MBTCS1= 160100          ;CONTROL & STATUS REG. 1
1379    160102                  MBTWC=  160102          ;WORD COUNT
1380    160104                  MBTBA=  160104          ;BUS ADDRESS REG.
1381    160106                  MBTMR2= 160106          ;MAINTENANCE REG. 2
1382    160110                  MBTCS2= 160110          ;CONTROL & STATUS REG. 2
1383    160112                  MBTST=  160112          ;STATUS REG. (TAPE)
1384    160114                  MBTER=  160114          ;ERROR REGISTER
1385    160116                  MBTAS=  160116          ;ATTENTION SUMMARY REG.
1386    160120                  MBTDB=  160120          ;DATA BUFFER
1387    160124                  MBTMR1= 160124          ;MAINTENANCE REG. 1
1388    160126                  MBTDT=  160126          ;DRIVE TYPE REG.
1389    160174                  MBTBAE= 160174          ;BUS ADDRESS EXTENSION REG.
1390    160176                  MBTCS3= 160176          ;CONTROL & STATUS REG. 3
1391    000774                  MBTVEC= 774             ;INTERRUPT VECTOR
1392    000776                  MBTPSW= 776
1393
```

```
                                ;MISCELLANEOUS BIT ASSIGNMENTS (USED IN OPT.CP)
100000                                  KTOPT=  100000          ;BIT15 - BELOW BIT ASSIGNMENTS ARE USED
040000                                  EISOPT= 040000          ;BIT14 - IN THE CPCHK ROUTINE
020000                                  FPOPT=  020000          ;BIT13 - A BIT FOR EACH OPTION PRESENT
002000                                  MBTOPT= 002000          ;BIT10 - BITS 15,14,13,9 NON OPTION BITS
001000                                  LKOPT=  001000          ;BIT09 - BITS 12,11,06-00 NOT USED
000400                                  TTOPT=  000400          ;BIT08
000200                                  UBEOPT= 000200          ;BIT07

                                ;MED OPERATION CODE DEFINITIONS
000022                                  RDWHAMI=022
000144                                  RDFLAG=144
000222                                  WRWHAMI=222
000226                                  WCNSSW=226
000344                                  WRFLAG=344
000100                                  RDLJAM=100
000300                                  WRLJAM=300
000101                                  RDLSERVICE=101
000301                                  WRLSERVICE=301
000102                                  RDLPBA=102
000302                                  WRLPBA=302
000103                                  RDLCUA=103
000303                                  WRLCUA=303
000104                                  RDLFGINT=104
000304                                  WRLFGINT=304
000105                                  RDLWHAMI=105
000305                                  WRLWHAMI=305
000106                                  RDLDATA=106
000306                                  WRLDATA=306
000107                                  RDLTAG=107
000307                                  WRLTAG=307
000352                                  WRINIT=352
000071                                  SWB01=71                ;MICRO ADDR. IN SWAB INST.
000710                                  SWB1A=710               ;SAME MICRO ADDR. SHIFTED RIGHT

                                ;ADDITIONAL DEFINITIONS
                                        .EQUIV  ERROR,HLT
000010                                  CALLHANDLER=10
000000                                  KM=0
140000                                  UM=140000
000000                                  PKM=0
030000                                  PUM=30000
000100                                  WWP=BIT6
000001                                  DPTRP=BIT0
000200                                  PABORT=BIT7
000100                                  LO=BIT6
000200                                  HI=BIT7
000040                                  TAG=BIT5

                                .SBTTL  TRAP CATCHER

000000                                  .=0
                                ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ".+2,HALT"
                                ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
                                ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
000174                                  .=174
```

```
1450  000174  000000                  DISPREG: .WORD  0               ;;SOFTWARE DISPLAY REGISTER
1451  000176  000000                  SWREG:   .WORD  0               ;;SOFTWARE SWITCH REGISTER
1452                                  .SBTTL  STARTING ADDRESS(ES)
1453  000200  000137  003276                  JMP     @#START ;;JUMP TO STARTING ADDRESS OF PROGRAM
1454                                  .SBTTL  ACT11 HOOKS
1455
1456                                  ;;**********************************************************************
1457                                  ;HOOKS REQUIRED BY ACT11
1458          000204                          $SVPC=.                 ;SAVE PC
1459          000046                          .=46
1460  000046  041230                          $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .$EOP
1461          000052                          .=52
1462  000052  040000                          .WORD   40000           ;;2)SET LOC.52 TO 40000
1463          000204                          .=$SVPC                 ;; RESTORE PC
```

```
                                .SBTTL  COMMON TAGS

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

                        001200                  .=1200
001200                  000000  $CMTAG:                 ;;START OF COMMON TAGS
001200  000000          000000  $PASS:   .WORD   0      ;;CONTAINS PASS COUNT
001202  000000          000000  $TSTNM:  .WORD   0      ;;CONTAINS THE TEST NUMBER
001204  000             000     $ERFLG:  .BYTE   0      ;;CONTAINS ERROR FLAG
                        001206          .EVEN
001206  000000          000000  $ICNT:   .WORD   0      ;;CONTAINS SUBTEST ITERATION COUNT
001210  000000          000000  $LPADR:  .WORD   0      ;;CONTAINS SCOPE LOOP ADDRESS
001212  000000          000000  $LPERR:  .WORD   0      ;;CONTAINS SCOPE RETURN FOR ERRORS
001214  000000          000000  $ERTTL:  .WORD   0      ;;CONTAINS TOTAL ERRORS DETECTED
001216  000             000     $ITEMB:  .BYTE   0      ;;CONTAINS ITEM CONTROL BYTE
001217  001             001     $ERMAX:  .BYTE   1      ;;CONTAINS MAX. ERRORS PER TEST
001220  000000          000000  $ERRPC:  .WORD   0      ;;CONTAINS PC OF LAST ERROR INSTRUCTION
001222  000000          000000  $GDADR:  .WORD   0      ;;CONTAINS ADDRESS OF 'GOOD' DATA
001224  000000          000000  $BDADR:  .WORD   0      ;;CONTAINS ADDRESS OF 'BAD' DATA
001226  000000          000000  $GDDAT:  .WORD   0      ;;CONTAINS 'GOOD' DATA
001230  000000          000000  $BDDAT:  .WORD   0      ;;CONTAINS 'BAD' DATA
001232  000000          000000          .WORD   0      ;;RESERVED--NOT TO BE USED
001234  000000          000000          .WORD   0
001236  000             000     $AUTOB:  .BYTE   0      ;;AUTOMATIC MODE INDICATOR
001237  000             000     $INTAG:  .BYTE   0      ;;INTERRUPT MODE INDICATOR
001240  000000          000000          .WORD   0
001242  177570          177570  SWR:     .WORD   DSWR   ;;ADDRESS OF SWITCH REGISTER
001244  177570          177570  DISPLAY: .WORD   DDISP  ;;ADDRESS OF DISPLAY REGISTER
001246  177560          177560  $TKS:    177560        ;;TTY KBD STATUS
001250  177562          177562  $TKB:    177562        ;;TTY KBD BUFFER
001252  177564          177564  $TPS:    177564        ;;TTY PRINTER STATUS REG. ADDRESS
001254  177566          177566  $TPB:    177566        ;;TTY PRINTER BUFFER REG. ADDRESS
001256  000             000     $NULL:   .BYTE   0      ;;CONTAINS NULL CHARACTER FOR FILLS
001257  002             002     $FILLS:  .BYTE   2      ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
001260  012             012     $FILLC:  .BYTE   12     ;;INSERT FILL CHARS. AFTER A "LINE FEED"
001261  000             000     $TPFLG:  .BYTE   0      ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
001262  000000          000000  $REGAD:  .WORD   0      ;;CONTAINS THE ADDRESS FROM
                                                        ;;WHICH  ($REG0) WAS OBTAINED
001264  000000          000000  $REG0:   .WORD   0      ;;CONTAINS (($REGAD)+0)
001266  000000          000000  $REG1:   .WORD   0      ;;CONTAINS (($REGAD)+2)
001270  000000          000000  $REG2:   .WORD   0      ;;CONTAINS (($REGAD)+4)
001272  000000          000000  $REG3:   .WORD   0      ;;CONTAINS (($REGAD)+6)
001274  000000          000000  $REG4:   .WORD   0      ;;CONTAINS (($REGAD)+10)
001276  000000          000000  $REG5:   .WORD   0      ;;CONTAINS (($REGAD)+12)
001300  000000          000000  $REG6:   .WORD   0      ;;CONTAINS (($REGAD)+14)
001302  000000          000000  $REG7:   .WORD   0      ;;CONTAINS (($REGAD)+16)
001304  000000          000000  $TMP0:   .WORD   0      ;;USER DEFINED
001306  000000          000000  $TMP1:   .WORD   0      ;;USER DEFINED
001310  000000          000000  $TMP2:   .WORD   0      ;;USER DEFINED
001312  000000          000000  $TMP3:   .WORD   0      ;;USER DEFINED
001314  000000          000000  $TMP4:   .WORD   0      ;;USER DEFINED
001316  000000          000000  $TMP5:   .WORD   0      ;;USER DEFINED
001320  000000          000000  $TMP6:   .WORD   0      ;;USER DEFINED
001322  000000          000000  $TMP7:   .WORD   0      ;;USER DEFINED
```

```
1520  001324  000000                  $TIMES: 0                       ;;MAX. NUMBER OF ITERATIONS
1521  001326  000000                  $ESCAPE:0                       ;;ESCAPE ON ERROR ADDRESS
1522  001330  177607  000377          $BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
1523  001334     077                  $QUES:  .ASCII  /?/             ;;QUESTION MARK
1524  001335     015                  $CRLF:  .ASCII  <15>            ;;CARRIAGE RETURN
1525  001336  000012                  $LF:    .ASCIZ  <12>            ;;LINE FEED
1526                                  ;;*****************************************************************
1527  001340  000000                  ERRRTN: .WORD
1528  001342  000044                  $FLBUFF:.BLKB   44      ;BUFFER FOR FLOATING POINT CONVERSION
1529  001406  000000                  $.JFF:  .WORD           ;
1530  001410  000000                  $AC0:   .WORD           ;EXTENDED EXPONENT VALUES
1531  001412  000000                  $AC1:   .WORD           ;FOR THE SIX FLOATING POINT
1532  001414  000000                  $AC2:   .WORD           ;ACCUMULATORS
1533  001416  000000                  $AC3:   .WORD
1534  001420  000000                  $AC4:   .WORD
1535  001422  000000                  $AC5:   .WORD
1536  001424  000000                  FTMP0:  .WORD   0       ;LOCATIONS TO HOLD FLT. PT. OPERANDS
1537  001426  000000                  FTMP1:  .WORD   0
1538  001430  000000                  FTMP2:  .WORD   0
1539  001432  000000                  FTMP3:  .WORD   0
1540  001434  000000                  FTMP4:  .WORD   0
1541  001436  000000                  FTMP5:  .WORD   0
1542  001440  000000                  FTMP6:  .WORD   0
1543  001442  000000                  FTMP7:  .WORD   0
1544  001444  000000                  FREG0:  .WORD   0
1545  001446  000000                  FREG1:  .WORD   0
1546  001450  000000                  FREG2:  .WORD   0
1547  001452  000000                  FREG3:  .WORD   0
1548  001454  000000                  FREG4:  .WORD   0
1549  001456  000000                  FREG5:  .WORD   0
1550  001460  000000                  FREG6:  .WORD   0
1551  001462  000000                  FREG7:  .WORD   0
1552  001464  000004                  FLTMP0: .BLKW   4       ;FLOATING POINT DBL PREC BUFFER
1553  001474  000004                  FLTMP1: .BLKW   4
1554  001504  001506                  TKBFRP: .WORD   TKBFR   ;POINTER FOR KEYBOARD BUFFER
1555  001506  000011                  TKBFR:  .BLKW   11      ;KEYBOARD BUFFER
1556  001530  000000                  NOTYPE: .WORD           ;NO TYPEOUT FLAG (INHIBIT WHEN SET)
1557  001532  000000                  OPT.CP: .WORD           ;CPU OPTION FLAGS
1558  001534  000006                  $RTRN:  RTT             ;RETURN FOR T-BIT TRAP
1559  001536  000000                  VADR:   .WORD           ;BUFFER FOR VIRTUAL ADDRESS
1560  001540  000000                  PA1500: .WORD           ;BUFFER FOR PHYSICAL ADDRESS BITS<15:00>
1561  001542  000000                  PA1716: .WORD           ;PHYSICAL ADDRESS BITS<17:16>
1562  001544     000                  NEXEC:  .BYTE           ;NO EXECUTE FLAG(NO TEST EXECUTION WHEN SET)
1563  001545     000                  MMON:   .BYTE           ;MEMORY MGMT FLAG(MGMT IS ON WHEN NON-ZERO)
1564  001546     000                  QV:     .BYTE           ;QV FLAG(QV PASS WHEN SET)
1565  001547     000                  AA:     .BYTE           ;AUTO ACCEPT FLAG (AA PASS WHEN SET)
1566  001550  000000                  FACTOR: .WORD           ;RELOCATION FACTOR(NUMBER OF
1567  001552  000000                  $FACTOR:.WORD           ;BYTES ABOVE BASE CODE)
1568  001554  000000                  FRSTAD: .WORD           ;FIRST ADDRESS OF SECTION BEING EXECUTED
1569  001556  000000                  FRSTMEM:.WORD           ;ADDRESS OF FIRST FREE MEMORY
1570  001560  000000                  LSTMEM:.WORD            ;ADDRESS OF LAST FREEE MEMORY(IN 28K)
1571  001562  000000                  NEXPAR: .WORD           ;NEXT VALUE TO PUT IN PAR0
1572  001564  123456                  $LONUM: .WORD   123456  ;LOW 16 BITS OF RANDOM NUMBER
1573  001566  065432                  $HINUM: .WORD   65432   ;HIGH 16 BITS OF RANDOM NUMBER
1574  001570     001  001     001     NULLS:  .BYTE   1,1,1,0 ;BUFFER FOR PRINTER TEST
1575  001573     000
```

```
1576  001574  000060                SUBPASS:.WORD   60      ;SUB-PASS COUNT IN ASCII
1577  001576  000000                SERPSW: .WORD           ;ERROR PSW FOR TYPEOUT
1578  001600  000000                EXITFL: .WORD
1579  001602  000000                OLDBASE:.WORD           ;SOURCE BASE ADDRESS FOR DEVICE RELOCATION
1580  001604  000C00                NWBASL: .WORD           ;DEST ADDRESS FOR DEVICE RELOC BITS<15:00>
1581  001606  000000                NWBASH: .WORD           ;DEST ADDRESS FOR DEVICE RELOC BITS<21:16>
1582  001610  000000                IOWC:   .WORD           ;TWO'S COMPLIMENT WORD COUNT FOR DEVICE RELOC
1583  001612  000000                DEVICE: .WORD
1584  001614  000000                DEVINDX:.WORD           ;DEVICE INDEX (0 TO 7)
1585  001616  000000                UNITNO: .WORD           ;DEVICE UNIT NUMBER
1586  001620  000000                RNTBINX:.WORD           ;INDEX TO RUN TABLE
1587  001622  000000                MXMMHI: .WORD           ;BITS<21:16> OF LAST MEM ADDRESS ON SYSTEM
1588  001624  000000                MXMMLO: .WORD           ;BITS<15:00> OF LAST MEM ADDRESS ON SYSTEM
1589  001626  000000                RP310:  .WORD           ;DATA TO LOAD INTO RP03 CS REGISTER
1590  001630  000000                RP311:  .WORD           ;RP03 FLAG FOR FIRST 2K OF PROGRAM
1591  001632  000000                RK10:   .WORD           ;DATA TO LOAD INTO RK05 CS REGISTER
1592  001634  000000                RK11:   .WORD           ;RK05 FLAG FOR FIRST 2K OF PROGRAM
1593  001636  000000                RP411:  .WORD           ;RP04 FLAG FOR FIRST 2K OF PROGRAM
1594  001640  000000                RS11:   .WORD           ;RS04 FLAG FOR FIRST 2K OF PROGRAM
1595  001642  000000                MTICKS: .WORD           ;ELAPSED RUN TIME IN MINUTES
1596  001644  000000                LTICKS: .WORD                   ;LOW BYTE=NUMBER OF CLOCK INTERRUPTS (0 TO 59)
1597                                                        ;HIGH BYTE=ELAPSED RUN TIME IN SECONDS(0 TO 59)
1598  001646  000010                SYSSIZE:.BLKW   10      ;SYSTEM SIZE TABLE(ONE ENTRY FOR EACH DEVICE)
1599  001666  000006                RUNTBL: .BLKW   6       ;RUN TIME TABLE(ONE ENTRY FOR EACH 2K BLOCK)
1600  001702  000006                RUNTRAK:.BLKW   6       ;RUN TRACK TABLE(ONE ENTRY FOR EACH 2K BLOCK)
1601  001716  000002                UBESAV: .BLKW   2       ;BASE ADDRESS OF UBE TRANSFER IN PROGRESS
1602  001722  000002                UBEADR: .BLKW   2       ;ADDRESS THAT GETS LOADED INTO UBE BA REG
1603  001726  000002                ERR-BA: .BLKW   2       ;18 BIT UNIBUS ADDRESS WHEN DEVICE DETECTED AN ERROR
1604  001732  000000                MEMFLG: .WORD   0       ;HOLDS FLAG FOR UBE & MBT
1605  001734  000000                ERRADR: .WORD   0       ;HOLDS ADDR. FOR UBE & MBT
1606  001736  000000                REPPSW: .WORD   0       ;HOLDS PSW FOR ERROR REPORT
1607  001740  000000                REPREG: .WORD   0       ;HOLDS REGISTER FOR ERROR REPORT
1608  001742  000000                REPADR: .WORD   0       ;HOLDS LOOP ADDR. FOR ERROR REPROT
1609  001744  000000                REPMR0: .WORD   0       ;HOLDS MR0 FOR ERROR REPORT
1610  001746  000000                REPMR2: .WORD   0       ;HOLDS MR2 FOR ERROR REPORT
1611  001750  000000                SRCADR: .WORD   0       ;HOLDS ADDR. DURING DATA CHECK
1612                                .SBTTL  DEVICE HANDLER STATUS WORDS
1613                                ;*      EACH WORD HAS THE FOLLOWING BIT ASSIGNMENTS:
1614                                ;*              7       HANDLER READY
1615                                ;*              8       REPEAT LAST FUNCTION
1616                                ;*              15      ERROR
1617  001752  000200                RP3HSTAT:.WORD  200     ;RP03
1618  001754  000200                RKHSTAT: .WORD  200     ;RK05
1619  001756  000200                SPARE0: .WORD   200
1620  001760  000200                SPARE1: .WORD   200
1621  001762  000200                RP4HSTAT:.WORD  200     ;RP04
1622  001764  000200                RSHSTAT:.WORD   200     ;RS04
1623  001766  000200                        .WORD   200     ;SPARE
1624  001770  000200                        .WORD   200     ;SPARE
1625
1626                                .SBTTL  DEVICE HANDLER WORD COUNTS
1627                                ;*      THIS TABLE GETS LOADED BY THE I/O
1628                                ;*      RELOCATION ROUTINE WITH THE TWO'S COMPLIMENT WORD
1629                                ;*      COUNT FOR THE TRANSFER FOR THE PARTICULAR DEVICE.
1630  001772  000000                RP3HWC: .WORD           ;RP03
1631  001774  000000                RKHWC:  .WORD           ;RK05
```

```
1632  001776  000000                        .WORD           ;SPARE
1633  002000  000000                        .WORD           ;SPARE
1634  002002  000000              RP4HWC:   .WORD           ;RP04
1635  002004  000000              RSHWC:    .WORD           ;RS04
1636
1637                               .SBTTL  DEVICE HANDLER OLD BASE ADDRESS
1638                               ;*      THIS TABLE GETS LOADED BY THE I/O RELOCATION ROUTINE
1639                               ;*      WITH THE BASE ADDRESS OF THE SOURCE DATA FOR THE
1640                               ;*      DEVICE THAT IS GOING TO TRANSFER THE DATA.
1641  002006  000000              RP3OLD:   .WORD           ;RP03
1642  002010  000000                        .WORD
1643  002012  000000              RKOLD:    .WORD           ;RK05
1644  002014  000000                        .WORD
1645  002016  000000                        .WORD           ;SPARE
1646  002020  000000                        .WORD           ;SPARE
1647  002022  000000                        .WORD
1648  002024  000000                        .WORD           ;SPARE
1649  002026  000000              RP4OLD:   .WORD           ;RP04
1650  002030  000000                        .WORD
1651  002032  000000              RSOLD:    .WORD           ;RS04
1652  002034  000000                        .WORD
1653
1654                               .SBTTL  DEVICE HANDLER NEW BASE ADDRESSES
1655                               ;*      THIS TABLE GETS LOADED BY THE I/O RELOCATION ROUTINE
1656                               ;*      WITH THE BASE ADDRESS OF THE DESTINATION FOR THE
1657                               ;*      PARTICULAR DEVICE THAT IS GOING TO DO THE TRANSFER.
1658  002036  000000              RP3NWL:   .WORD           ;RP03
1659  002040  000000              RP3NWH:   .WORD
1660  002042  000000              RKNEWL:   .WORD           ;RK05
1661  002044  000000              RKNEWH:   .WORD
1662  002046  000000                        .WORD           ;SPARE
1663  002050  000000                        .WORD
1664  002052  000000                        .WORD           ;SPARE
1665  002054  000000                        .WORD
1666  002056  000000              RP4NWL:   .WORD           ;RP04
1667  002060  000000              RP4NWH:   .WORD
1668  002062  000000              RSNEWL:   .WORD           ;RS04
1669  002064  000000              RSNEWH:   .WORD
1670
1671                               .SBTTL  DEVICE HANDLER UNIT NUMBER
1672                               ;*      THIS TABLE GETS LOADED BY THE I/O RELOCATION ROUTINE.
1673                               ;*      IT TELLS THE DEVICE HANDLER WHICH UNIT NUMBER IS
1674                               ;*      TO DO THE TRANSFER.
1675  002066  000000              RP3UNIT:  .WORD           ;RP03
1676  002070  000000              RKUNIT:   .WORD           ;RK05
1677  002072  000000                        .WORD           ;SPARE
1678  002074  000000                        .WORD           ;SPARE
1679  002076  000000              RP4UNIT:  .WORD           ;RP04
1680  002100  000000              RSUNIT:   .WORD           ;RS04
1681
1682                               .SBTTL  ADDRESS OF THE DEVICE HANDLERS
1683                               ;*      THIS TABLE CONTAINS THE ADDRESS OF THE DEVICE HANDLER
1684                               ;*      ROUTINES. IT IS USED BY THE I/O RELOCATION ROUTINE
1685                               ;*      TO TRANSFER CONTROL TO THE DEVICE HANDLER.
1686  002102  041250              RP3HANA:  .WORD   RP3DRV  ;RP03
1687  002104  041644              RKHANA:   .WORD   RKDRV   ;RK05
```

```
                                                .WORD           ;SPARE
                                                .WORD           ;SPARE
                                RP4HANA:.WORD   RP4DRV          ;RP04
                                RSHANA: .WORD   RSDRV           ;RS04

                                .SBTTL  DEVICE HANDLER DISK ADDRESS TABLE
                                ;*      THIS TABLE GETS LOADED BY THE DEVICE HANDLER WITH THE
                                ;*      DISK ADDRESS(SECTOR AND CYLINDER) OF THE CURRENT
                                ;*      TRANSFER.
                                RP3HDA: .WORD           ;RP03 DISK ADDRESS
                                RP3HDC: .WORD           ;RP03 DESIRED CYLINDER
                                RKHDA:  .WORD           ;RK05 DISK ADDRESS
                                        .WORD           ;SPARE
                                RP4HDA: .WORD
                                RP4HDC: .WORD           ;RP04 DESIRED CYLINDER
                                RSHDA:  .WORD           ;RS04 DISK ADDRESS

                                .SBTTL  DEVICE HANDLER FUNCTION TABLE
                                ;*      THIS TABLE GETS LOADED BY THE DEVICE HANDLERS
                                ;*      AND THE DEVICE SERVICE ROUTINES. IT TELLS THE ROUTINES
                                ;*      WHICH FUNCTION TO DO NEXT.
                                RP3FUN: .WORD           ;RP03
                                RKFUN:  .WORD           ;RK05
                                        .WORD           ;SPARE
                                RP4FUN: .WORD           ;RP04
                                RSFUN:  .WORD           ;RS04

                                .SBTTL  DEVICE HANDLER RETRY COUNT
                                ;*      THIS TABLE GETS LOADED BY THE DEVICE HANDLERS AND IS USED
                                ;*      BY THE DEVICE SERVICE ROUTINES. IF AN ERROR OCCURS
                                ;*      THE DEVICE SERVICE ROUTINE WILL RETRY THE FUNCTION UNTIL
                                ;*      THE BYTE IN THIS TABLE GOES TO ZERO. IT IS INITIALIZED
                                ;*      TO A -3.
                                RP3TRY: .BYTE           ;RP03
                                RKTRY:  .BYTE           ;RK05
                                        .BYTE           ;SPARE
                                RP4TRY: .BYTE           ;RP04
                                RSTRY:  .BYTE           ;RS04
                                        .EVEN

                                .SBTTL  DEVICE REGISTER TABLES
                                ;*      THE FOLLOWING TABLES CONTAIN THE STANDARD ADDRESS FOR
                                ;*      THE DEVICES USED BY THIS PROGRAM. IF A DEVICE IS PLACED
                                ;*      AT A NON-STANDARD ADDRESS THE APPROPRIATE TABLE CAN BE
                                ;*      CHANGED AND THE PROGRAM WILL OPERATE THAT DEVICE.
                                ;*
                                ;*      EXCEPTION--SEE DOCUMENTATION FOR RP03 AND RP04 PROBLEMS.
                                .SBTTL  RP11/RP03 REGISTERS
                                RP3DS:  .WORD   176710  ;DRIVE STATUS
                                RP3ER:  .WORD   176712  ;ERROR REGISTER
                                RP3CS:  .WORD   176714  ;CONTROL AND STATUS
                                RP3WC:  .WORD   176716  ;WORD COUNT
                                RP3BA:  .WORD   176720  ;BUS ADDRESS
                                RP3DA:  .WORD   176724  ;DISK ADDRESS
                                RP3DC:  .WORD   176722  ;DESIRED CYLINDER
                                RP3VEC: .WORD   254     ;INTERRUPT VECTOR
```

```
1744  002174  000256                  RP3PSW: .WORD   256     ;INTERRUPT VECTOR+2
1745
1746                                  .SBTTL RK11/RK05 REGISTERS
1747  002176  177400                  RKDS:   .WORD   177400  ;DRIVE STATUS
1748  002200  177402                  RKER:   .WORD   177402  ;ERROR REGISTER
1749  002202  177404                  RKCS:   .WORD   177404  ;CONTROL AND STATUS
1750  002204  177406                  RKWC:   .WORD   177406  ;WORD COUNT
1751  002206  177410                  RKBA:   .WORD   177410  ;BUS ADDRESS
1752  002210  177412                  RKDA:   .WORD   177412  ;DISK ADDRESS
1753  002212  000220                  RKVEC:  .WORD   220     ;INTERRUPT VECTOR
1754  002214  000222                  RKPSW:  .WORD   222     ;INTERRUPT VECTOR+2
1755
1756                                  .SBTTL  RH11/RP04 REGISTERS
1757  002216  176700                  RP4CS1: .WORD   176700  ;CONTROL AND STATUS #1
1758  002220  176702                  RP4WC:  .WORD   176702  ;WORD COUNT
1759  002222  176704                  RP4BA:  .WORD   176704  ;BUS ADDRESS
1760  002224  176700                  RP4BAE: .WORD   176700  ;CONTROL AND STATUS #1
1761  002226  176706                  RP4DA:  .WORD   176706  ;DISK ADDRESS
1762  002230  176710                  RP4CS2: .WORD   176710  ;CONTROL AND STATUS #2
1763  002232  176752                  RP4CS3: .WORD   176752  ;CONTROL AND STATUS #3
1764  002234  176712                  RP4DS:  .WORD   176712  ;DRIVE STATUS
1765  002236  176714                  RP4ER1: .WORD   176714  ;ERROR REG #1
1766  002240  176734                  RP4DC:  .WORD   176734  ;DESIRED CYLINDER
1767  002242  176740                  RP4ER2: .WORD   176740  ;EPROR REG #2
1768  002244  176742                  RP4ER3: .WORD   176742  ;ERROR REG #3
1769  002246  176736                  RPCC:   .WORD   176736  ;CURRENT CYLINDER
1770  002250  176732                  RP4OF:  .WORD   176732  ;OFFSET REGISTER
1771  002252  000254                  RP4VEC: .WORD   254     ;INTERRUPT VECTOR
1772  002254  000256                  RP4PSW: .WORD   256     ;INTERRUPT VECTOR+2
1773
1774                                  .SBTTL  RH11/RS04 REGISTERS
1775  002256  172040                  RSCS1:  .WORD   172040  ;CONTROL AND STATUS #1
1776  002260  172042                  RSWC:   .WORD   172042  ;WORD COUNT
1777  002262  172044                  RSBA:   .WORD   172044  ;BUS ADDRESS
1778  002264  172040                  RSBAE:  .WORD   172040  ;CONTROL AND STATUS #1
1779  002266  172046                  RSDA:   .WORD   172046  ;DISK ADDRESS
1780  002270  172050                  RSCS2:  .WORD   172050  ;CONTROL AND STATUS #2
1781  002272  172072                  RSCS3:  .WORD   172072  ;CONTROL AND STATUS #3
1782  002274  172052                  RSDS:   .WORD   172052  ;DRIVE STATUS
1783  002276  172054                  RSER:   .WORD   172054  ;ERROR REG
1784  002300  000204                  RSVEC:  .WORD   204     ;INTERRUPT VECTOR
1785  002302  000206                  RSPSW:  .WORD   206     ;INTERRUPT VECTOR+2
1786
1787                                  .SBTTL  UNIBUS EXERCISER REGISTER ADDRESS TABLE
1788                                  ;*      THIS TABLE IS ASSEMBLED FOR UBE #0. IF THE UBE
1789                                  ;*      ADDRESSES ARE CUT FOR OTHER THAN UNIT #0, THE PROGRAM
1790                                  ;*      WILL CHANGE THIS TABLE. THE PROGRAM LOOKS FOR A
1791                                  ;*      UBE AT ADDRESSES 770000, 770020, 770040, AND 770060.
1792  002304  170002                  UBETBL: .WORD   UBECC   ;CYCLE COUNT
1793  002306  170004                          .WORD   UBEBA   ;BUS ADDRESS REG
1794  002310  170016                          .WORD   UBECR2  ;CONTROL REGISTER #2
1795  002312  170006                          .WORD   UBECR1  ;CONTROL REGISTER #1
1796  002314  170010                          .WORD   UBECLR  ;UBE CLEAR ADDRESS
1797  002316  000510                          .WORD   UBEVEC  ;INTERRUPT VECTOR
1798  002320  000512                          .WORD   UBEVEC+2        ;INTERRUPT VECTOR +2
1799
```

```
                                .SBTTL  MASS BUS TESTER REGISTER ADDRESSES
                                ;*      THE PROGRAM IS ASSEMBLED WITH ADDRESSES FOR A MBT
                                ;*      AT 760100. IF THE MBT IS AT ANOTHER ADDRESS THE PROGRAM
                                ;*      WILL CHANGE THIS TABLE. THE PROGRAM LOOKS FOR A MBT
                                ;*      AT ADDRESSES 760100, 760200, 760300, AND 760400.
002322  160100                  MBTTBL: .WORD   MBTCS1  ;CONTROL AND STATUS #1
002324  160102                          .WORD   MBTWC   ;WORD COUNT
002326  160104                          .WORD   MBTBA   ;BUS ADDRESS
002330  160100                          .WORD   MBTCS1  ;CONTROL AND STATUS #1
002332  160106                          .WORD   MBTMR2  ;MAINTENANCE REGISTER #2
002334  160110                          .WORD   MBTCS2  ;CONTROL REGISTER #2
002336  160112                          .WORD   MBTST   ;STATUS REGISTER
002340  160114                          .WORD   MBTER   ;ERROR REGISTER
002342  160176                          .WORD   MBTCS3  ;CONTROL REGISTER #3
002344  000774                          .WORD   MBTVEC  ;INTERRUPT VECTOR
002346  000776                          .WORD   MBTPSW  ;INTERRUPT VECTOR+2
002350  160126                          .WORD   MBTDT   ;DRIVE TYPE REGISTER
002352  160200                  MBTN2:  .WORD   160200  ;MASS BUS TESTER #2
002354  160300                  MBTN3:  .WORD   160300  ;MASS BUS TESTER #3
002356  160400                  MBTN4:  .WORD   160400  ;MASS BUS TESTER #4

                                .SBTTL  MED TEST TABLES
002360  000000                  TLOC1:  .WORD   0
002362  000000                  PSWHOL: .WORD   0
002364  000000                  TAPREG: .WORD   0
002366  000000                  TALEND: .WORD   0
002370  000040                  STGBLK: .BLKW   40
002470  000000                  TLOC2:  .WORD   0
002472  000000                  MEDTP0: .WORD   0
002474  000000                  MEDTP1: .WORD   0
002476  000000                  MEDTP2: .WORD   0
002500  000000                  MEDTP3: .WORD   0


                                ;*
                                ;*      TABLE II
                                ;*
                                ;*      FOLLOWING IS A TABLE OF INTERNAL REGISTER OPERATION CODES
                                ;*      USED FOR TESTING THE MED INSTRUCTION.  LABELS CORRESPOND
                                ;*      TO REGISTER NAMES, THE HIGH BYTE IS THE READ OPERATION
                                ;*      CODE, THE LOW BYTE THE WRITE CODE.
                                ;*              NOTE:  WHEN ADDING OR DELETING
                                ;*              ENTRIES IN THIS TABLE, CHECK DUAL
                                ;*              ADDRESING TEST TO SEE THAT THE "SCRATCH
                                ;*              PAD LIMITS" ARE MAINTAINED.
                                ;*

002502                          TBL2:


002502                          ASP1:                           ;A SCRATCH PAD - LO
002502  201     001             R1A:    .BYTE   201,001         ;LOBYTE, HIBYTE=WRITE CODE, READ CODE
002504  202     002             R2A:    .BYTE   202,002
002506  203     003             R3A:    .BYTE   203,003
002510  204     004             R4A:    .BYTE   204,004
002512  205     005             R5A:    .BYTE   205,005
```

```
1856  002514  206  006  R6A:     .BYTE  206,006
1857  002516  210  010  FAC3.0:  .BYTE  210,010
1858  002520  211  011  FAC3.1:  .BYTE  211,011
1859  002522  212  012  FAC3.2:  .BYTE  212,012
1860  002524  213  013  FAC3.3:  .BYTE  213,013
1861  002526  214  014  FAC3.4:  .BYTE  214,014
1862  002530  215  015  FAC3.5:  .BYTE  215,015
1863  002532  216  016  UR6A:    .BYTE  216,016
1864  002534  217  017  FDST3:   .BYTE  217,017
1865  002536  220  020  WCSA.0:  .BYTE  220,020        ;A SCRATCH PAD-HI
1866  002540  221  021  WCSA.1:  .BYTE  221,021
1867  002542  222  022  GNWHAM:  .BYTE  222,022
1868  002544  223  023  CNSTSW:  .BYTE  223,023
1869  002546  224  024  RT1A:    .BYTE  224,024
1870  002550  225  025  RT2A:    .BYTE  225,025
1871  002552  226  026  CNSSW:   .BYTE  226,026
1872  002554  227  027  CNSCDR:  .BYTE  227,027
1873  002556  230  030  FAC1.0:  .BYTE  230,030
1874  002560  231  031  FAC1.1:  .BYTE  231,031
1875  002562  232  032  FAC1.2:  .BYTE  232,032
1876  002564  233  033  FAC1.3:  .BYTE  233,033
1877  002566  234  034  FAC1.4:  .BYTE  234,034
1878  002570  235  035  FAC1.5:  .BYTE  235,035
1879  002572  236  036  FPSHI:   .BYTE  236,036
1880  002574  237  037  ASP2:   FDST1:  .BYTE  237,037
1881
1882
1883  002576                  BSP1:
1884  002576  241  041  R1B:     .BYTE  241,041        ;B SCRATCH PAD - LO
1885  002600  242  042  R2B:     .BYTE  242,042
1886  002602  243  043  R3B:     .BYTE  243,043
1887  002604  244  044  R4B:     .BYTE  244,044
1888  002606  245  045  R5B:     .BYTE  245,045
1889  002610  246  046  R6B:     .BYTE  246,046
1890  002612  250  050  FAC2.0:  .BYTE  250,050
1891  002614  251  051  FAC2.1:  .BYTE  251,051
1892  002616  252  052  FAC2.2:  .BYTE  252,052
1893  002620  253  053  FAC2.3:  .BYTE  253,053
1894  002622  254  054  FAC2.4:  .BYTE  254,054
1895  002624  255  055  FAC2.5:  .BYTE  255,055
1896  002626  256  056  UR6B:    .BYTE  256,056
1897  002630  257  057  FDST2:   .BYTE  257,057
1898  002632  260  060  WCSB.0:  .BYTE  260,060        ;B SCRATCH PAD - HI
1899  002634  261  061  WCSB.1:  .BYTE  261,061
1900  002636  262  062  WCSAOR:  .BYTE  262,062
1901  002640  263  063  RZERO:   .BYTE  263,063
1902  002642  264  064  RT1B:    .BYTE  264,064
1903  002644  265  065  RT2B:    .BYTE  265,065
1904  002646  266  066  RVECT:   .BYTE  266,066
1905  002650  270  070  FAC0.0:  .BYTE  270,070
1906  002652  272  072  FAC0.1:  .BYTE  272,072
1907  002654  273  073  FAC0.2:  .BYTE  273,073
1908  002656  274  074  FAC0.4:  .BYTE  274,074
1909  002660  275  075  FAC0.5:  .BYTE  275,075
1910  002662  276  076  FEA:     .BYTE  276,076
1911  002664  277  077  BSP2:   FDST0:  .BYTE  277,077
```

```
1912
1913
1914  002666                          CSP1:
1915  002666  300     100             LJAM:   .BYTE   300,100          ;C SCRATCH PAD
1916  002670  301     101             LSERV:  .BYTE   301,101
1917  002672  302     102             LPBA:   .BYTE   302,102
1918  002674  303     103             LCUA:   .BYTE   303,103
1919  002676  304     104             LFGIN:  .BYTE   304,104
1920  002700  305     105             LWHAM:  .BYTE   305,105
1921  002702  307     107             LTAG:   .BYTE   307,107
1922  002704  310     110             CNSC0:  .BYTE   310,110
1923  002706  311     111             CNSC1:  .BYTE   311,111
1924  002710  312     112             CNSC2:  .BYTE   312,112
1925  002712  313     113             CST200: .BYTE   313,113
1926  002714  316     116             CSP2:   CNST0:  .BYTE   316,116
1927
1928  002716  000000                          .WORD   0               ;END OF ADDRESS TABLE = 0
1929
1930
1931                                  ;*
1932                                  ;*      TABLE IV
1933                                  ;*
1934                                  ;*      THE LIST BELOW CONTAINS THOSE OPERATION CODES
1935                                  ;*      CORRESPONDING TO THE INTERNAL REGISTERS WHICH MUST
1936                                  ;*      BE TESTED SEPERATELY BECAUSE THEY ARE READ-ONLY,
1937                                  ;*      WRITE-ONLY, OR USED IN MACRO CODE EXECUTION, ETC. . .
1938
1939  002720                          TBL4:
1940  002720  200     000             R0A:    .BYTE   200,000         ;LOBYTE,HYBYTE - WRITE CODE, READ CODE
1941  002722  207     007             R7A:    .BYTE   207,007
1942  002724  240     040             R0B:    .BYTE   240,040
1943  002726  247     047             R7B:    .BYTE   247,047
1944  002730  314     114             CNST2:  .BYTE   314,114
1945  002732  317     117             CNST1:  .BYTE   317,117
1946                                  ;*      TABLE V
1947                                  ;*
1948  002734                          TBL5:
1949
1950  002734  306                     LCDTA:  .BYTE   306             ;THIS TABLE CONTAINS THE OPERATION
1951  002735  106                             .BYTE   106             ;CODES OF THOSE INTERNAL REGISTERS
1952  002736  315                     MD:     .BYTE   315             ;WHICH MUST BE TESTED USING THE
1953  002737  115                             .BYTE   115             ;MICROBREAK REGISTER.  THEIR
1954  002740  267                     CNSCTL: .BYTE   267             ;ASSOCIATED MICRO-ADDRESSES ARE IN
1955  002741  067                             .BYTE   067             ;THE NEXT TABLE
1956  002742  140                     JAM:    .BYTE   140
1957  002743  141                     SERV:   .BYTE   141             ;THESE MICROADDRESSES ARE THE ENTRY
1958  002744  142                     PBA:    .BYTE   142             ;POINTS INTO THE MICROCODE FOR THE SERVICE
1959  002745  143                     CUA:    .BYTE   143             ;OF THE INTERNAL REGISTERS
1960  002746  344                     FLAG:   .BYTE   344
1961  002747  144                             .BYTE   144
1962  002750  345                     DREG:   .BYTE   345
1963  002751  146                     REV:    .BYTE   146
1964  002752  346                     SREG:   .BYTE   346
1965  002753  147                     COUNT:  .BYTE   147
1966  002754  347                     NUA:    .BYTE   347
1967  002755  351                     RES:    .BYTE   351
```

```
1968  002756  000152                  DCS0:   .BYTE   152
1969  002757  000352                  INIT:   .BYTE   352
1970  002760  000153                  DCS1:   .BYTE   153
1971  002761  000000                          .BYTE   0               ;0 BYTE TERMINATES THE PROGRAM
1972
1973                                          .EVEN
1974                                  ;*      TABLE VI
1975                                  ;*
1976  002762                          TBL6:
1977
1978  002762  003330                  ULCDTA: .WORD   3330            ;THIS TABLE CONTAINS THE MICRO-ADDRESSES
1979  002764  003150                          .WORD   3150            ;WHICH ARE LOADED INTO THE MICROBREAK
1980  002766  003375                  UMD:    .WORD   3375            ;REG. TO TEST THE OPERATION CODES
1981  002770  003271                          .WORD   3271            ;CONTAINED IN THE PRECEEDING TABLE.
1982  002772  003240                  UCNSCTL:.WORD   3240
1983  002774  003224                          .WORD   3224
1984  002776  003160                  UJAM:   .WORD   3160            ;THESE MICROADDRESSES SHOULD BE
1985  003000  003161                  USERV:  .WORD   3161            ;CHANGED (IF NECESSARY) IF THE BASE MACHINE
1986  003002  003170                  UPBA:   .WORD   3170            ;MICROCODE SHIFTS (MICROCODE SERVICING
1987  003004  003171                  UCUA:   .WORD   3171            ;THE INTERNAL REGISTERS).
1988  003006  003344                  UFLAG:  .WORD   3344
1989  003010  003320                          .WORD   3320
1990  003012  003345                  UDREG:  .WORD   3345
1991  003014  003340                  UREV:   .WORD   3340
1992  003016  003350                  USREG:  .WORD   3350
1993  003020  003341                  UCOUNT: .WORD   3341
1994  003022  003351                  UMUA:   .WORD   3351
1995  003024  003355                  URES:   .WORD   3355
1996  003026  003720                  UDCS0:  .WORD   3720
1997  003030  003724                  UINIT:  .WORD   3724
1998  003032  003721                  UDCS1:  .WORD   3721
1999
2000                                  ;*      TABLE VII
2001                                  ;*
2002                                  ;*      THIS TABLE HOLDS THE OPERATION CODES AND THE CONSTANT
2003                                  ;*      VALUE EXPECTED FOR CERTAIN INTERNAL REGISTERS.
2004  003034                          TBL7:
2005
2006  003034  000100  077600          CLJAM:  .WORD   100,77600
2007  003040  000101  000010          CLSERV: .WORD   101,10
2008  003044  000102  020000          CLPBA:  .WORD   102,20000
2009  003050  000103  000004          CLCUA:  .WORD   103,4
2010  003054  000104  050000          CLFGIN: .WORD   104,50000
2011  003060  000105  054000          CLWAAM: .WORD   105,54000
2012  003064  000107  024000          CLTAG:  .WORD   107,24000
2013  003070  000110  177400          CCNSC0: .WORD   110,177400
2014  003074  000111  177600          CCNSC1: .WORD   111,177600
2015  003100  000112  100000          CCNSC2: .WORD   112,100000
2016  003104  000113  000200          CCST200:.WORD   113,200
2017  003110  000114  000002          CCNST2: .WORD   114,2
2018  003114  000116  000000          CCNST0: .WORD   116,0
2019  003120  000117  000001          CCNST1: .WORD   117,1
2020  003124  000000                          .WORD   0
```

```
                                .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 SITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
                                ;*NOTE1:        IF SITEMB 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

003126                          $ERRTB:
                                        ;ITEM 1
003126  056411                  EM1             ;UNEXPECTED TRAP TO 4
003130  056436                  DH1             ;VIRTPC  PHYSC      PSW  CPUERR
003132  056502                  DT1             ;VADR,VADR,REPPSW,REPREG
003134  056475                  DF1             ;0,1,0,0,0
                                ;ITEM 2
003136  056514                  EM2             ;UNEXPECTED TRAP TO 10
003140  056542                  DH2             ;VIRTPC  PHYSPC  PSW
003142  056570                  DT2             ;VADR,VADR,REPPSW
003144  056475                  DF1
                                ;ITEM 3
003146  056600                  EM3             ;UNEXPECTED TRAP TO 250(MGMT)
003150  056635                  DH3             ;VIRTPC  PHYSPC    PSW    MMR0    MMR2
003152  056704                  DT3             ;VADR,VADR,REPPSW,REPMR0,REPMR2
003154  056475                  DF1
                                ;ITEM 4
003156  056720                  EM4             ;UNEXPECTED TRAP TO 114
003160  056747                  DH4             ;VIRTPC  PHYSPC   PSW     MEMERRREG
003162  057014                  DT4             ;VADR,VADR,REPPSW,REPREG
003164  057026                  DF4             ;0,1,0,0
                                ;ITEM 5
003166  057032                  EM5             ;PARITY ERROR DURING DATA CHECK
003170  057071                  DH5             ;SRCADR DSTADR MEM ERR REG
003172  057130                  DT5             ;SRCADR,PA1500,REPREG
003174  057125                  DF5
                                ;ITEM 6
003176  057140                  EM6             ;ERROR DURING CHECK OF RELOCATED DATA
003200  057210                  DH6             ;SRCADR  DSTADR
003202  057230                  DT6             ;$TMP0,PA1500
003204  057026                  DF4
                                ;ITEM 7
003206  000000                  0               ;DEVICE ERROR
003210  000000                  0
003212  000000                  0
003214  000000                  0
                                ;ITEM 10
003216  057236                  EM10            ;ERROR DURING DATA CHECK-RELOC WAS BY I/O
003220  057307                  DH10            ;SRCADR   DSTADR   DEVICE THAT DID XFER
003222  057362                  DT10            ;$TMP0,VADR,$TMP2,$TMP3
003224  057356                  DF10            ;0,1,3,0
                                ;ITEM 11
```

```
2077  003226  057637                  EM14            ;FLOATING POINT ERROR
2078  003230  057374                  DH11            ;          DATA1          DATA2
2079  003232  057472                  DT11            ;FLTMP0,FREG2,FLTMP1,FREG3
2080  003234  057465                  DF11            ;5,0,5,0
2081                                  ;ITEM 12
2082  003236  057504                  EM12            ;UNIBUS EXERCISOR NON-EXISTANT MEMORY
2083  003240  057542                  DH12            ;PHYSICAL ADDRESS
2084  003242  057560                  DT12            ;PA1500
2085  003244  057556                  DF12            ;2
2086                                  ;ITEM 13
2087  003246  057564                  EM13            ;MASS BUS TESTER NON-EXISTANT MEMORY
2088  003250  057622                  DH13            ;PHYSICAL ADDRESS
2089  003252  057560                  DT12
2090  003254  057556                  DF12
2091                                  ;ITEM 14
2092  003256  057637                  EM14            ;FLOATING POINT ERROR
2093  003260  057664                  DH14            ;       DATA1          DATA2
2094  003262  057704                  DT14            ;FTMP4,FREG2,FTMP6,FREG3
2095  003264  057716                  DF14            ;4,0,4,0
2096                                  ;ITEM 15
2097  003266  057722                  EM15            ;DEVICE HUNG
2098  003270  000000                  0
2099  003272  000000                  0
2100  003274  000000                  0
2101
```

```
                                .SBTTL  PROGRAM INITIALIZATION

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

```
2105  003276  012706  001200          START:  MOV     #KERSTK,SP      ;SET KERNEL STACK PTR
2106  003302  012737  017654  001566          MOV     #17654,@#$HINUM         ;INITIALIZE RANDOM NUM GEN
2107  003310  012737  123456  001564          MOV     #123456,@#$LONUM
2108
2109                                  ;DETERMINE HOW PROGRAM WAS LOADED AND WHAT MODE (IF ACT11)
2110                                  ;AND SET MEMORY PROTECTION.
2111  003316  005037  001546                  CLR     @#QV                    ;SET NOT QV NOR AA MODE
2112  003322  005027                          CLR     (PC)+                   ;SET NOT XXDP
2113  003324     000          XXDP:   .BYTE   0                       ;XXDP INDICATOR
2114  003325     000          XXDPC:  .BYTE   0                       ;XXDP CHAIN MODE INDICATOR
2115  003326  005027                          CLR     (PC)+                   ;CLEAR MEMORY PROTECTION LIMIT
2116  003330  000000          PROT:   .WORD   0                       ;WILL CONTAIN MEM PROT LIMIT
2117  003332  005737  041234                  TST     @#$ENDAD+4              ;BRANCH IF NOT QV
2118  003336  100003                          BPL     1$
2119  003340  110637  001546                  MOVB    SP,@#QV                 ;SET ACT11 QV MODE
2120  003344  000414                          BR      3$
2121
2122  003346  001003          1$:     BNE     2$
2123  003350  110637  001547                  MOVB    SP,@#AA                 ;SET ACT11 AA MODE
2124  003354  000410                          BR      3$
2125
2126  003356  113737  000041  003324  2$:     MOVB    @#41,@#XXDP             ;GET LOAD MEDIA
2127  003364  005737  000042                  TST     @#42                    ;BRANCH IF NOT IN CHAIN MODE
2128  003370  001402                          BEQ     3$
2129  003372  110637  003325                  MOVB    SP,@#XXDPC              ;SET CHAIN MODE INDICATOR
2130
2131                                  ;SET MEMORY PROTECTION LIMITS
2132  003376  005737  001546          3$:     TST     @#QV                    ;BRANCH IF QV OR AA
2133  003402  001006                          BNE     MEMSIZ
2134  003404  005737  003324                  TST     @#XXDP                  ;BRANCH IF NOT VIA XXDP
2135  003410  001403                          BEQ     MEMSIZ
2136  003412  012737  005700  003330          MOV     #5700,@#PROT            ;PROTECT XXDP MONITOR
2137  003420  005000          MEMSIZ: CLR     R0                      ;INITIALIZE R0 WITH FIRST ADDR.
2138  003422  012737  003434  000004          MOV     #11$,@#ERRVEC           ;SET TIMEOUT VECTOR TO 11$
2139  003430  005720          10$:    TST     (R0)+                   ;DOES ADDR. IN R0 EXSIST?
2140  003432  000776                          BR      10$                     ;CONTINUE UNTIL AN ADDR. TIMES OUT
2141
2142  003434  022626          11$:    CMP     (SP)+,(SP)+             ;CLEAN UP STACK
2143  003436  012737  055064  000004          MOV     #ERPRT,@#ERRVEC         ;RESTORE TIMEOUT SERVICE ROUTINE
2144  003444  162700  000004                  SUB     #4,R0                   ;GET ADDR. OF LAST MEM. LOC.
2145  003450  010037  001560                  MOV     R0,@#LSTMEM             ;SAVE IT IN "LSTMEM"
2146  003454  163737  003330  001560          SUB     @#PROT,@#LSTMEM         ;SET PROTECTION
2147  003462  012737  057740  001556          MOV     #ENDTAG+2,@#FRSTMEM     ;SET FIRST RELOCATION ADDRESS
2148
2149
2150  003470  012706  001200                  MOV     #KERSTK,SP              ;SET STACK PTR
2151  003474  005037  001200                  CLR     @#$PASS                 ;CLEAR PASS COUNT
2152  003500  105037  001545                  CLRB    @#MMON                  ;SET MEM MGMT ON IND=NOT ON
2153  003504  012737  000600  001562          MOV     #600,@#NEXPAR           ;SET FIRST 'PAR' VALUE
2154  003512  005737  003330                  TST     @#PROT
2155  003516  001403                          BEQ     1$
2156  003520  012737  001600  001562          MOV     #1600,@#NEXPAR
2157  003526                          1$:
2158  003526  012700  000027                  MOV     #27,R0                  ;SET SOB COUNT
2159  003532  005001                          CLR     R1                      ;SETUP INDEX
2160  003534  005061  001642          2$:     CLR     MTICKS(R1)              ;CLEAR TABLES
```

```
2161  003540  062701  000002                ADD     #2,R1
2162  003544  077005                        SOB     R0,2$                   ;CONTINUE
2163  003546  012700  000010                MOV     #10,R0                  ;SET SOB COUNT
2164  003552  012701  001752                MOV     #RP3HSTAT,R1            ;GET ADDRESS OF HANDLER STAT
2165  003556  012721  000200        3$:     MOV     #200,(R1)+              ;INITIALIZE STATUS TABLE
2166  003562  077003                        SOB     R0,3$                   ;CONTINUE
2167  003564  012737  000060  001574        MOV     #60,@#SUBPASS           ;INIT SUBPASS TO ASCII 0
2168  003572  012700  051236                MOV     #TIMEBUF,R0             ;GET ADR OF TIME BUFFER
2169  003576  012701  000012                MOV     #12,R1                  ;SET SOB COUNT
2170  003602  112720  000060        4$:     MOVB    #60,(R0)+               ;INIT TIME BUFFER
2171  003606  077103                        SOB     R1,4$
2172  003610  105040                        CLRB    -(R0)                   ;INSERT TERMINATOR
2173  003612  112737  000072  051241        MOVB    #72,@#TIMEBUF+3         ;INSERT COLON
2174  003620  112737  000072  051244        MOVB    #72,@#TIMEBUF+6
2175  003626  005037  001624                CLR     @#MXMML0                ;CLEAR MEM. SIZE INDICATOR
2176                                .SBTTL  INITIALIZE THE COMMON TAGS
2177                                ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
2178  003632  012706  001200                MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
2179  003636  005026                        CLR     (R6)+           ;;CLEAR MEMORY LOCATION
2180  003640  022706  001242                CMP     #SWR,R6 ;;DONE?
2181  003644  001374                        BNE     .-6             ;;LOOP BACK IF NO
2182  003646  012706  001200                MOV     #STACK,SP       ;;SETUP THE STACK POINTER
2183                                ;;INITIALIZE A FEW VECTORS
2184  003652  012737  046720  000020        MOV     #$SCOPE,@#IOTVEC ;;IOT VECTOR FOR SCOPE ROUTINE
2185  003660  012737  000340  000022        MOV     #340,@#IOTVEC+2 ;;LEVEL 7
2186  003666  012737  047160  000030        MOV     #$ERROR,@#EMTVEC ;;EMT VECTOR FOR ERROR ROUTINE
2187  003674  012737  000340  000032        MOV     #340,@#EMTVEC+2 ;;LEVEL 7
2188  003702  012737  053566  000034        MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
2189  003710  012737  000340  000036        MOV     #340,@#TRAPVEC+2;LEVEL 7
2190  003716  012737  053376  000024        MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
2191  003724  012737  000340  000026        MOV     #340,@#PWRVEC+2 ;;LEVEL 7
2192  003732  016767  035136  035126        MOV     $ENDCT,$EOPCT   ;;SETUP END-OF-PROGRAM COUNTER
2193  003740  005067  175360                CLR     $TIMES          ;;INITIALIZE NUMBER OF ITERATIONS
2194  003744  005067  175356                CLR     $ESCAPE         ;;CLEAR THE ESCAPE ON ERROR ADDRESS
2195  003750  112767  000001  175241        MOVB    #1,$ERMAX       ;;ALLOW ONE ERROR PER TEST
2196  003756  012767  003756  175224        MOV     #.,$LPADR       ;;INITIALIZE THE LOOP ADDRESS FOR SCOPE
2197  003764  012767  003764  175220        MOV     #.,$LPERR       ;;SETUP THE ERROR LOOP ADDRESS
2198                                ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
2199                                ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
2200  003772  013746  000004                MOV     @#ERRVEC,-(SP)  ;;SAVE ERROR VECTOR
2201  003776  012737  004032  000004        MOV     #64$,@#ERRVEC   ;;SET UP ERROR VECTOR
2202  004004  012767  177570  175230        MOV     #DSWR,SWR       ;;SETUP FOR A HARDWARE SWICH REGISTER
2203  004012  012767  177570  175224        MOV     #DDISP,DISPLAY  ;;AND A HARDWARE DISPLAY REGISTER
2204  004020  022777  177777  175214        CMP     #-1,@SWR        ;;TRY TO REFERENCE HARDWARE SWR
2205  004026  001012                        BNE     66$             ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
2206                                                                ;;AND  THE HARDWARE SWR IS NOT = -1
2207  004030  000403                        BR      65$             ;;BRANCH IF NO TIMEOUT
2208  004032  012716  004040        64$:    MOV     #65$,(SP)       ;;SET UP FOR TRAP RETURN
2209  004036  000002                        RTI
2210  004040  012767  000176  175174  65$:  MOV     #SWREG,SWR      ;;POINT TO SOFTWARE SWR
2211  004046  012767  000174  175170        MOV     #DISPREG,DISPLAY
2212  004054  012637  000004        66$:    MOV     (SP)+,@#ERRVEC  ;;RESTORE ERROR VECTOR
2213
2214  004060  012700  002002                MOV     #2002,R0                ;TURN OFF WCS BY INITIALIZING
2215  004064  076600                        MED                             ;WHAMI REG. WITH AN INIT.
2216  004066  000352                        WRINIT                          ;SO RESERVED INSTRUCTIONS CAN BE
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                                                                        ;TESTED.

                                        ;CLEAR PROGRAM INDICATORS
004070  052777  000100  175150          BIS     #100,@#TKS              ;SET IE BIT IN KEYBOARD STATUS REG
004076  012737  054152  000060          MOV     #TKISR,@#TKVEC          ;SETUP KEYBOARD VECTOR
004104  012737  000200  000062          MOV     #PR4,@#TKVEC+2
004112  012737  054364  000064          MOV     #TPISR,@#TPVEC
004120  012737  000200  000066          MOV     #PR4,@#TPVEC+2
004126  005037  001530                  CLR     @#NOTYPE                ;CLEAR 'NO TYPING' INDICATOR

                                        ;THE BELOW ROUTINE ASCERTAINS WHICH CP & CP OPTIONS THE PROGRAM IS RUN-
                                        ;NING ON AND SETS AN INDICATOR IN OPT.CP ACCORDINGLY.
004132  012737  000006  000004  CPCHK:  MOV     #ERRVEC+2,@#ERRVEC      ;SET UP ERROR TRAP TO RETURN
004140  012737  000002  000006          MOV     #2,@#ERRVEC+2           ;RTI OPCODE = 2
004146  012737  000012  000010          MOV     #RESVEC+2,@#RESVEC      ;AND ALSO RESERVED INST TRAP
004154  012737  000002  000012          MOV     #2,@#RESVEC+2
004162  012702  160000                  MOV     #160000,R2              ;SET PROCESSER'S NON-OPTION BITS
                                                                        ;EXCEPT FOR LKOPT
004166  000261                          SEC
004170  005737  177546                  TST     @#LKS                   ;BRANCH IF NO KW11-L
004174  103402                          BCS     7$                      ;OR IF IT'S NOT WORKING
004176  052702  001000                  BIS     #LKOPT,R2               ;SET OPTION INDICATOR
004202  000261          7$:             SEC
004204  005777  175042                  TST     @$TPS                   ;BRANCH IF NO CONSOLE TTY
004210  103402                          BCS     9$
004212  052702  000400                  BIS     #TTOPT,R2
004216  005003          9$:             CLR     R3
004220  000261                          SEC
004222  005737  170000                  TST     @#UBEDB                 ;IS UBE1 THERE?
004226  103410                          BCS     12$                     ;BRANCH IF NO
004230  105037  170006                  CLRB    @#UBECR1                ;IS THIS A TESTER OR EXERCISOR?
004234  105737  170006                  TSTB    @#UBECR1
004240  100045                          BPL     15$                     ;BRANCH IF TESTER
004242  052702  000200          16$:    BIS     #UBEOPT,R2              ;SET INDICATOR
004246  000425                          BR      17$
004250  000261          12$:            SEC
004252  005737  170020                  TST     @#UBEDB+20                      ;IS UBE2 THERE?
004256  103403                          BCS     13$                     ;BRANCH IF NO
004260  012703  000020                  MOV     #20,R3                  ;SET OFFSET IN R3
004264  000766                          BR      16$
004266  000261          13$:            SEC
004270  005737  170040                  TST     @#UBEDB+40              ;IS UBE3 THERE?
004274  103403                          BCS     14$                     ;BRANCH IF NO
004276  012703  000040                  MOV     #40,R3                  ;PUT OFFSET IN R3
004302  000757                          BR      16$
004304  000261          14$:            SEC
004306  005737  170060                  TST     @#UBEDB+60              ;IS UBE4 THERE?
004312  103420                          BCS     15$                     ;BRANCH IF NO
004314  012703  000060                  MOV     #60,R3                  ;PUT OFFSET IN R3
004320  000750                          BR      16$
004322  005227  177777          17$:    INC     #-1
004326  001012                          BNE     15$
004330  012704  002304                  MOV     #UBETBL,R4              ;GET ADDRESS OF UBE TABLE
004334  012705  000005                  MOV     #5,R5                   ;SET SOB COUNT
004340  060324          18$:            ADD     R3,(R4)+                ;ADJUST UBE TABLE ENTRIES
004342  077502                          SOB     R5,18$                  ;CONTINUE
```

```
2273  004344  006003                        ROR     R3
2274  004346  006003                        ROR     R3              ;ADJUST OFFSET FOR UBE VECTOR
2275  004350  060324                        ADD     R3,(R4)+        ;ADJUST UBEVEC ENTRY
2276  004352  060314                        ADD     R3,(R4)         ;ADJUST UBEVEC PSW ENTRY
2277  004354  005003                15$:    CLR     R3                      ;INIT R3
2278  004356  000261                        SEC
2279  004360  005777  175736                TST     @#MBTTBL        ;IS MASS BUS TESTER THERE?
2280  004364  103403                        BCS     20$             ;BRANCH IF NO
2281  004366  052702  002000        21$:    BIS     #MBTOPT,R2      ;SET OPTION AVAILABLE
2282  004372  000422                        BR      24$
2283  004374  005777  175752        20$:    TST     @#MBTN2         ;IS MBT2 THERE?
2284  004400  103403                        BCS     22$             ;BRANCH IF NO
2285  004402  012703  000100                MOV     #100,R3         ;SETUP R3
2286  004406  000767                        BR      21$
2287  004410  005777  175740        22$:    TST     @#MBTN3         ;IS MBT3 THERE?
2288  004414  103403                        BCS     23$             ;BRANCH IF NO
2289  004416  012703  000200                MOV     #200,R3
2290  004422  000761                        BR      21$
2291  004424  005777  175726        23$:    TST     @#MBTN4         ;IS MBT4 THERE?
2292  004430  103427                        BCS     30$             ;BRANCH IF NO
2293  004432  012703  000300                MOV     #300,R3
2294  004436  000753                        BR      21$
2295  004440  005227  177777        24$:    INC     #-1
2296  004444  001021                        BNE     30$
2297  004446  012704  002322                MOV     #MBTTBL,R4      ;GET ADDRESS OF MBT TABLE
2298  004452  012705  000011                MOV     #11,R5          ;SET SOB COUN
2299  004456  062324                25$:    ADD     R3,(R4)+        ;ADJUST MBT TABLE
2300  004460  077502                        SOB     R5,25$          ;CONTINUE
2301  004462  060337  002350                ADD     R3,@#MBTTBL+26  ;ADJUST DRIVE TYPE ADDRESS
2302  004466  112777  000007  175640        MOVB    #7,@#MBTTBL+12
2303  004474  122777  000040  175646        CMPB    #40,@#MBTTBL+26 ;IS THIS REALLY A MBT?
2304  004502  001402                        BEQ     30$             ;BRANCH IF YES
2305  004504  042702  002000                BIC     #MBTOPT,R2      ;CLEAR OPTION AVAILABLE BIT
2306  004510  012737  055064  000004  30$:  MOV     #ERRPRT,@#ERRVEC ;RESTORE ERROR TRAP
2307  004516  012737  054774  000010        MOV     #RESERR,@#RESVEC ;AND ALSO RESERVED INST TRAP
2308  004524  010237  001532                MOV     R2,@#OPT.CP     ;LOAD INDICATOR
2309                                .SBTTL  TYPE PROGRAM NAME
2310                                ;;TYPE THE NAME OF THE PROGRAM IF FIRST PASS
2311  004530  005227  177777                INC     #-1             ;;FIRST TIME?
2312  004534  001037                        BNE     64$             ;;BRANCH IF NO
2313  004536  022737  041230  000042        CMP     #$ENDAD,@#42    ;;ACT-11?
2314  004544  001433                        BEQ     64$             ;;BRANCH IF YES
2315  004546  104401  004554                TYPE    ,65$            ;;TYPE ASCIZ STRING
2316  004552  000430                        BR      64$             ;;GET OVER THE ASCIZ
2317                              65$:  .ASCIZ  <CRLF>"MAINDEC-11-DQKDC-A...PDP 11/6X CPU EXERCISER"<CRLF>
2318  004634                      64$:
2319                              ;;*****************************************************************
2320                              .SBTTL  SYSTEM SIZER
2321                              ;       THIS ROUTINE DETERMINES WHAT DRIVES ARE AVAILABLE ON
2322                              ;       THE FOLLOWING DEVICES: RK05, RP03, RP04, AND RS04. THE
2323                              ;       INFORMATION IS STORED IN THE TABLE "SYSSIZE" IN THE FOLLOWING FORMAT:
2324                              ;               A. EACH DEVICE IS ASSIGNED A WORD
2325                              ;               B. THE LOW BYTE OF THIS WORD INDICATES WHICH DRIVES ARE AVAILABLE
2326                              ;               C. THE HIGH BYTE INDICATES WHICH DRIVES HAVE BEEN USED
2327                              ;                  BY THE RELOCATION ROUTINE.
2328                              ;;*****************************************************************
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2329  004634  012737  004746  000004  SIZE:   MOV     #21$,@#ERRVEC           ;SETUP TIMEOUT VECTOR
2330  004642  005037  001304          SIZE:   CLR     @#$TMPO                 ;ENSURE $TMPO CLEAR
2331  004646  005000                  SIZE:   CLR     R0                      ;USED TO SET THE UNIT AVAIL BITS
2332  004650  012701  000010          SIZE:   MOV     #10,R1                  ;SCB COUNT
2333  004654  013777  001304  175326  9$:     MOV     @#$TMPO,@RKDA           ;SET UNIT NUMBER
2334  004662  012777  000015  175312          MOV     #15,@RKCS               ;SEND DRIVE RESET
2335  004670  032777  000200  175302          BIT     #BIT7,@RKER             ;NON EXISTANT DISK?
2336  004676  001011                          BNE     7$                      ;BRANCH IF YES
2337  004700  017702  175272                  MOV     @RKDS,R2                ;GET DRIVE STATUS
2338  004704  042702  177537                  BIC     #177537,R2              ;GET BITS 5 & 7 ONLY
2339  004710  022702  000200                  CMP     #200,R2                 ;IS DRIVE READY?
2340  004714  001002                          BNE     7$                      ;BRANCH IF NO
2341  004716  052700  000400                  BIS     #BIT8,R0                ;SET UNIT AVAILABLE
2342  004722  006000                  7$:     ROR     R0
2343  004724  012777  000001  175250          MOV     #1,@RKCS                ;CLEAR THE ERRORS
2344  004732  062737  020000  001304          ADD     #20000,@#$TMPO          ;SELECT NEXT UNIT
2345  004740  077133                          SOB     R1,9$                   ;CONTINUE
2346  004742  110037  001650                  MOVB    R0,@#SYSSIZE+2          ;STORE IN TABLE
2347
2348                                  ;;*****************************************************************
2349                                  ;THIS CODE DETERMINES IF THERE IS AN RP03 OR AN RP04 OR BOTH.
2350                                  ;IF BOTH ARE ON THE SYSTEM, THE OPERATOR MUST CHANGE THE RP04
2351                                  ;ADDRESSES IN THE TABLE IN "COMMON TAGS" AND "NOP" THE BRANCH
2352                                  ;AT "100$".
2353
2354  004746  012737  005206  000004  21$:    MOV     #11$,@#ERRVEC           ;SET THE ERROR VECTOR
2355  004754  005737  176710          21$:    TST     @#176710                ;IS THERE AN RP ON THE SYSTEM?
2356                                                                          ;STAY HERE IF YES
2357  004760  012737  004774  000004          MOV     #1$,@#ERRVEC
2358  004766  005777  175224          21$:    TST     @RP4CS1         ;IS THERE AN RP04 ON SYSTEM?
2359  004772  000441                  100$:   BR      10$                     ;BRANCH IF YES
2360                                  ;;*****************************************************************
2361
2362                                  ;;*****************************************************************
2363  004774  012737  005076  000004  1$:     MOV     #10$,@#ERRVEC           ;SETUP TIMEOUT VEC FOR RP03 TEST
2364  005002  012737  000001  001304          MOV     #1,@#$TMPO              ;SETUP TEMPO
2365  005010  005000                          CLR     R0                      ;USED TO SET UNIT AVAILABLE BITS
2366  005012  012701  000010                  MOV     #10,R1                  ;SOB COUNT
2367  005016  013777  001304  175134  3$:     MOV     @#$TMPO,@RP3CS          ;SET FUNCTION IDLE WITH UNIT NO
2368  005024  005777  175130                  TST     @RP3CS                  ;WAS THERE AN ERROR?
2369  005030  100006                          BPL     6$                      ;BRANCH IF NO
2370  005032  006000                  4$:     ROR     R0                      ;UNIT NOT AVAILABLE
2371  005034  062737  000400  001304          ADD     #400,@#$TMPO            ;SELECT NEXT UNIT
2372  005042  077113                          SOB     R1,3$                   ;CONTINUE
2373  005044  000412                          BR      5$
2374  005046  017702  175102          6$:     MOV     @RP3DS,R2               ;GET STATUS REGISTER
2375  005052  042702  136377                  BIC     #136377,R2              ;GET BITS 14, 9 & 8 ONLY
2376  005056  022702  041400                  CMP     #41400,R2               ;IS DRIVE READY?
2377  005062  001363                          BNE     4$                      ;BRANCH IF NO
2378  005064  052700  000400                  BIS     #BIT8,R0                ;SET DRIVE AVAILABLE BIT
2379  005070  000760                          BR      4$                      ;CONTINUE
2380  005072  110037  001646          5$:     MOVB    R0,@#SYSSIZE            ;STORE IN TABLE
2381
2382                                  ;;*****************************************************************
2383  005076  012737  005206  000004  10$:    MOV     #11$,@#ERRVEC           ;SETUP ERROR VEC FOR RP04 TEST
2384  005104  005037  001304          10$:    CLR     @#$TMPO
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```
2385  005110  005000                          CLR     R0                      ;UNIT AVAILABLE WORD
2386  005112  012701  000010                  MOV     #10,R1                  ;SOB COUNT
2387  005116  113777  001304  175104  14$:    MOVB    @#$TMP0,@RP4CS2         ;SET UNIT NUMBER
2388  005124  012777  000021  175064          MOV     #21,@RP4CS1             ;TRY READ-IN-PRESET
2389  005132  032777  010000  175070          BIT     #BIT12,@RP4CS2          ;NON EXISTANT DRIVE?
2390  005140  001011                          BNE     12$                     ;BRANCH IF YES
2391  005142  017702  175066                  MOV     @RP4DS,R2               ;GET DRIVE STATUS
2392  005146  042702  163277                  BIC     #163277,R2              ;GET BITS 12, 11, 8, & 6 ONLY
2393  005152  022702  010500                  CMP     #10500,R2               ;IS DRIVE READY?
2394  005156  001002                          BNE     12$                     ;BRANCH IF NO
2395  005160  052700  000400                  BIS     #BIT8,R0                ;SET UNIT AVAILABLE
2396  005164  006000                  12$:    ROR     R0
2397  005166  052777  000040  175034          BIS     #BIT5,@RP4CS2           ;CLEAR ERROR BITS
2398  005174  005237  001304                  INC     @#$TMP0                 ;SELECT NEXT DRIVE
2399  005200  077132                          SOB     R1,14$                  ;CONTINUE
2400  005202  110037  001656                  MOVB    R0,@#SYSSIZE+10         ;STORE IN TABLE
2401
2402                                  ;;*****************************************************************
2403  005206  012737  005316  000004  11$:    MOV     #15$,@#ERRVEC           ;SETUP ERROR VEC FOR RS04 TEST
2404  005214  005037  001304                  CLR     @#$TMP0
2405  005220  005000                          CLR     R0
2406  005222  012701  000010                  MOV     #10,R1                  ;SOB COUNT
2407  005226  113777  001304  175034  18$:    MOVB    @#$TMP0,@RSCS2          ;SET UNIT NUMBER
2408  005234  012777  000001  175014          MOV     #1,@RSCS1               ;TRY NOP OPERATION
2409  005242  032777  010000  175020          BIT     #BIT12,@RSCS2           ;NON EXISTANT DRIVE?
2410  005250  001011                          BNE     16$                     ;BRANCH IF YES
2411  005252  017702  175016                  MOV     @RSDS,R2                ;GET DRIVE STATUS
2412  005256  042702  163577                  BIC     #163577,R2              ;GET BITS 12, 11, & 7 ONLY
2413  005262  022702  010200                  CMP     #10200,R2               ;IS DRIVE READY?
2414  005266  001002                          BNE     16$                     ;BRANCH IF NO
2415  005270  052700  000400                  BIS     #BIT8,R0                ;SET DRIVE AVAILABLE BIT
2416  005274  006000                  16$:    ROR     R0
2417  005276  052777  000040  174764          BIS     #BIT5,@RSCS2            ;CLEAR ANY ERROR BITS
2418  005304  005237  001304                  INC     @#$TMP0                 ;SELECT NEXT UNIT
2419  005310  077132                          SOB     R1,18$                  ;CONTINUE
2420  005312  110037  001660                  MOVB    R0,@#SYSSIZE+12         ;STORE IN TABLE
2421                                  ;
2422                                  ;NEXT, DELETE XXDP UNIT 0 FROM TABLE
2423  005316  122737  000002  000041  15$:    CMPB    #2,@#41                 ;RK?
2424  005324  001004                          BNE     19$                     ;BRANCH IF NO
2425  005326  042737  000001  001650          BIC     #BIT0,@#SYSSIZE+2       ;MAKE UNIT ZERO NOT AVAILABLE
2426  005334  000420                          BR      20$
2427  005336  113700  000041          19$:    MOVB    @#41,R0                 ;GET LOCATION 41
2428  005342  042700  177770                  BIC     #177770,R0              ;GET LEAST SIG 3 BITS
2429  005346  000241                          CLC                             ;ENSURE C CLEAR
2430  005350  006100                          ROL     R0                      ;ADJUST
2431  005352  122700  000002                  CMPB    #2,R0                   ;
2432  005356  002404                          BLT     40$                     ;BRANCH IF NO
2433  005360  042737  000001  001646          BIC     #BIT0,@#SYSSIZE
2434  005366  000403                          BR      20$
2435  005370  042760  000001  001652  40$:    BIC     #BIT0,SYSSIZE+4(R0)
2436  005376  005737  001546          20$:    TST     @#QV                    ;ACT11?
2437  005402  001052                          BNE     LOOP                    ;;BRANCH IF YES
2438  005404  105737  003325                  TSTB    @#XXDPC                 ;XXDP CHAIN MODE?
2439  005410  001047                          BNE     LOOP                    ;;BRANCH IF YES
2440  005412  105737  001200                  TSTB    @#$PASS                 ;FIRST PASS?
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2441  005416  001044                        BNE     LOOP            ;;BRANCH IF NO
2442  005420  005227  177777                INC     #-1
2443  005424  001041                        BNE     LOOP            ;;BRANCH IF NOT FIRST TIME
2444  005426  032777  000200  173606        BIT     #SW7,@SWR               ;INHIBIT SIZE TYPEOUT?
2445  005434  001035                        BNE     LOOP            ;;BRANCH IF YES
2446  005436  032737  000400  001532        BIT     #BIT8,@#OPT.CP          ;TTY AVAILABLE?
2447  005444  001431                        BEQ     LOOP            ;;BRANCH IF NO TTY
2448  005446  004767  043576                JSR     PC,TYPSIZ               ;GO TYPE SYSTEM SIZE
2449  005452  104401  005460                TYPE    ,65$            ;;TYPE ASCIZ STRING
2450  005456  000417                        BR      64$             ;;GET OVER THE ASCIZ
2451                                ;;65$:  .ASCIZ  /TYPE A CHARACTER TO CONTINUE/<CRLF>
2452  005516                        64$:
2453  005516  005037  177776                CLR     @#PSW
2454  005522  000001                        WAIT
2455  005524  000137  004634                JMP     @#SIZE                  ;GO CHECK SYSTEM AGAIN
```

```
                                ;PROGRAM RESTARTS HERE AFTER RELOCATION ABOVE 28K IS COMPLETE.
                                ;INITIALIZE TRAP VECTORS
005530  012706  000700  LOOP:   MOV     #USESTK,SP              ;SET THE STACK...WILL BE DIFFERENT
                                                                ;THAN KERN STACK WHEN IN OUTER MODE
005534  012700  000004          MOV     #ERRVEC,R0
005540  013701  177776          MOV     @#PSW,R1                ;GET CURRENT PSW
005544  012720  055064          MOV     #ERPRT,(R0)+            ;SET ERROR VEC
005550  052701  000340          BIS     #PR7,R1         ;SET PRIORITY 7 IN CURRENT PSW
005554  042701  000020          BIC     #BIT4,R1
005560  010120                  MOV     R1,(R0)+
005562  012720  054774          MOV     #RESERR,(R0)+           ;SET RESERVED INST TRAP VECTOR
005566  010120                  MOV     R1,(R0)+
005570  012720  001534          MOV     #$RTRN,(R0)+            ;SET T BIT VEC
005574  005020                  CLR     (R0)+                   ;SET TBIT VEC+2
005576  005720                  TST     (R0)+                   ;BUMP R0 TO SCOPE VEC+2
005600  005020                  CLR     (R0)+                   ;SET SCOPE VEC+2
005602  062700  000006          ADD     #6,R0                   ;SET R0 TO ERROR TRAP VEC
005606  012720  000340          MOV     #PR7,(R0)+              ;SET ERROR VEC
005612  005720                  TST     (R0)+
005614  012720  000340          MOV     #PR7,(R0)+              ;SET TRAP VEC+2
005620  012737  054414  000114  MOV     #.PARSRV,@#CACHVEC      ;SET PARITY ERROR VECTOR
005626  010137  000116          MOV     R1,@#CACHVEC+2
005632  012737  054662  000250  MOV     #KTABRT,@#MMVEC         ;SET MEM. MGMT. ABORT VECTOR
005640  010137  000252          MOV     R1,@#MMVEC+2
005644  005077  173374          CLR     @DISPLAY
005650  042737  000340  177776  BIC     #PR7,@#PSW
                        ;;*****************************************************************
                        ;*TEST 1        MEMORY VERIFICATION TEST
                        ;;*****************************************************************
005656                  TST1:
005656  012767  000001  173440  MOV     #1,$TIMES       ;;DO 1 ITERATION
005664  000004                  SCOPE
005666  112737  000001  001202  MOVB    #1,@#$TSTNM

                                .SBTTL  START OF SECTION 0
                        ;000000000000 FIRST ADDRESS TO BE RELOCATED 000000000
005674  112737  000001  001202  RELO:   MOVB    #$TN-1,@#$TSTNM
005702  010700                  MOV     PC,R0                   ;GET PC
005704  005740                  TST     -(R0)                   ;R0 CONTAINS THE ADDRESS OF RELO
005706  010037  001554          MOV     R0,@#FRSTAD             ;SAVE
005712  010700                  MOV     PC,R0                   ;GET CURRENT PC
005714  162700  005714          SUB     #.,R0                   ;SUBTRACT RELOCATION FACTOR
005720  010037  001550          MOV     R0,@#FACTOR             ;SAVE RELOCATION FACTOR
005724  010737  001212          MOV     PC,@#$LPERR             ;SET LOOP ADDRESS
005730  062737  000026  001212  ADD     #26,@#$LPERR            ;ADJUST
005736  013737  001212  001210  MOV     @#$LPERR,@#$LPADR
005744  105737  001544          TSTB    @#NEXEC                 ;BR IF TEST CODE TO BE EXECUTED
005750  001402                  BEQ     .+6
005752  000167  000720          JMP     RELE0
                        ;MEMORY AND DISK (IF SELECTED) VERIFICATION TEST.
005756  000167  000714          JMP     1$
005762  177777  177777  177777  .WORD   -1,-1,-1,-1,0,0,0,0
006000  177777  000000  000000
006006  000000  000000
006010  177777  177777  177777  .WORD   -1,-1,-1,-1,0,0,0,0
006016  177777  000000  000000
```

```
2512  006016  000000  000000
2513  006022  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2514  006030  177777  000000  000000
2515  006036  000000  000000
2516  006042  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2517  006050  177777  000000  000000
2518  006056  000000  000000
2519  006062  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2520  006070  177777  000000  000000
2521  006076  000000  000000
2522  006102  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2523  006110  177777  000000  000000
2524  006116  000000  000000
2525  006122  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2526  006130  177777  000000  000000
2527  006136  000000  000000
2528  006142  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2529  006150  177777  000000  000000
2530  006156  000000  000000
2531  006162  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2532  006170  177777  000000  000000
2533  006176  000000  000000
2534  006202  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2535  006210  177777  000000  000000
2536  006216  000000  000000
2537  006222  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2538  006230  177777  000000  000000
2539  006236  000000  000000
2540  006242  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2541  006250  177777  000000  000000
2542  006256  000000  000000
2543  006262  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2544  006270  177777  000000  000000
2545  006276  000000  000000
2546  006302  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2547  006310  177777  000000  000000
2548  006316  000000  000000
2549  006322  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2550  006330  177777  000000  000000
2551  006336  000000  000000
2552  006342  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2553  006350  177777  000000  000000
2554  006356  000000  000000
2555  006362  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2556  006370  177777  000000  000000
2557  006376  000000  000000
2558  006402  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2559  006410  177777  000000  000000
2560  006416  000000  000000
2561  006422  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2562  006430  177777  000000  000000
2563  006436  000000  000000
2564  006442  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2565  006450  177777  000000  000000
2566  006456  000000  000000
2567  006462  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
```

```
2568  006470  177777  000000  000000
2569  006476  000000  000000
2570  006502  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2571  006510  177777  000000  000000
2572  006516  000000  000000
2573  006522  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2574  006530  177777  000000  000000
2575  006536  000000  000000
2576  006542  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2577  006550  177777  000000  000000
2578  006556  000000  000000
2579  006562  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2580  006570  177777  000000  000000
2581  006576  000000  000000
2582  006602  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2583  006610  177777  000000  000000
2584  006616  000000  000000
2585  006622  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2586  006630  177777  000000  000000
2587  006636  000000  000000
2588  006642  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0,0,0
2589  006650  177777  000000  000000
2590  006656  000000  000000
2591  006662  177777  177777  177777          .WORD   -1,-1,-1,-1,0,0
2592  006670  177777  000000  000000
2593  006676                          1$:
2594  006676  000004                RELEO:  SCOPE
2595  006700  010702                        MOV     PC,R2
2596  006702  062702  000012                ADD     #12,R2
2597  006706  012707  036574                MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
2598  006712  000000                RELOO:  .WORD   0
2599                                ;000000000000 LAST ADDRESS OF CODE TO BE RELOCATED 00000000000
2600
2601                                ;;*****************************************************************
2602                                ;*TEST 2         CHECK BRANCH INSTRUCTIONS
2603                                ;;*****************************************************************
2604  006714                        TST2:
2605  006714  012767  000001  172402        MOV     #1,$TIMES       ;;DO 1 ITERATION
2606  006722  000004                        SCOPE
2607  006724  112737  000002  001202        MOVB    #2,@#$TSTNM
2608
2609                                        .SBTTL  START OF SECTION 1
2610                                ;111111111111 FIRST ADDRESS TO BE RELOCATED 11111111
2611  006732  112737  000002  001202  REL1:  MOVB    #$TN-1,@#$TSTNM
2612  006740  010700                        MOV     PC,R0           ;GET PC
2613  006742  005740                        TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL1
2614  006744  010037  001554                MOV     R0,@#FRSTAD     ;SAVE
2615  006750  010700                        MOV     PC,R0           ;GET CURRENT PC
2616  006752  162700  006752                SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
2617  006756  010037  001550                MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
2618  006762  010737  001212                MOV     PC,@#$LPERR     ;SET LOOP ADDRESS
2619  006766  062737  000026  001212        ADD     #26,@#$LPERR    ;ADJUST
2620  006774  013737  001212  001210        MOV     @#$LPERR,@#$LPADR
2621  007002  105737  001544                TSTB    @#NEXEC         ;BR IF TEST CODE TO BE EXECUTED
2622  007006  001402                        BEQ     .+6
2623  007010  000167  004052                JMP     RELE1
```

```
2624
2625  007014  000257                ;
                              CCC                       ;CC'S=0000
2626  007016  103407                 BCS     CC0         ;SAME AS BLO
2627  007020  102406                 BVS     CC0
2628  007022  001405                 BEQ     CC0
2629  007024  100404                 BMI     CC0
2630  007026  002403                 BLT     CC0
2631  007030  003402                 BLE     CC0
2632  007032  101401                 BLOS    CC0
2633  007034  101001                 BHI     .+4
2634  007036  104000          CC0:   HLT                 ;ONE OF THE ABOVE BRANCHES FAILED
2635
2636                          ;CONTINUE
2637  007040  000270                 SEN                 ;CC'S=1000
2638  007042  100003                 BPL     CC1
2639  007044  002002                 BGE     CC1
2640  007046  003001                 BGT     CC1
2641  007050  002401                 BLT     .+4
2642  007052  104000          CC1:   HLT                 ;ONE OF THE ABOVE BRANCHES FAILED
2643
2644                          ;CONTINUE
2645  007054  000262                 SEV                 ;CC'S=1010
2646  007056  102003                 BVC     CC2
2647  007060  002402                 BLT     CC3
2648  007062  003401                 BLE     CC2
2649  007064  002001                 BGE     .+4
2650  007066  104000          CC2:   HLT                 ;ERROR! ONE OF THE ABOVE BRANCHES FAILED
2651
2652                          ;CONTINUE
2653  007070  000261                 SEC                 ;CC'S=1011
2654  007072  103002                 BCC     CC3
2655  007074  101001                 BHI     CC3
2656  007076  003001                 BGT     .+4
2657  007100  104000          CC3:   HLT                 ;ERROR! ONE OF THE ABOVE BRANCHES FAILED
2658
2659                          ;CONTINUE
2660  007102  000264                 SEZ                 ;CC'S=1111
2661  007104  001003                 BNE     CC4
2662  007106  003002                 BGT     CC4
2663  007110  101001                 BHI     CC4
2664  007112  003401                 BLE     .+4
2665  007114  104000          CC4:   HLT                 ;ERROR! ONE OF THE ABOVE BRANCHES FAILED
2666                          ;;*****************************************************************
2667                          ;*TEST 3        TEST UNIARY CONDITION CODES
2668                          ;;*****************************************************************
2669  007116                  TST3:
2670  007116  000004                 SCOPE
2671  007120  112737  000003  001202        MOVB    #3,@#$TSTNM
2672                          ;CLR    R0
2673  007126  000277                 SCC
2674  007130  000244                 CLZ
2675  007132  005000                 CLR     R0          ;R0=0,CC'S=0100
2676  007134  103404                 BCS     CLR0
2677  007136  102403                 BVS     CLR0
2678  007140  001002                 BNE     CLR0
2679  007142  100401                 BMI     CLR0
```

```
2680  007144  003401                        BLE     .+4
2681  007146  104000              CLR0:     HLT                     ;ERROR! INCORRECT CC'S AFTER CLR
2682
2683  007150  000277                        SCC
2684  007152  000244                        CLZ
2685  007154  005700                        TST     R0              ;R0=0,CC'S=0100
2686  007156  103404                        BCS     TST0
2687  007160  102403                        BVS     TST0
2688  007162  001002                        BNE     TST0
2689  007164  100401                        BMI     TST0
2690  007166  101401                        BLOS    .+4
2691  007170  104000              TST0:     HLT                     ;ERROR! INCORRECT CC'S AFTER TST
2692
2693  007172  000257                        CCC
2694  007174  000266                        +SEZ!SEV
2695  007176  005100                        COM     R0              ;R0=-1,CC'S=1001
2696  007200  103004                        BCC     COM0
2697  007202  102403                        BVS     COM0
2698  007204  001402                        BEQ     COM0
2699  007206  100001                        BPL     COM0
2700  007210  002401                        BLT     .+4
2701  007212  104000              COM0:     HLT                     ;ERROR! INCORRECT CC'S AFTER COM
2702
2703  007214  000261                        SEC
2704  007216  005500                        ADC     R0              ;R0=000000,CC'S=0101
2705  007220  103003                        BCC     ADC0
2706  007222  102402                        BVS     ADC0
2707  007224  001001                        BNE     ADC0
2708  007226  002001                        BGE     .+4
2709  007230  104000              ADC0:     HLT                     ;ERROR! INCORRECT CC'S AFTER ADC
2710
2711  007232  000261                        SEC
2712  007234  006000                        ROR     R0              ;R0=100000,CC'S=1010
2713  007236  103404                        BCS     ROR0
2714  007240  102003                        BVC     ROR0
2715  007242  001402                        BEQ     ROR0
2716  007244  100001                        BPL     ROR0
2717  007246  003001                        BGT     .+4
2718  007250  104000              ROR0:     HLT                     ;ERROR! INCORRECT CC'S AFTER ROR
2719  007252  000277                        SCC
2720  007254  000242                        CLV
2721  007256  005300                        DEC     R0              ;R0=077777,CC'S=0011
2722  007260  100004                        BCC     DEC0
2723  007262  102003                        BVC     DEC0
2724  007264  001402                        BEQ     DEC0
2725  007266  100401                        BMI     DEC0
2726  007270  003401                        BLE     .+4
2727  007272  104000              DEC0:     HLT                     ;ERROR! INCORRECT CC'S AFTER DEC
2728
2729  007274  000257                        CCC
2730  007276  005200                        INC     R0              ;R0=100000,CC'S=1010
2731  007300  103404                        BCS     INC0
2732  007302  102003                        BVC     INC0
2733  007304  001402                        BEQ     INC0
2734  007306  100001                        BPL     INC0
2735  007310  003001                        BGT     .+4
```

```
2736  007312  104000                  INCO:   HLT                     ;ERROR! INCORRECT CC'S AFTER INC
2737
2738  007314  000277                          SCC
2739  007316  000242                          CLV
2740  007320  005400                          NEG     R0              ;R0=100000,CC'S=1011
2741  007322  103003                          BCC     NEGO
2742  007324  102002                          BVC     NEGO
2743  007326  001401                          BEQ     NEGO
2744  007330  002001                          BGE     .+4
2745  007332  104000                  NEGO:   HLT                     ;ERROR! INCORRECT CC'S AFTER NEG
2746
2747  007334  000261                          SEC
2748  007336  006300                          ASL     R0              ;R0=000000,CC'S=0111
2749  007340  103004                          BCC     ASLO
2750  007342  102003                          BVC     ASLO
2751  007344  001002                          BNE     ASLO
2752  007346  100401                          BMI     ASLO
2753  007350  101401                          BLOS    .+4
2754  007352  104000                  ASLO:   HLT                     ;ERROR! INCORRECT CC'S AFTER ASL
2755
2756  007354  006100                          ROL     R0              ;R0=000001,CC'S=0000
2757  007356  103402                          BCS     ROLO
2758  007360  003401                          BLE     ROLO
2759  007362  002001                          BGE     .+4
2760  007364  104000                  ROLO:   HLT                     ;ERROR! INCORRECT CC'S AFTER ROL
2761
2762  007366  006200                          ASR     R0              ;R0=000000,CC'S=0111
2763  007370  103003                          BCC     ASRO
2764  007372  102002                          BVC     ASRO
2765  007374  001001                          BNE     ASRO
2766  007376  002401                          BLT     .+4
2767  007400  104000                  ASRO:   HLT                     ;ERROR! INCORRECT CC'S AFTER ASR
2768
2769  007402  000277                          SCC
2770  007404  005600                          SBC     R0              ;R0=-1,CC'S=1001
2771  007406  103002                          BCC     SBCO
2772  007410  102401                          BVS     SBCO
2773  007412  003401                          BLE     .+4
2774  007414  104000                  SBCO:   HLT                     ;ERROR! INCORRECT CC'S AFTER SBC
2775
2776  007416  005400                          NEG     R0              ;R0=000001,CC'S=00001
2777  007420  000300                          SWAB    R0              ;R0=000400',CC'S=0100
2778  007422  103403                          BCS     SWABO
2779  007424  102402                          BVS     SWABO
2780  007426  001001                          BNE     SWABO
2781  007430  002001                          BGE     .+4
2782  007432  104000                  SWABO:  HLT                     ;ERROR! INCORRECT CC'S AFTER SWAB
2783                                  ;;*****************************************************************
2784                                  ;*TEST 4         CHECK REGISTER SELECTION
2785                                  ;;*****************************************************************
2786  007434                          TST4:
2787  007434  000004                          SCOPE
2788  007436  112737  000004  001202         MOVB    #4,@#$TSTNM
2789  007444  012737  000005  001324         MOV     #5,@#$TIMES
```

```
2790  007452  005000                        CLR     R0
2791  007454  000277                        SCC
2792  007456  006100                        ROL     R0              ;R0=1
2793  007460  010002                        MOV     R0,R2
2794  007462  006302                        ASL     R2              ;R2=2
2795  007464  010203                        MOV     R2,R3
2796  007466  006303                        ASL     R3              ;R3=4
2797  007470  010304                        MOV     R3,R4
2798  007472  006304                        ASL     R4              ;R4=10
2799  007474  010405                        MOV     R4,R5
2800  007476  006305                        ASL     R5              ;R5=20
2801  007500  010546                        MOV     R5,-(SP)        ;SET BITS SET IN REGISTERS
2802  007502  050416                        BIS     R4,(SP)         ;INTO STACK ADDRESS
2803  007504  050316                        BIS     R3,(SP)
2804  007506  050216                        BIS     R2,(SP)
2805  007510  050016                        BIS     R0,(SP)
2806  007512  022726  000037                CMP     #37,(SP)+
2807  007516  001401                        BEQ     .+4             ;WERE SET
2808  007520  104000                        HLT                     ;MISSING BIT(S) REPRESENT
2809                                                                ;INCORRECT REGISTER SELECTION
2810
2811                                ;CHECK THAT ALL BITS CAN BE SET & CLEARED IN ALL REGISTERS
2812  007522  000257                        CCC
2813  007524  112700  000377                MOVB    #377,R0         ;SET ALL BITS (MOVB EXTENDS SIGN)
2814  007530  006100                1$:     ROL     R0              ;ROTATE A 0 THROUGH ALL BIT
2815  007532  103776                        BCS     1$              ;POSITIONS
2816  007534  005200                        INC     R0              ;FINAL RESULT IS -1
2817  007536  001401                        BEQ     .+4
2818  007540  104000                        HLT                     ;ERROR!
2819
2820  007542  012700  000020                MOV     #16.,R0         ;SET SHIFT COUNT
2821  007546  005002                        CLR     R2
2822  007550  000261                2$:     SEC
2823  007552  006002                        ROR     R2              ;ROTATE 1 THROUGH ALL BIT POSITS
2824  007554  005300                        DEC     R0              ;DECREMENT SHIFT COUNT
2825  007556  001374                        BNE     2$
2826  007560  005102                        COM     R2              ;R2 SHOULD CONTAIN -1
2827  007562  001401                        BEQ     .+4
2828  007564  104000                        HLT                     ;ERROR! CHECK R2 SHOULD = 0
2829
2830  007566  012703  100000                MOV     #100000,R3
2831  007572  006203                3$:     ASR     R3              ;EXTEND 1 BIT THROUGH ALL POSITIONS
2832  007574  103376                        BCC     3$
2833  007576  005203                        INC     R3
2834  007600  001401                        BEQ     .+4
2835  007602  104000                        HLT                     ;ERROR!
```

```
2836
2837  007604  112704  177401          MOVB    #177401,R4      ;R4=1
2838  007610  060404          4$:     ADD     R4,R4           ;HAS THE AFFECT OF SHIFTING A BIT
2839  007612  103376                  BCC     4$              ;THROUGH ALL POSITIONS
2840  007614  005704                  TST     R4              ;RESULT SHOULD BE 0
2841  007616  001401                  BEQ     .+4
2842  007620  104000                  HLT
2843
2844  007622  012705  000001          MOV     #1,R5
2845  007626  006305          5$:     ASL     R5
2846  007630  102376                  BVC     5$
2847  007632  006305                  ASL     R5
2848  007634  103002                  BCC     6$
2849  007636  005705                  TST     R5
2850  007640  001401                  BEQ     .+4
2851  007642  104000          6$:     HLT
2852
2853                          ;CHECK REGISTER VOLITILITY
2854  007644  005002                  CLR     R2
2855  007646  005102                  COM     R2              ;R2=-1
2856  007650  010203                  MOV     R2,R3
2857  007652  000257                  CCC
2858  007654  006002                  ROR     R2              ;R2=LOOP COUNT
2859  007656  006202                  ASR     R2
2860  007660  010304          7$:     MOV     R3,R4
2861  007662  005302                  DEC     R2              ;DECREMENT LOOP COUNT
2862  007664  001375                  BNE     7$
2863  007666  005203                  INC     R3              ;CHECK R3
2864  007670  001002                  BNE     8$
2865  007672  005204                  INC     R4              ;CHECK R4
2866  007674  001401                  BEQ     .+4
2867  007676  104000          8$:     HLT
2868
2869                          ;CHECK TRANSFER OF REGISTER DATA BETWEEN THE GS AND GD REGISTERS
2870  007700  032737  000020  177776  GSTST:  BIT     #20,@#PSW       ;CHECK IF 'T' BIT IS SET
2871  007706  001050                  BNE     7$              ;SKIP TEST IF 'T' BIT SET
2872  007710  010627                  MOV     SP,(PC)+        ;SAVE STACK PTR
2873  007712  000000          1$:     .WORD   0               ;CONTAINS SAVED STACK PTR
2874  007714  010727                  MOV     PC,(PC)+        ;LOAD DATA. THE CURRENT PC IS USED AS
2875  007716  000000          2$:     .WORD   0               ;DATA. IF THIS TEST FAILS 2$ CON-
2876                                                          ;TAINS THE DATA BEING USED.
2877  007720  005267  177772          INC     2$              ;MAKE ODD TO CHECK BIT 0
2878  007724  016700  177766  3$:     MOV     2$,R0           ;LOAD GD REGISTER 0
2879  007730  010001                  MOV     R0,R1           ;TRANSFER GS REG 0 TO GD REG 1
2880  007732  010102                  MOV     R1,R2           ;AND GS REG 1 TO GD REG 2
2881  007734  010203                  MOV     R2,R3           ;ETC...
2882  007736  010304                  MOV     R3,R4
2883  007740  010405                  MOV     R4,R5
2884  007742  152737  000340  177776  BISB    #340,@#PSW      ;SET PRIORITY LEVEL 7
2885  007750  010506                  MOV     R5,SP           ;TRANSFER GS REG 5 TO GD STK PTR
2886  007752  010627                  MOV     SP,(PC)+        ;TRANSFER GS STK PTR TO MEMORY
2887  007754  000000          4$:     .WORD   0               ;CONTAINS GS STACK PTR
2888  007756  016706  177730          MOV     1$,SP           ;RESTORE STK PTR NEEDED FOR HLT/SCOPE
2889  007762  142737  000340  177776  BICB    #340,@#PSW      ;SET PRIORITY LEVEL 0
2890  007770  026700  177760          CMP     4$,R0           ;COMPARE GS/GD STACK WITH GS REG 0
2891  007774  001004                  BNE     5$              ;BRANCH IF THEY WERE NOT =
```

```
2892  007776  006367  177714          ASL     2$              ;SHIFT TEST DATA UNTIL = 000000
2893  010002  001350                  BNE     3$
2894  010004  000411                  BR      6$
2895  010006  010046          5$:     MOV     R0,-(SP)        ;GET GS REG 0
2896  010010  010146                  MOV     R1,-(SP)        ;ETC...
2897  010012  010246                  MOV     R2,-(SP)
2898  010014  010346                  MOV     R3,-(SP)
2899  010016  010446                  MOV     R4,-(SP)
2900  010020  010546                  MOV     R5,-(SP)
2901  010022  104000                  HLT                     ;ERROR! DATA IN GS STK PTR NOT = GS REG 0
2902                                                          ;GS REG 0-GS REG 5 ARE ON THE STACK
2903  010024  016706  177662          MOV     1$,SP           ;RESTORE STACK PTR
2904  010030                  6$:
2905  010030                  7$:
2906                          ;;**********************************************************************
2907                          ;*TEST 5         TEST UNIARY WORD INSTRUCTIONS USING ADDRESS MODE 1
2908                          ;;**********************************************************************
2909  010030                  TST5:
2910  010030  000004                  SCOPE
2911  010032  112737  000005  001202  MOVB    #5,@#$TSTNM
2912  010040  012737  000005  001324  MOV     #5,@#$TIMES
2913  010046  000401                  BR      .+4
2914  010050  000000                  .WORD   0               ;RESERVE ADDRESS FOR TESTS
2915  010052  010702                  MOV     PC,R2
2916  010054  162702  000004          SUB     #4,R2           ;R2 POINTS TO RESERVED WORD
2917  010060  005012                  CLR     (R2)            ;PRESET (R2)
2918
2919  010062  000261                  SEC
2920  010064  006012                  ROR     (R2)            ;(R2)=100000,CC=1010
2921  010066  101402                  BLOS    ROR1
2922  010070  100001                  BPL     ROR1
2923  010072  002001                  BGE     .+4
2924  010074  104000          ROR1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
2925
2926  010076  000257                  CCC
2927  010100  000261                  SEC
2928  010102  005312                  DEC     (R2)            ;(R2)=077777,CC=0011
2929  010104  103001                  BCC     DEC1
2930  010106  003401                  BLE     .+4
2931  010110  104000          DEC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
2932
2933  010112  000257                  CCC
2934  010114  000261                  SEC
2935  010116  005512                  ADC     (R2)            ;(R2)=100000,CC=1010
2936  010120  103403                  BCS     ADC1
2937  010122  102002                  BVC     ADC1
2938  010124  100001                  BPL     ADC1
2939  010126  001001                  BNE     .+4
2940  010130  104000          ADC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
2941
2942  010132  006112                  ROL     (R2)            ;(R2)=000000,CC=0111
2943  010134  103003                  BCC     ROL1
2944  010136  102002                  BVC     ROL1
2945  010140  001001                  BNE     ROL1
2946  010142  100001                  BPL     .+4
2947  010144  104000          ROL1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
```

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2948
2949  010146  006112                    ROL     (R2)            ;(R2)=000001,CC=0000
2950  010150  101402                    BLOS    ROL1A           ;BRANCH IF C OR Z IS SET
2951  010152  102401                    BVS     ROL1A
2952  010154  100001                    BPL     .+4
2953  010156  104000            ROL1A:  HLT
2954
2955  010160  006212                    ASR     (R2)            ;(R2)=000000,CC=0111
2956  010162  103003                    BCC     ASR1
2957  010164  102002                    BVC     ASR1
2958  010166  001001                    BNE     ASR1
2959  010170  100001                    BPL     .+4
2960  010172  104000            ASR1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
2961
2962  010174  006012                    ROR     (R2)            ;(R2)=100000,CC=1010
2963  010176  103403                    BCS     ROR1A
2964  010200  102002                    BVC     ROR1A
2965  010202  001401                    BEQ     ROR1A
2966  010204  100401                    BMI     .+4
2967  010206  104000            ROR1A:  HLT
2968
2969  010210  000261                    SEC
2970  010212  005212                    INC     (R2)            ;(R2)=100001,CC=1001
2971  010214  103003                    BCC     INC1
2972  010216  102402                    BVS     INC1
2973  010220  001401                    BEQ     INC1
2974  010222  100401                    BMI     .+4
2975  010224  104000            INC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
2976
2977  010226  005612                    SBC     (R2)            ;(R2)=100000,CC=1000
2978  010230  103403                    BCS     SBC1
2979  010232  102402                    BVS     SBC1
2980  010234  001401                    BEQ     SBC1
2981  010236  100401                    BMI     .+4
2982  010240  104000            SBC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
2983
2984  010242  000261                    SEC
2985  010244  005612                    SBC     (R2)            ;(R2)=077777,CC=0010
2986  010246  103403                    BCS     SBC1A
2987  010250  102002                    BVC     SBC1A
2988  010252  001401                    BEQ     SBC1A
2989  010254  100001                    BPL     .+4
2990  010256  104000            SBC1A:  HLT                     ;ERROR! INCORRECT CC'S AS SHOEN ABOVE
2991
2992  010260  000261                    SEC
2993  010262  005512                    ADC     (R2)            ;(R2)=100000,CC=1010
2994  010264  100401                    BMI     .+4
2995  010266  104000                    HLT
2996
2997  010270  000261                    SEC
2998  010272  006312                    ASL     (R2)            ;(R2)=000000,CC=0111
2999  010274  103003                    BCC     ASL1
3000  010276  102002                    BVC     ASL1
3001  010300  001001                    BNE     ASL1
3002  010302  100001                    BPL     .+4
3003  010304  104000            ASL1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
```

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3004
3005  010306  005112                    COM     (R2)            ;(R2)=177777,CC=1001
3006  010310  103002                    BCC     COM1
3007  010312  102401                    BVS     COM1
3008  010314  100401                    BMI     .+4
3009  010316  104000            COM1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3010
3011  010320  000250                    CLN
3012  010322  005712                    TST     (R2)            ;(R2)=177777,CC=1000
3013  010324  103403                    BCS     TEST1
3014  010326  102402                    BVS     TEST1
3015  010330  100001                    BPL     TEST1
3016  010332  001001                    BNE     .+4
3017  010334  104000            TEST1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3018
3019  010336  000262                    SEV
3020  010340  005412                    NEG     (R2)            ;(R2)=000001,CC=0000
3021  010342  103002                    BCC     NEG1
3022  010344  102401                    BVS     NEG1
3023  010346  001001                    BNE     .+4
3024  010350  104000            NEG1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3025
3026  010352  005312                    DEC     (R2)            ;(R2)=000000,CC=0101
3027  010354  103001                    BCC     DEC1A
3028  010356  001401                    BEQ     .+4
3029  010360  104000            DEC1A:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3030                                    ;;*****************************************************************
3031                                    ;*TEST 6         CHECK UNIARY BYTE INSTRUCTIONS USING ADDRESS MODE 1
3032                                    ;;*****************************************************************
3033  010362                    TST6:
3034  010362  000004                    SCOPE
3035  010364  112737  000006  001202    MOVB    #6,@#$TSTNM
3036  010372  000401                    BR      .+4             ;RESERVE A WORD
3037  010374  000000                    .WORD   0               ;ADDRESS RESERVED FOR TESTS
3038  010376  010703                    MOV     PC,R3
3039  010400  162703  000004            SUB     #4,R3           ;R3 POINTS TO EVEN BYTE OF WORD
3040  010404  010304                    MOV     R3,R4           ;R4 POINTS TO ODD BYTE OF WORD
3041  010406  005204                    INC     R4
3042  010410  005013                    CLR     (R3)            ;PRESET DATA
3043
3044  010412  000261            1$:     SEC
3045  010414  105513                    ADCB    (R3)            ;ADD CARRY TO EVEN BYTE
3046  010416  100402                    BMI     2$              ;UNTIL EVEN BYTE BECOMES NEGATIVE
3047  010420  105214                    INCB    (R4)            ;INCREMENT ODD BYTE
3048  010422  000773                    BR      1$
3049  010424  102401            2$:     BVS     .+4             ;(R3)=077600=[0774][200],CC=1010
3050  010426  104000                    HLT
3051  010430  000242                    CLV
3052  010432  105214                    INCB    (R4)            ;(R3)=100200=[1000][200],CC=1010
3053  010434  103402                    BCS     INCB1
3054  010436  102001                    BVC     INCB1
3055  010440  100401                    BMI     .+4
3056  010442  104000            INCB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3057
3058  010444  106114                    ROLB    (R4)            ;(R3)=000200=[0000][200],CC=0111
3059  010446  103002                    BCC     ROLB1
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3060  010450  102001                    BVC     ROLB1
3061  010452  001401                    BEQ     .+4
3062  010454  104000          ROLB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3063
3064  010456  105614                    SBCB    (R4)            ;(R3)=177600=[1774][200], CC=1001
3065  010460  103002                    BCC     SBCB1
3066  010462  102401                    BVS     SBCB1
3067  010464  100401                    BMI     .+4
3068  010466  104000          SBCB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3069
3070  010470  106313                    ASLB    (R3)            ;(R3)=177400,CC=0111
3071  010472  103002                    BCC     ASLB1
3072  010474  102001                    BVC     ASLB1
3073  010476  001401                    BEQ     .+4
3074  010500  104000          ASLB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3075
3076  010502  105413                    NEGB    (R3)            ;(R3)=177400,CC=0100
3077  010504  103402                    BCS     NEGB1
3078  010506  102401                    BVS     NEGB1
3079  010510  001401                    BEQ     .+4
3080  010512  104000          NEGB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3081
3082  010514  000277                    SCC
3083  010516  105313                    DECB    (R3)            ;(R3)=177777,CC=1001
3084  010520  103002                    BCC     DECB1
3085  010522  102401                    BVS     DECB1
3086  010524  001001                    BNE     .+4
3087  010526  104000          DECB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3088
3089  010530  000241                    CLC
3090  010532  106013                    RORB    (R3)            ;(R3)=177577,CC=0011
3091  010534  103002                    BCC     RORB1
3092  010536  102001                    BVC     RORB1
3093  010540  100001                    BPL     .+4
3094  010542  104000          RORB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3095
3096  010544  000241                    CLC
3097  010546  105114                    COMB    (R4)            ;(R3)=000177,CC=0101
3098  010550  103002                    BCC     COMB1
3099  010552  102401                    BVS     COMB1
3100  010554  001401                    BEQ     .+4
3101  010556  104000          COMB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3102
3103  010560  106213          1$:       ASRB    (R3)            ;SHIFT EVEN BYTE UNTIL V CLEARS
3104  010562  102002                    BVC     2$
3105  010564  105514                    ADCB    (R4)            ;AND ADD CARRY TO ODD BYTE
3106  010566  000774                    BR      1$
3107  010570  103401          2$:       BCS     ASRB1
3108  010572  001401                    BEQ     .+4
3109  010574  104000          ASRB1:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3110
3111  010576  106214                    ASRB    (R4)
3112  010600  106214                    ASRB    (R4)            ;(R3)=000400,CC=0011
3113  010602  103002                    BCC     ASRB1A
3114  010604  102001                    BVC     ASRB1A
3115  010606  001001                    BNE     .+4
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3116  010610  104000          ASRB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3117
3118  010612  105314                  DECB    (R4)            ;(R3)=000000,CC=0100
3119  010614  001401                  BEQ     .+4
3120  010616  104000                  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3121
3122  010620  000261                  SEC
3123  010622  106014                  RORB    (R4)            ;(R3)=100000,CC=1010
3124  010624  103402                  BCS     RORB1A
3125  010626  102001                  BVC     RORB1A
3126  010630  100401                  BMI     .+4
3127  010632  104000          RORB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3128
3129  010634  000242                  CLV
3130  010636  105314                  DECB    (R4)            ;(R3)=077400,CC=0100
3131  010640  102401                  BVS     .+4
3132  010642  104000                  HLT
3133
3134  010644  000261                  SEC
3135  010646  105313                  DECB    (R3)            ;(R3)=077777,CC=1001
3136  010650  103002                  BCC     DECB1A
3137  010652  102401                  BVS     DECB1A
3138  010654  100401                  BMI     .+4
3139  010656  104000          DECB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3140
3141  010660  000277                  SCC
3142  010662  000313                  SWAB    (R3)            ;(R3)=177577=[1774][177],CC=0000
3143  010664  103402                  BCS     SWAB1
3144  010666  102401                  BVS     SWAB1
3145  010670  100001                  BPL     .+4
3146  010672  104000          SWAB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3147
3148  010674  105714                  TSTB    (R4)            ;(R3)=177577=[1774][177],CC=1000
3149  010676  103402                  BCS     TSTB1
3150  010700  102401                  BVS     TSTB1
3151  010702  100401                  BMI     .+4
3152  010704  104000          TSTB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3153
3154  010706  105014                  CLRB    (R4)            ;(R3)=000177=[0000][177],CC=0100
3155  010710  001401                  BEQ     .+4
3156  010712  104000                  HLT
3157  010714  106313                  ASLB    (R3)            ;(R3)=000376 ,CC=1010
3158  010716  103402                  BCS     ASLB1A
3159  010720  102001                  BVC     ASLB1A
3160  010722  100401                  BMI     .+4
3161  010724  104000          ASLB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3162
3163  010726  105113                  COMB    (R3)            ;(R3)=000001,CC=0001
3164  010730  103002                  BCC     COMB1A
3165  010732  102401                  BVS     COMB1A
3166  010734  100001                  BPL     .+4
3167  010736  104000          COMB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3168
3169  010740  000313                  SWAB    (R3)            ;(R3)=000400, CC=0100
3170  010742  001401                  BEQ     .+4
3171  010744  104000                  HLT
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3172
3173  010746  105213                        INCB    (R3)
3174  010750  000261                        SEC
3175  010752  105613                        SBCB    (R3)            ;(R3)=000400,CC=0100
3176  010754  001401                        BEQ     .+4
3177  010756  104000                        HLT
3178  010760  022713  000400                CMP     #400,(R3)       ;CHECK REMAINING RESULT
3179  010764  001401                        BEQ     .+4
3180  010766  104000                        HLT
3181                                ;;*****************************************************************
3182                                ;*TEST 7         CHECK UNIARY WORD OPS USING ADDRESS MODES 2 & 4
3183                                ;;*****************************************************************
3184  010770                        TST7:
3185  010770  000004                        SCOPE
3186  010772  112737  000007  001202        MOVB    #7,@#STSTNM
3187  011000  000401                        BR      .+4
3188  011002  000000                        .WORD   0               ;ADDRESS RESERVED FOR TESTS
3189  011004  010704                        MOV     PC,R4
3190  011006  162704  000004                SUB     #4,R4           ;R4 AND R5 POINT TO
3191  011012  010405                        MOV     R4,R5           ;RESERVED WORD
3192  011014  005015                        CLR     (R5)            ;PRESET DATA=0
3193
3194  011016  000277                        SCC
3195  011020  000244                        CLZ
3196  011022  005725                        TST     (R5)+           ;(R5)=000000,CC=0100
3197  011024  103402                        BCS     TEST2
3198  011026  102401                        BVS     TEST2
3199  011030  001401                        BEQ     .+4
3200  011032  104000                TEST2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3201
3202  011034  005145                        COM     -(R5)           ;(R5)=177777,CC=1001
3203  011036  103001                        BCC     COM4
3204  011040  100401                        BMI     .+4
3205  011042  104000                COM4:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3206
3207  011044  000241                        CLC
3208  011046  006024                        ROR     (R4)+           ;(R4)=077777,CC=0011
3209  011050  103002                        BCC     ROR2
3210  011052  102001                        BVC     ROR2
3211  011054  100001                        BPL     .+4
3212  011056  104000                ROR2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3213
3214  011060  000257                        CCC
3215  011062  005244                        INC     -(R4)           ;(R4)=100000,CC=1010
3216  011064  102002                        BVC     INC4
3217  011066  001401                        BEQ     INC4
3218  011070  100401                        BMI     .+4
3219  011072  104000                INC4:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3220
3221  011074  000261                        SEC
3222  011076  000324                        SWAB    (R4)+           ;(R4)=000200,CC=1000
3223  011100  103401                        BCS     SWAB2
3224  011102  100401                        BMI     .+4
3225  011104  104000                SWAB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3226
3227  011106  005425                        NEG     (R5)+           ;(R5)=177600,CC=1001
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3228  011110  103001                    BCC     NEG2
3229  011112  100401                    BMI     .+4
3230  011114  104000          NEG2:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3231
3232  011116  005044                    CLR     -(R4)           ;(R4)=000000,CC=0100
3233  011120  001401                    BEQ     .+4
3234  011122  104000                    HLT
3235
3236  011124  000261                    SEC
3237  011126  006045                    ROR     -(R5)           ;(R5)=100000,CC=1010
3238  011130  000261                    SEC
3239  011132  005525                    ADC     (R5)+           ;(R5)=100001,CC=1000
3240  011134  102401                    BVS     ADC2
3241  011136  100401                    BMI     .+4
3242  011140  104000          ADC2:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3243
3244  011142  000262                    SEV
3245  011144  006224                    ASR     (R4)+           ;(R4)=140000,CC=1001
3246  011146  103002                    BCC     ASR2
3247  011150  102401                    BVS     ASR2
3248  011152  100401                    BMI     .+4
3249  011154  104000          ASR2:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3250
3251  011156  000262                    SEV
3252  011160  006144                    ROL     -(R4)           ;(R4)=100001, CC=1001
3253  011162  103002                    BCC     ROL4
3254  011164  102401                    BVS     ROL4
3255  011166  100401                    BMI     .+4
3256  011170  104000          ROL4:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3257
3258  011172  005645                    SBC     -(R5)           ;(R5)=100000,CC=1000
3259  011174  103001                    BCC     .+4
3260  011176  104000                    HLT                     ;ERROR! 'C' BIT FAILED TO CLEAR
3261
3262  011200  005325                    DEC     (R5)+           ;(R5)=077777,CC=0010
3263  011202  103402                    BCS     DEC2
3264  011204  102001                    BVC     DEC2
3265  011206  100001                    BPL     .+4
3266  011210  104000          DEC2:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3267
3268  011212  006324                    ASL     (R4)+           ;(R4)=177776,CC=1010
3269  011214  102401                    BVS     .+4
3270  011216  104000                    HLT
3271  011220  006344                    ASL     -(R4)           ;(R4)=177774,CC=1001
3272  011222  103003                    BCC     ASL4
3273  011224  102402                    BVS     ASL4
3274  011226  001401                    BEQ     ASL4
3275  011230  100401                    BMI     .+4
3276  011232  104000          ASL4:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3277
3278  011234  022724  177774            CMP     #177774,(R4)+
3279  011240  001401                    BEQ     .+4
3280  011242  104000                    HLT
3281  011244  020405                    CMP     R4,R5
3282  011246  001401                    BEQ     .+4
3283  011250  104000                    HLT
```

```
3284                                    ;;*****************************************************************
3285                                    ;*TEST 10       CHECK UNIARY BYTE OPS USING ADDRESS MODES 2 & 4
3286                                    ;;*****************************************************************
3287  011252                            TST10:
3288  011252  000004                           SCOPE
3289  011254  112737  000010  001202           MOVB    #10,@#STSTNM
3290  011262  000401                           BR      .+4                     ;RESERVE A WORD
3291  011264  000000                           .WORD   0                       ;RESERVED WORD
3292  011266  010705                           MOV     PC,R5
3293  011270  162705  000004                   SUB     #4,R5                   ;R5 POINTS TO EVEN BYTE OF RESERVED WORD
3294  011274  010500                           MOV     R5,R0
3295  011276  010002                           MOV     R0,R2
3296  011300  005202                           INC     R2                      ;R2 POINTS TO ODD BYTE OF RESERVED WORD
3297  011302  005010                           CLR     (R0)                    ;PRESET
3298
3299  011304  000277                           SCC
3300  011306  000241                           CLC
3301  011310  105125                           COMB    (R5)+                   ;(R0)=000377,CC=1001
3302  011312  103002                           BCC     COMB2
3303  011314  102401                           BVS     COMB2
3304  011316  100401                           BMI     .+4
3305  011320  104000                   COMB2:  HLT                             ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3306
3307  011322  105542                           ADCB    -(R2)                   ;(R0)=000000,CC=0101
3308  011324  001401                           BEQ     .+4
3309  011326  104000                           HLT                             ;ERROR! INCORRECT RESULT AS SHOWN ABOVE
3310  011330  105525                           ADCB    (R5)+                   ;(R0)=000400,CC=0000
3311  011332  103401                           BCS     ADCB2
3312  011334  001001                           BNE     .+4
3313  011336  104000                   ADCB2:  HLT                             ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3314
3315  011340  000263                           +SEC!SEV
3316  011342  106045                           RORB    -(R5)                   ;(R0)=100000,CC=1001
3317  011344  103003                           BCC     RORB4
3318  011346  102402                           BVS     RORB4
3319  011350  001401                           BEQ     RORB4
3320  011352  100401                           BMI     .+4
3321  011354  104000                   RORB4:  HLT                             ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3322
3323  011356  000277                           SCC
3324  011360  106122                           ROLB    (R2)+                   ;(R0)=100001,CC=0000
3325  011362  103403                           BCS     ROLB2
3326  011364  102402                           BVS     ROLB2
3327  011366  001401                           BEQ     ROLB2
3328  011370  100001                           BPL     .+4
3329  011372  104000                   ROLB2:  HLT                             ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3330
3331  011374  000257                           CCC
3332  011376  106225                           ASRB    (R5)+                   ;(R0)=140001, CC=1010
3333  011400  103402                           BCS     ASRB2
3334  011402  102001                           BVC     ASRB2
3335  011404  100401                           BMI     .+4
3336  011406  104000                   ASRB2:  HLT                             ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3337
3338  011410  105242                           INCB    -(R2)                   ;(R0)=140002,CC=0000
3339  011412  000277                           SCC
```

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3340  011414  106222                  ASRB    (R2)+           ;(R0)=140001,CC=0000
3341  011416  103402                  BCS     ASRB2A
3342  011420  102401                  BVS     ASRB2A
3343  011422  100001                  BPL     .+4
3344  011424  104000          ASRB2A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3345
3346  011426  000266                  +SEZ!SEV                ;SET Z,V
3347  011430  106345                  ASLB    -(R5)           ;(R0)=100001,CC=1001
3348  011432  103003                  BCC     ASLB4
3349  011434  102402                  BVS     ASLB4
3350  011436  001401                  BEQ     ASLB4
3351  011440  100401                  BMI     .+4
3352  011442  104000          ASLB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3353
3354  011444  105322                  DECB    (R2)+           ;(R0)=077401=[0774][001] ,CC=0010
3355  011446  103002                  BCC     DECB2
3356  011450  102001                  BVC     DECB2
3357  011452  100001                  BPL     .+4
3358  011454  104000          DECB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWNABOVE
3359
3360  011456  105645                  SBCB    -(R5)           ;(R0)=077400, CC=0100
3361  011460  103402                  BCS     SBCB4
3362  011462  102401                  BVS     SBCB4
3363  011464  001401                  BEQ     .+4
3364  011466  104000          SBCB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3365
3366  011470  105442                  NEGB    -(R2)           ;(R0)=10400,CC=1001
3367  011472  103002                  BCC     NEGB4
3368  011474  102401                  BVS     NEGB4
3369  011476  100401                  BMI     .+4
3370  011500  104000          NEGB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
3371
3372  011502  105725                  TSTB    (R5)+           ;(R0)=100400,CC=0100
3373  011504  103401                  BCS     TSTB2
3374  011506  001401                  BEQ     .+4
3375  011510  104000          TSTB2:  HLT
3376
3377  011512  105722                  TSTB    (R2)+           ;(R0)=100400,CC=1000
3378  011514  001401                  BEQ     TSTB2A
3379  011516  100401                  BMI     .+4
3380  011520  104000          TSTB2A: HLT
3381
3382  011522  000261                  SEC
3383  011524  000342                  SWAB    -(R2)           ;(R0)=000201,CC=1000
3384  011526  103401                  BCS     SWAB4
3385  011530  100401                  BMI     .+4
3386  011532  104000          SWAB4:  HLT
3387
3388  011534  000277                  SCC
3389  011536  105225                  INCB    (R5)+           ;(R0)=000601=[0004][201],CC=0000
3390  011540  103003                  BCC     INCB2
3391  011542  102402                  BVS     INCB2
3392  011544  001401                  BEQ     INCB2
3393  011546  100001                  BPL     .+4
3394  011550  104000          INCB2:  HLT
3395
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3396  011552  022227  000601                  CMP     (R2)+,#000601   ;CHECK END RESULT
3397  011556  001401                          BEQ     .+4
3398  011560  104000                          HLT
3399  011562  020205                          CMP     R2,R5           ;CHECK REGISTERS
3400  011564  001401                          BEQ     .+4
3401  011566  104000                          HLT
3402                                  ;;*****************************************************************
3403                                  ;*TEST 11        CHECK UNIARY WORD OPS USING ADDRESS MODES 3 & 5
3404                                  ;;*****************************************************************
3405  011570                          TST11:
3406  011570  000004                          SCOPE
3407  011572  112737  000011  001202          MOVB    #11,@#$TSTNM
3408  011600  000402                          BR      .+6             ;RESERVE 2 WORDS
3409  011602  000000                          .WORD   0               ;1 FOR THE ADDRESS
3410  011604  000000                          .WORD   0               ;AND 1 FOR DATA
3411  011606  010703                          MOV     PC,R3
3412  011610  162703  000004                 SUB     #4,R3
3413  011614  005013                          CLR     (R3)            ;PRESET DATA
3414  011616  010300                          MOV     R3,R0           ;R0 POINTS TO DATA WORD
3415  011620  005743                          TST     -(R3)
3416  011622  010013                          MOV     R0,(R3)
3417  011624  010304                          MOV     R3,R4
3418
3419  011626  000257                          CCC
3420  011630  005733                          TST     @(R3)+          ;(R0)=000000,CC=0100
3421  011632  001401                          BEQ     .+4
3422  011634  104000                          HLT
3423
3424  011636  000261                          SEC
3425  011640  006053                          ROR     @-(R3)          ;(R0)=100000,CC=1010
3426  011642  103402                          BCS     ROR5
3427  011644  102001                          BVC     ROR5
3428  011646  100401                          BMI     .+4
3429  011650  104000                  ROR5:   HLT
3430
3431  011652  000257                          CCC
3432  011654  006234                          ASR     @(R4)+          ;(R0)=140000,CC=1010
3433  011656  102001                          BVC     ASR3
3434  011660  100401                          BMI     .+4
3435  011662  104000                  ASR3:   HLT
3436
3437  011664  000250                          CLN
3438  011666  006333                          ASL     @(R3)+          ;(R0)=100000,CC=1001
3439  011670  103002                          BCC     ASL3
3440  011672  102401                          BVS     ASL3
3441  011674  100401                          BMI     .+4
3442  011676  104000                  ASL3:   HLT
3443
3444  011700  000277                          SCC
3445  011702  005354                          DEC     @-(R4)          ;(R0)=077777, CC=0010
3446  011704  103003                          BCC     DEC5
3447  011706  102002                          BVC     DEC5
3448  011710  001401                          BEQ     DEC5
3449  011712  100001                          BPL      +4
3450  011714  104000                  DEC5:   HLT
3451
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3452  011716  005453                    NEG     @-(R3)          ;(R0)=100001, CC=1001
3453  011720  103002                    BCC     NEG5
3454  011722  102401                    BVS     NEG5
3455  011724  100401                    BMI     .+4
3456  011726  104000              NEG5: HLT
3457
3458  011730  000262                    SEV
3459  011732  005134                    COM     @(R4)+          ;(R0)=077776, CC=0001
3460  011734  103001                    BCC     COM3
3461  011736  102001                    BVC     .+4
3462  011740  104000              COM3: HLT
3463
3464  011742  005233                    INC     @(R3)+          ;(R0)=077777, CC=0001
3465  011744  103001                    BCC     INC3
3466  011746  100001                    BPL     .+4
3467  011750  104000              INC3: HLT
3468
3469  011752  005554                    ADC     @-(R4)          ;(R0)=100000, CC=1010
3470  011754  103402                    BCS     ADC5
3471  011756  102001                    BVC     ADC5
3472  011760  100401                    BMI     .+4
3473  011762  104000              ADC5: HLT
3474
3475  011764  000257                    CCC
3476  011766  006134                    ROL     @(R4)+          ;(R0)=000000,CC=0111
3477  011770  103002                    BCC     ROL3
3478  011772  102001                    BVC     ROL3
3479  011774  001401                    BEQ     .+4
3480  011776  104000              ROL3: HLT
3481
3482  012000  005253                    INC     @-(R3)          ;(R0)=000001, CC=0001
3483  012002  005654                    SBC     @-(R4)          ;(R0)=000000, CC=0100
3484  012004  103401                    BCS     SBC5
3485  012006  001401                    BEQ     .+4
3486  012010  104000              SBC5: HLT
3487                              ;;*****************************************************************
3488                              ;*TEST 12       CHECK UNIARY BYTE OPS USING ADDRESS MODES 3 & 5
3489                              ;;*****************************************************************
3490  012012                      TST12:
3491  012012  000004                    SCOPE
3492  012014  112737  000012  001202    MOVB    #12,@#$TSTNM
3493  012022  000403                    BR      .+10            ;RESERVE 3 WORDS
3494  012024  000000                    .WORD   0               ;1 FOR EVEN BYTE ADDRESS
3495  012026  000000                    .WORD   0               ;1 FOR ODD BYTE ADDRESS
3496  012030  000000                    .WORD   0               ;AND 1 FOR DATA
3497  012032  010702                    MOV     PC,R2
3498  012034  005742                    TST     -(R2)           ;BACK R2 UP TO
3499  012036  005742                    TST     -(R2)           ;DATA WORD
3500  012040  010200                    MOV     R2,R0           ;R0 POINTS TO THE DATA WORD
3501  012042  005010                    CLR     (R0)            ;PRESET DATA
3502  012044  005742                    TST     -(R2)           ;BACK R2 UP TO
3503  012046  005742                    TST     -(R2)           ;EVEN BYTE ADDRESS WORD
3504  012050  010022                    MOV     R0,(R2)+        ;LOAD ADDRESS
3505  012052  005200                    INC     R0              ;ODD BYTE ADDRESS
3506  012054  010022                    MOV     R0,(R2)+        ;LOAD ODD BYTE ADDRESS
3507  012056  010200                    MOV     R2,R0           ;RESET R0
```

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3508  012060  010205                      MOV     R2,R5
3509  012062  105152                      COMB    @-(R2)          ;(R0)=177400,CC=1001
3510  012064  103001                      BCC     COMB5
3511  012066  100401                      BMI     .+4
3512  012070  104000              COMB5:  HLT
3513  012072  105752                      TSTB    @-(R2)          ;(R0)=177400, CC=0100
3514  012074  001401                      BEQ     .+4
3515  012076  104000                      HLT
3516  012100  000262                      SEV
3517  012102  106255                      ASRB    @-(R5)          ;(R0)=177400, CC=1001
3518  012104  103002                      BCC     ASRB5
3519  012106  102401                      BVS     ASRB5
3520  012110  100401                      BMI     .+4
3521  012112  104000              ASRB5:  HLT
3522
3523  012114  105232                      INCB    @(R2)+          ;(R0)=177401, CC=000
3524  012116  103001                      BCC     INCB3
3525  012120  100001                      BPL     .+4
3526  012122  104000              INCB3:  HLT
3527
3528  012124  000241                      CLC
3529  012126  106055                      RORB    @-(R5)          ;(R0)=177400, CC=0111
3530  012130  103003                      BCC     RORB5
3531  012132  102002                      BVC     RORB5
3532  012134  001001                      BNE     RORB5
3533  012136  100001                      BPL     .+4
3534  012140  104000              RORB5:  HLT
3535
3536  012142  106332                      ASLB    @(R2)+          ;(R0)=177000, CC=1001
3537  012144  103002                      BCC     ASLB3
3538  012146  102401                      BVS     ASLB3
3539  012150  100401                      BMI     .+4
3540  012152  104000              ASLB3:  HLT
3541
3542  012154  105552                      ADCB    @-(R2)          ;(R0)=177400, CC=1000
3543  012156  103401                      BCS     ADCB5
3544  012160  100401                      BMI     .+4
3545  012162  104000              ADCB5:  HLT
3546
3547  012164  000277                      SCC
3548  012166  106135                      ROLB    @(R5)+          ;(R0)=177401, CC=0000
3549  012170  101402                      BLOS    ROLB3           ;BRANCH IF C OR Z IS SET
3550  012172  102401                      BVS     ROLB3
3551  012174  100001                      BPL     .+4
3552  012176  104000              ROLB3:  HLT
3553
3554  012200  000352                      SWAB    @-(R2)          ;(R0)=000777, CC=1000
3555  012202  100401                      BMI     .+4
3556  012204  104000                      HLT
3557
3558  012206  000261                      SEC
3559  012210  105635                      SBCB    @(R5)+          ;(R0)=000377, CC=0100
3560  012212  103401                      BCS     SBCB3
3561  012214  001401                      BEQ     .+4
3562  012216  104000              SBCB3:  HLT
3563
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3564  012220  105432                        NEGB    @(R2)+          ;(R0)=000001
3565  012222  105352                        DECB    @-(R2)          ;(R0)=000000, CC=0101
3566  012224  103001                        BCC     DECB5
3567  012226  001401                        BEQ     .+4
3568  012230  104000                DECB5:  HLT
3569                                  ;;**********************************************************************
3570                                  ;*TEST 13        CHECK UNIARY WORD OPS USING ADDRESS MODE 6 (PC)
3571                                  ;;**********************************************************************
3572  012232                          TST13:
3573  012232  000004                        SCOPE
3574  012234  112737  000013  001202        MOVB    #13,@#$TSTNM
3575  012242  005027                        CLR     (PC)+           ;PRESET DATA = 0
3576  012244  000000                UWM6:   .WORD   0               ;RESERVED FOR DATA
3577  012246  010700                        MOV     PC,R0
3578  012250  024040                        CMP     -(R0),-(R0)     ;R0 POINTS TO DATA WORD
3579  012252  000277                        SCC
3580  012254  006167  177764                ROL     UWM6            ;(R0)=000001,CC=0000
3581  012260  103403                        BCS     ROL6
3582  012262  102402                        BVS     ROL6
3583  012264  001401                        BEQ     ROL6
3584  012266  100001                        BPL     .+4
3585  012270  104000                ROL6:   HLT
3586
3587  012272  005167  177746                COM     UWM6            ;(R0)=177776, CC=1001
3588  012276  103002                        BCC     COM6
3589  012300  102401                        BVS     COM6
3590  012302  100401                        BMI     .+4
3591  012304  104000                COM6:   HLT
3592  012306  006267  177732                ASR     UWM6            ;(R0)=177777, CC=1010
3593  012312  103402                        BCS     ASR6
3594  012314  102001                        BVC     ASR6
3595  012316  100401                        BMI     .+4
3596  012320  104000                ASR6:   HLT
3597
3598  012322  000277                        SCC
3599  012324  005467  177714                NEG     UWM6            ;(R0)=000001, CC=0001
3600  012330  103003                        BCC     NEG6
3601  012332  102402                        BVS     NEG6
3602  012334  001401                        BEQ     NEG6
3603  012336  100001                        BPL     .+4
3604  012340  104000                NEG6:   HLT
3605
3606  012342  000277                        SCC
3607  012344  006067  177674                ROR     UWM6            ;(R0)=100000, CC=1001
3608  012350  103003                        BCC     ROR6
3609  012352  102402                        BVS     ROR6
3610  012354  001401                        BEQ     ROR6
3611  012356  100401                        BMI     .+4
3612  012360  104000                ROR6:   HLT
3613
3614  012362  005667  177656                SBC     UWM6            ;(R0)=077777, CC=0010
3615  012366  103402                        BCS     SBC6
3616  012370  102001                        BVC     SBC6
3617  012372  100001                        BPL     .+4
3618  012374  104000                SBC6:   HLT
3619
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3620  012376  000242                          CLV
3621  012400  005267  177640                  INC     UWM6            ;(R0)=100000, CC=1011
3622  012404  103403                          BCS     INC6
3623  012406  102002                          BVC     INC6
3624  012410  001401                          BEQ     INC6
3625  012412  100401                          BMI     .+4
3626  012414  104000                  INC6:   HLT
3627
3628  012416  006267  177622                  ASR     UWM6            ;(R0)=140000, CC=1010
3629  012422  000261                          SEC
3630  012424  006367  177614                  ASL     UWM6            ;(R0)=100000, CC=1001
3631  012430  103002                          BCC     ASL6
3632  012432  102401                          BVS     ASL6
3633  012434  100401                          BMI     .+4
3634  012436  104000                  ASL6:   HLT
3635
3636  012440  005367  177600                  DEC     UWM6            ;(R0)=077777, CC=0011
3637  012444  103002                          BCC     DEC6
3638  012446  102001                          BVC     DEC6
3639  012450  100001                          BPL     .+4
3640  012452  104000                  DEC6:   HLT
3641
3642  012454  005567  177564                  ADC     UWM6            ;(R0)=100000, CC=1010
3643  012460  103402                          BCS     ADC6
3644  012462  102001                          BVC     ADC6
3645  012464  100401                          BMI     .+4
3646  012466  104000                  ADC6:   HLT
3647  012470  000242                          CLV
3648  012472  000367  177546                  SWAB    UWM6
3649  012476  100401                          BMI     .+4
3650  012500  104000                          HLT
3651  012502  022710  000200                  CMP     #200,(R0)
3652  012506  001401                          BEQ     .+4
3653  012510  104000                          HLT
3654                                  ;;**********************************************************************
3655                                  ;*TEST 14        CHECK UNIARY BYTE OPS (EVEN/ODD) USING ADDRESS MODE 6 (PC)
3656                                  ;;**********************************************************************
3657  012512                          TST14:
3658  012512  000004                          SCOPE
3659  012514  112737  000014  001202          MOVB    #14,@#$TSTNM
3660  012522  012700  013064                  MOV     #UBM6,R0
3661  012526  063700  001550                  ADD     @#FACTOR,R0     ;R0 POINTS TO ADDRESS OF DATA
3662  012532  005067  000326                  CLR     UBM6            ;CLEAR DATA
3663  012536  000277                          SCC
3664  012540  000244                          CLZ
3665  012542  105767  000316                  TSTB    UBM6
3666  012546  103403                          BCS     TSTB6
3667  012550  102402                          BVS     TSTB6
3668  012552  001001                          BNE     TSTB6
3669  012554  100001                          BPL     .+4
3670  012556  104000                  TSTB6:  HLT
3671
3672  012560  000257                          CCC
3673  012562  105767  000277                  TSTB    UBM6+1          ;TEST ODD BYTE
3674  012566  001401                          BEQ     .+4
3675  012570  104000                          HLT
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3676
3677  012572  105667  000266          SBCB    UBM6            ;(R0)=000000, CC=0100
3678  012576  103402                  BCS     SBCB6
3679  012600  102401                  BVS     SBCB6
3680  012602  001401                  BEQ     .+4
3681  012604  104000          SBCB6:  HLT
3682
3683  012606  000261          1$:     SEC
3   4 012610  10 367  000250          INCB    UBM6            ;LOOP UNTIL (R0)=077600, CC=1011
3   5 012614  100403                  BMI     2$
3   6 012616  105567  000243          ADCB    UBM6+1          ;INCB INST INCREMENTS EVEN BYTE
3   7 012  22  000771                  BR      1$              ;ADCB INCREMENTS ODD BYTE
3   8 012   4  103001          2$:     BCC     INCB6
3689  012626  102401                  BVS     .+4
3690  012630  104000          INCB6:  HLT
3691
3692  012632  106367  000226          ASLB    UBM6            ;(R0)=077400, CC=0111
3693  012  36  103003                  BCC     ASLB6
3694  012640  102002                  BVC     ASLB6
3695  012642  001001                  BNE     ASLB6
3696  012644  100001                  BPL     .+4
3697  012646  104000          ASLB6:  HLT
3698
3699  012650  000242                  CLV
3700  012652  105567  000207          ADCB    UBM6+1          ;(R0)=100000, CC=1010
3701  012656  103402                  BCS     ADCB6
3702  012660  102001                  BVC     ADCB6
3703  012662  100401                  BMI     .+4
3704  012664  104000          ADCB6:  HLT
3705
3706  012666  000261                  SEC
3707  012670  10 067  000171          RORB    UBM6+1          ;(R0)=140000, CC=1010
3708  012674  103402                  BCS     RORB6
3709  012676  102001                  BVC     RORB6
3710  012700  100401                  BMI     .+4
3711  012702  104000          RORB6:  HLT
3712
3713  012704  105167  000154          COMB    UBM6            ;(R0)=140377 CC=1001
3714  012710  103002                  BCC     COMB6
3715  012712  102401                  BVS     COMB6
3716  012714  100401                  BMI     .+4
3717  012716  104000          COMB6:  HLT
3718
3719  012720  000262                  SEV
3720  012722  105467  000137          NEGB    UBM6+1          ;(R0)=040377, CC=0001
3721  012726  103002                  BCC     NEGB6
3722  012730  102401                  BVS     NEGB6
3723  012732  100001                  BPL     .+4
3724  012734  104000          NEGB6:  HLT
3725
3726  012736  106167  000123          ROLB    UBM6+1          ;(R0)=100777, CC=1010
3727  012742  103402                  BCS     ROLB6
3728  012744  102001                  BVC     ROLB6
3729  012746  100401                  BMI     .+4
3730  012750  104000          ROLB6:  HLT
3731
```

```
3732  012752  106267  000106                ASRB    UBM6            ;(R0)=100777, CC=1001
3733  012756  103002                        BCC     ASRB6
3734  012760  102401                        BVS     ASRB6
3735  012762  100401                        BMI     .+4
3736  012764  104000              ASRB6:    HLT
3737
3738  012766  105267  000072                INCB    UBM6            ;(R0)=100400, CC=0101
3739  012772  103002                        BCC     INCB6A
3740  012774  102401                        BVS     INCB6A
3741  012776  001401                        BEQ     .+4
3742  013000  104000              INCB6A:   HLT
3743
3744  013002  105367  000057                DECB    UBM6+1          ;(R0)=100000, CC=1001
3745  013006  103003                        BCC     DECB6A
3746  013010  102402                        BVS     DECB6A
3747  013012  001401                        BEQ     DECB6A
3748  013014  100401                        BMI     .+4
3749  013016  104000              DECB6A:   HLT
3750
3751  013020  000367  000040                SWAB    UBM6            ;(R0)=000200, CC=1000
3752  013024  103401                        BCS     SWAB6
3753  013026  100401                        BMI     .+4
3754  013030  104000              SWAB6:    HLT
3755
3756  013032  106167  000026                ROLB    UBM6            ;(R0)=000000, CC=0111
3757  013036  103002                        BCC     ROLB6A
3758  013040  102001                        BVC     ROLB6A
3759  013042  001401                        BEQ     .+4
3760  013044  104000              ROLB6A:   HLT
3761
3762  013046  005767  000012                TST     UBM6            ;(R0)=000000, CC=0100
3763  013052  103402                        BCS     TEST6
3764  013054  102401                        BVS     TEST6
3765  013056  001401                        BEQ     .+4
3766  013060  104000              TEST6:    HLT
3767
3768  013062  000401                        BR      .+4             ;RESERVE A WORD
3769  013064  000000              UBM6:     .WORD   0               ;WORD RESERVED FOR DATA
3770  013066  000004              RELE1:    SCOPE
3771  013070  010702                        MOV     PC,R2
3772  013072  062702  000012                ADD     #12,R2
3773  013076  012707  036574                MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
3774  013102  000000              REL11:    .WORD   0
3775                              ;111111111111 LAST ADDRESS OF CODE TO BE RELOCATED 11111111111
3776
3777                              ;;*****************************************************************
3778                              ;*TEST 15       CHECK UNIARY WORD OPS USING ADDRESS MODE 7
3779                              ;;*****************************************************************
3780  013104                      TST15:
3781  013104  012767  000001  166212        MOV     #1,$TIMES       ;;DO 1 ITERATION
3782  013112  000004                        SCOPE
3783  013114  112737  000015  001202        MOVB    #15,@#$TSTNM
3784
3785                                        .SBTTL  START OF SECTION 2
3786                              ;2222222222222 FIRST ADDRESS TO BE RELOCATED 222222222
3787  013122  112737  000015  001202  REL2:  MOVB    #$TN-1,@#$TSTNM
```

```
3788  013130  010700                          MOV     PC,R0           ;GET PC
3789  013132  005740                          TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL2
3790  013134  010037  001554                  MOV     R0,@#FRSTAD     ;SAVE
3791  013140  010700                          MOV     PC,R0           ;GET CURRENT PC
3792  013142  162700  013142                  SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
3793  013146  010037  001550                  MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
3794  013152  010737  001212                  MOV     PC,@#$LPERR     ;SET LOOP ADDRESS
3795  013156  062737  000026  001212          ADD     #26,@#$LPERR    ;ADJUST
3796  013164  013737  001212  001210          MOV     @#$LPERR,@#$LPADR
3797  013172  105737  001544                  TSTB    @#NEXEC         ;BR IF TEST CODE TO BE EXECUTED
3798  013176  001402                          BEQ     .+6
3799  013200  000167  004062                  JMP     RELE2
3800  013204  000403                          BR      UW7             ;RESERVE 3 WORDS FOR ADDRESSES & DATA
3801  013206  000000                          .WORD   0               ;CONTAINS ADDRESS OF UWM7
3802  013210  000000                  UWM7:   .WORD   0               ;CONTAINS DATA
3803  013212  000000                          .WORD   0               ;CONTAINS ADDRESS OF UWM7
3804
3805  013214  010700                  UW7:    MOV     PC,R0
3806  013216  005740                          TST     -(R0)
3807  013220  005740                          TST     -(R0)
3808  013222  005040                          CLR     -(R0)           ;CLEAR TEST DATA
3809  013224  010002                          MOV     R0,R2
3810  013226  010240                          MOV     R2,-(R0)        ;SET UP ADDRESS
3811  013230  005720                          TST     (R0)+           ;MOVE R0 TO NEXT ADDRESS
3812  013232  005720                          TST     (R0)+
3813  013234  010210                          MOV     R2,(R0)         ;SET NEXT ADDRESS
3814  013236  010200                          MOV     R2,R0           ;SET R0 POINTING TO DATA
3815  013240  000277                          SCC
3816  013242  000244                          CLZ
3817  013244  005772  000002                  TST     @2(2)           ;(R0)=000000, CC=0100
3818  013250  001401                          BEQ     .+4
3819  013252  104000                          HLT
3820
3821  013254  000277                          SCC
3822  013256  005672  177776                  SBC     @-2(2)          ;(R0)=177777, CC=1001
3823  013262  103002                          BCC     SBC7
3824  013264  102401                          BVS     SBC7
3825  013266  100401                          BMI     .+4
3826  013270  104000                  SBC7:   HLT
3827
3828  013272  000277                          SCC
3829  013274  000241                          CLC
3830  013276  006372  000002                  ASL     @2(2)           ;(R0)=177776, CC=1001
3831  013302  103002                          BCC     ASL7
3832  013304  102401                          BVS     ASL7
3833  013306  100401                          BMI     .+4
3834  013310  104000                  ASL7:   HLT
3835
3836  013312  000257                          CCC
3837  013314  005372  000002                  DEC     @2(2)           ;(R0)=177775, CC=1000
3838  013320  103402                          BCS     DEC7
3839  013322  102401                          BVS     DEC7
3840  013324  100401                          BMI     .+4
3841  013326  104000                  DEC7:   HLT
3842
3843  013330  000262                          SEV
```

```
3844  013332  006272  177776          ASR     @-2(2)          ;(R0)=177776, CC=1001
3845  013336  103002                  BCC     ASR7
3846  013340  102401                  BVS     ASR7
3847  013342  100401                  BMI     .+4
3848  013344  104000          ASR7:   HLT
3849
3850  013346  000241                  CLC
3851  013350  000262                  SEV
3852  013352  006072  177776          ROR     @-2(2)          ;(R0)=077777, CC=0000
3853  013356  101402                  BLOS    ROR7            ;BRANCH IF C OR Z IS SET
3854  013360  102401                  BVS     ROR7
3855  013362  100001                  BPL     .+4
3856  013364  104000          ROR7:   HLT
3857
3858  013366  000262                  SEV
3859  013370  005472  000002          NEG     @2(2)           ;(R0)=100001, CC=1001
3860  013374  103002                  BCC     NEG7
3861  013376  102401                  BVS     NEG7
3862  013400  100401                  BMI     .+4
3863  013402  104000          NEG7:   HLT
3864
3865  013404  000250                  CLN
3866  013406  000372  177776          SWAB    @-2(2)          ;(R0)=000600, CC=1000
3867  013412  103401                  BCS     SWAB7
3868  013414  100401                  BMI     .+4
3869  013416  104000          SWAB7:  HLT
3870
3871  013420  000262                  SEV
3872  013422  005172  000002          COM     @2(2)           ;(R0)=177177, CC=1001
3873  013426  103002                  BCC     COM7
3874  013430  102401                  BVS     COM7
3875  013432  100401                  BMI     .+4
3876  013434  104000          COM7:   HLT
3877
3878  013436  000372  000002          SWAB    @2(2)           ;(R0)=077776, CC=1000
3879  013442  100401                  BMI     .+4
3880  013444  104000                  HLT
3881
3882  013446  000277                  SCC
3883  013450  005572  177776          ADC     @-2(2)          ;(R0)=077777, CC=0000
3884  013454  103402                  BCS     ADC7
3885  013456  102401                  BVS     ADC7
3886  013460  100001                  BPL     .+4
3887  013462  104000          ADC7:   HLT
3888
3889  013464  005272  000002          INC     @2(2)           ;(R0)=100000, CC=1010
3890  013470  102001                  BVC     INC7
3891  013472  100401                  BMI     .+4
3892  013474  104000          INC7:   HLT
3893
3894  013476  000257                  CCC
3895  013500  006172  177776          ROL     @-2(2)          ;(R0)=000000, CC=0111
3896  013504  103002                  BCC     ROL7
3897  013506  102001                  BVC     ROL7
3898  013510  001401                  BEQ     .+4
3899  013512  104000          ROL7:   HLT
```

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MAINDEC-11-DQKDC-A PDP 11/6X SERIES CPU EXERCISER      MACY11 27(1006)  07-FEB-77  10:08  PAGE 91
DQKDCA.P11    07-FEB-77 09:58           Title     CHECK UNIARY BYTE OPS USING ADDRESS MODE 7

                                        ;;*****************************************************************
                                        ;*TEST 16       CHECK UNIARY BYTE OPS USING ADDRESS MODE 7
                                        ;;*****************************************************************
                                        ;
                                        TST16:
                                                SCOPE
013514  000004                                 MOVB    #16.,@#$TSTNM
013516  112737  000016  001202                 MOV     #UWM7,R0
013524  012700  013210                        
```

```
3907  013530  063700  001550              ADD     @#FACTOR,R0
3908  013534  010002                      MOV     R0,R2
3909  013536  010067  177450              MOV     R0,UWM7+2
3910  013542  005720                      TST     (R0)+
3911  013544  005210                      INC     (R0)            ;WORD FOLLOWING UWM7 CONTAINS ADDRESS
3912  013546  005740                      TST     -(R0)           ;OF ODD BYTE, R0 POINTS TO DATA WORD
3913  013550  005010                      CLR     (R0)            ;PRESET DATA
3914  013552  010067  177430              MOV     R0,UWM7-2
3915                           ;NOTE:  @2(2) REFERENCES THE ODD BYTE, AND @-2(2) REFERENCES THE EVEN BYTE.
3916
3917  013556  000263                      +SEC!SEV                ;SET C AND V
3918  013560  105672  000002              SBCB    @2(2)           ;(R0)=177400, CC=1001
3919  013564  103003                      BCC     SBCB7
3920  013566  102402                      BVS     SBCB7
3921  013570  001401                      BEQ     SBCB7
3922  013572  100401                      BMI     .+4
3923  013574  104000              SBCB7:  HLT
3924
3925  013576  000277                      SCC                     ;SET CONDITION CODES
3926  013600  105572  177776              ADCB    @-2(2)          ;(R0)=177401, CC=0000
3927  013604  103403                      BCS     ADCB7
3928  013606  102402                      BVS     ADCB7
3929  013610  001401                      BEQ     ADCB7
3930  013612  100001                      BPL     .+4
3931  013614  104000              ADCB7:  HLT
3932
3933  013616  105172  177776              COMB    @-2(2)          ;(R0)=177776, CC=1001
3934  013622  103002                      BCC     COMB7
3935  013624  102401                      BVS     COMB7
3936  013626  100401                      BMI     .+4
3937  013630  104000              COMB7:  HLT
3938
3939  013632  000241                      CLC                     ;CLEAR CARRY
3940  013634  106072  000002              RORB    @2(2)           ;(R0)=077776, CC=0011
3941  013640  103002                      BCC     RORB7
3942  013642  102001                      BVC     RORB7
3943  013644  100001                      BPL     .+4
3944  013646  104000              RORB7:  HLT
3945
3946  013650  105272  000002              INCB    @2(2)           ;(R0)=100376, CC=1011
3947  013654  103002                      BCC     INCB7
3948  013656  102001                      BVC     INCB7
3949  013660  100401                      BMI     .+4
3950  013662  104000              INCB7:  HLT
3951
3952  013664  105372  177776              DECB    @-2(2)          ;(R0)=100375, CC=1001
3953  013670  103002                      BCC     DECB7
3954  013672  102401                      BVS     DECB7
3955  013674  100401                      BMI     .+4
3956  013676  104000              DECB7:  HLT
3957
3958  013700  106372  000002              ASLB    @2(2)           ;(R0)=000375, CC=0111
3959  013704  103002                      BCC     ASLB7
3960  013706  102001                      BVC     ASLB7
3961  013710  001401                      BEQ     .+4
3962  013712  104000              ASLB7:  HLT
```

```
3963
3964  013714  000241                          CLC                     ;CLEAR CARRY
3965  013716  106272  177776                  ASRB    @-2(2)          ;(R0)=000376, CC=1001
3966  013722  103002                          BCC     ASRB7
3967  013724  102401                          BVS     ASRB7
3968  013726  100401                          BMI     .+4
3969  013730  104000                ASRB7:    HLT
3970
3971  013732  105472  000002                  NEGB    @2(2)           ;(R0)=000376, CC=0100
3972  013736  103402                          BCS     NEGB7
3973  013740  102401                          BVS     NEGB7
3974  013742  001401                          BEQ     .+4
3975  013744  104000                NEGB7:    HLT
3976
3977  013746  000262                          SEV
3978  013750  106172  177776                  ROLB    @-2(2)          ;(R0)=00374, CC=1001
3979  013754  103002                          BCC     ROLB7
3980  013756  102401                          BVS     ROLB7
3981  013760  100401                          BMI     .+4
3982  013762  104000                ROLB7:    HLT
3983
3984  013764  105272  177776                  INCB    @-2(2)          ;(R0)=000375, CC=1001
3985  013770  105272  177776                  INCB    @-2(2)          ;(R0)=000376, CC=1001
3986  013774  105572  177776                  ADCB    @-2(2)          ;(R0)=000377, CC=1000
3987  014000  105172  177776                  COMB    @-2(2)          ;(R0)=000000, CC=0100
3988  014004  001401                          BEQ     .+4
3989  014006  104000                          HLT
3990
3991                                ;;*****************************************************************
3992                                ;*TEST 17       CHECK BINARY OPS USING ADDRESS MODE 0
3993                                ;;*****************************************************************
3994  014010                        TST17:
3995  014010  000004                          SCOPE
3996  014012  112737  000017  001202          MOVB    #17,@#$TSTNM
3997  014020  000277                          SCC                     ;SET CONDITION CODES
3998  014022  010700                          MOV     PC,R0           ;R0=PC, CC=X001
3999  014024  103002                          BCC     MOV0
4000  014026  102401                          BVS     MOV0
4001  014030  001001                          BNE     .+4
4002  014032  104000                MOV0:     HLT
4003  014034  010002                          MOV     R0,R2           ;R2=R0
4004  014036  000262                          SEV                     ;SET V
4005  014040  160002                          SUB     R0,R2           ;R2=000000, CC=0100
4006  014042  103402                          BCS     SUB0
4007  014044  102401                          BVS     SUB0
4008  014046  001401                          BEQ     .+4
4009  014050  104000                SUB0:     HLT
4010
4011  014052  000244                          CLZ
4012  014054  010203                          MOV     R2,R3           ;R2=R3=000000, CC=0100
4013  014056  103401                          BCS     MOV0A
4014  014060  001401                          BEQ     .+4
4015  014062  104000                MOV0A:    HLT
4016
4017  014064  000257                          CCC
4018  014066  000272                          +SEV!SEN                ;SET V & N
```

```
4019  014070  020203                  CMP     R2,R3           ;R2=R3=000000, CC=0100
4020  014072  103403                  BCS     CMPO
4021  014074  102402                  BVS     CMPO
4022  014076  001001                  BNE     CMPO
4023  014100  100001                  BPL     .+4
4024  014102  104000          CMPO:   HLT
4025
4026  014104  010002                  MOV     R0,R2           ;R0=R2
4027  014106  010203                  MOV     R2,R3           ;R0=R2=R3
4028  014110  060203                  ADD     R2,R3           ;R3=2*R0
4029  014112  006302                  ASL     R2              ;R2=2*R0
4030  014114  020203                  CMP     R2,R3           ;R2=R3=2*R0
4031  014116  001401                  BEQ     .+4
4032  014120  104000                  HLT                     ;ERROR! CHECK ADD INSTRUCTION
4033
4034                          ;THE FOLLOWING SUBTEST SHIFTS A BIT THROUGH R2 AND R5 AND DOES A
4035                          ;BIT TEST (BIT) USING R2 AND R5.
4036  014122  005002                  CLR     R2
4037  014124  005202                  INC     R2
4038  014126  000402                  BR      2$
4039  014130  006302          1$:     ASL     R2
4040  014132  100407                  BMI     4$
4041  014134  010205          2$:     MOV     R2,R5
4042  014136  000277                  SCC
4043  014140  030205                  BIT     R2,R5           ;R2=R5
4044  014142  103002                  BCC     3$
4045  014144  102401                  BVS     3$
4046  014146  001370                  BNE     1$
4047  014150  104000          3$:     HLT
4048  014152  010205          4$:     MOV     R2,R5
4049  014154  000257                  CCC
4050  014156  030205                  BIT     R2,R5
4051  014160  100401                  BMI     .+4
4052  014162  104000                  HLT
4053
4054  014164  005002                  CLR     R2
4055  014166  000277                  SCC
4056  014170  050002                  BIS     R0,R2
4057  014172  103002                  BCC     BISO
4058  014174  102401                  BVS     BISO
4059  014176  001001                  BNE     .+4
4060  014200  104000          BISO:   HLT
4061
4062  014202  010003                  MOV     R0,R3
4063  014204  000277                  SCC
4064  014206  000244                  CLZ
4065  014210  040003                  BIC     R0,R3
4066  014212  103003                  BCC     BICO
4067  014214  102402                  BVS     BICO
4068  014216  001001                  BNE     BICO
4069  014220  100001                  BPL     .+4
4070  014222  104000          BICO:   HLT
4071
4072  014224  010004                  MOV     R0,R4
4073  014226  005104                  COM     R4
4074  014230  040004                  BIC     R0,R4
```

```
4075  014232  005104                          COM     R4
4076  014234  020004                          CMP     R0,R4
4077  014236  001401                          BEQ     .+4
4078  014240  104000                          HLT
4079
4080  014242  010004                          MOV     R0,R4
4081  014244  005104                          COM     R4
4082  014246  010403                          MOV     R4,R3
4083  014250  050003                          BIS     R0,R3
4084  014252  103001                          BCC     BISOA
4085  014254  100401                          BMI     .+4
4086  014256  104000                BISOA:    HLT
4087  014260  005203                          INC     R3
4088  014262  001401                          BEQ     .+4
4089  014264  104000                          HLT
4090  014266  010304                          MOV     R3,R4           ;R3=R4=0
4091  014270  005103                          COM     R3              ;R3=177777
4092  014272  000261                          SEC                     ;SET C
4093  014274  006004                          ROR     R4              ;R4=100000
4094  014276  060304                          ADD     R3,R4           ;R3=177777,R4=077777, CC=0011
4095  014300  103003                          BCC     ADDO
4096  014302  102002                          BVC     ADDO
4097  014304  001401                          BEQ     ADDO
4098  014306  100001                          BPL     .+4
4099  014310  104000                ADDO:     HLT
4100  014312  010700                          MOV     PC,R0
4101  014314  022020                          CMP     (R0)+,(R0)+
4102  014316  020007                          CMP     R0,PC
4103  014320  001401                          BEQ     .+4
4104  014322  104000                          HLT
4105
4106  014324  010700                          MOV     PC,R0
4107  014326  062700  000010                  ADD     #10,R0
4108  014332  010002                          MOV     R0,R2
4109  014334  020700                          CMP     PC,R0
4110  014336  001002                          BNE     CMPOA
4111  014340  020200                          CMP     R2,R0
4112  014342  001401                          BEQ     .+4
4113  014344  104000                CMPOA:    HLT
4114                                  ;;*****************************************************************
4115                                  ;*TEST 20        CHECK BINARY OPS USING ADDRESS MODE 1
4116                                  ;;*****************************************************************
4117  014346                          TST20:
4118  014346  000004                          SCOPE
4119  014350  112737  000020  001202          MOVB    #20,@#STSTNM
4120  014356  000402                          BR      .+6             ;RESERVE TWO WORDS
4121  014360  000000                          .WORD   0               ;RESERVED FOR SOURCE DATA
4122  014362  000000                          .WORD   0               ;RESERVED FOR DESTINATION DATA
4123  014364  010704                          MOV     PC,R4
4124  014366  005744                          TST     -(R4)
4125  014370  005044                          CLR     -(R4)           ;R4 POINTS TO DESTINATION DATA
4126  014372  010403                          MOV     R4,R3
4127  014374  005043                          CLR     -(R3)           ;R3 POINTS TO SOUCE DATA
4128
4129  014376  005113                          COM     (R3)            ;(R3)=177777
4130  014400  005214                          INC     (R4)            ;(R4)=000001
```

```
4131  014402  000262                    SEV                         ;SET V
4132  014404  061314                    ADD     (R3),(R4)           ;(R3)=177777,(R4)=000000, CC=0101
4133  014406  103002                    BCC     ADD1
4134  014410  102401                    BVS     ADD1
4135  014412  001401                    BEQ     .+4
4136  014414  104000              ADD1: HLT
4137
4138  014416  000277                    SCC
4139  014420  000250                    CLN
4140  014422  021314                    CMP     (R3),(R4)           ;(R3)=177777,(R4)=000000, CC=1000
4141  014424  103403                    BCS     CMP1
4142  014426  102402                    BVS     CMP1
4143  014430  001401                    BEQ     CMP1
4144  014432  100401                    BMI     .+4
4145  014434  104000              CMP1: HLT
4146
4147  014436  000277                    SCC
4148  014440  000244                    CLZ
4149  014442  031314                    BIT     (R3),(R4)           ;(R3)=177777,(R4)=000000, CC=0101
4150  014444  103002                    BCC     BITT1
4151  014446  102401                    BVS     BITT1
4152  014450  001401                    BEQ     .+4
4153  014452  104000              BITT1: HLT
4154
4155  014454  000277                    SCC
4156  014456  000245                    +CLC!CLZ
4157  014460  005114                    COM     (R4)                ;(R4)=177777
4158  014462  161314                    SUB     (R3),(R4)           ;(R3)=177777,(R4)=000000, CC=0100
4159  014464  103402                    BCS     SUB1
4160  014466  102401                    BVS     SUB1
4161  014470  001401                    BEQ     .+4
4162  014472  104000              SUB1: HLT
4163
4164  014474  105013                    CLRB    (R3)                ;(R3)=177400
4165  014476  000313                    SWAB    (R3)                ;(R3)=000377
4166  014500  000270                    SEN
4167  014502  011314                    MOV     (R3),(R4)           ;(R3)=(R4)=000377
4168  014504  100001                    BPL     .+4
4169  014506  104000                    HLT
4170  014510  000314                    SWAB    (R4)                ;(R3)=000377,(R4)=177400
4171  014512  000263                    +SEC!SEV                    ;SET C & V
4172  014514  051314                    BIS     (R3),(R4)           ;(R3)=000377,(R4)=177777, CC=1001
4173  014516  103002                    BCC     BIS1
4174  014520  102401                    BVS     BIS1
4175  014522  100401                    BMI     .+4
4176  014524  104000              BIS1: HLT
4177
4178  014526  041314                    BIC     (R3),(R4)           ;(R3)=000377,(R4)=177400, CC=1001
4179  014530  103002                    BCC     BIC1
4180  014532  102401                    BVS     BIC1
4181  014534  100401                    BMI     .+4
4182  014536  104000              BIC1: HLT
4183
4184  014540  000262                    SEV                         ;SET V
4185  014542  021314                    CMP     (R3),(R4)           ;(R3)=000377,(R4)=177400, CC=0001
4186  014544  103003                    BCC     CMP1A
```

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4187  014546  102402                        BVS     CMP1A
4188  014550  001401                        BEQ     CMP1A
4189  014552  100001                        BPL     .+4
4190  014554  104000              CMP1A:    HLT
4191
4192  014556  005013                        CLR     (R3)            ;(R3)=000000
4193  014560  000261                        SEC
4194  014562  006013                        ROR     (R3)            ;(R3)=100000
4195  014564  011314                        MOV     (R3),(R4)       ;(R3)=(R4)=100000
4196  014566  005114                        COM     (R4)            ;(R4)=077777
4197  014570  161314                        SUB     (R3),(R4)       ;(R3)=100000,(R4)=177777, CC=1011
4198  014572  103002                        BCC     SUB1A
4199  014574  102001                        BVC     SUB1A
4200  014576  100401                        BMI     .+4
4201  014600  104000              SUB1A:    HLT
4202
4203  014602  000277                        SCC
4204  014604  161314                        SUB     (R3),(R4)       ;(R3)=100000,(R4)=077777, CC=0000
4205  014606  101402                        BLOS    SUB1B           ;BRANCH IF C OR Z IS SET
4206  014610  102401                        BVS     SUB1B
4207  014612  100001                        BPL     .+4
4208  014614  104000              SUB1B:    HLT
4209
4210  014616  011314                        MOV     (R3),(R4)       ;(R3)=100000,(R4)=100000, CC=1000
4211  014620  001401                        BEQ     MOV1
4212  014622  100401                        BMI     .+4
4213  014624  104000              MOV1:     HLT
4214
4215  014626  061314                        ADD     (R3),(R4)       ;(R3)=100000,(R4)=000000, CC=0111
4216  014630  103003                        BCC     ADD1A
4217  014632  102002                        BVC     ADD1A
4218  014634  001001                        BNE     ADD1
4219  014636  100001                        BPL     .+4
4220  014640  104000              ADD1A:    HLT
4221
4222  014642  005113                        COM     (R3)            ;(R3)=077777
4223  014644  011314                        MOV     (R3),(R4)       ;(R4)=077777
4224  014646  061314                        ADD     (R3),(R4)       ;(R3)=077777,(R4)=177776, CC=1010
4225  014650  103402                        BCS     ADD1B
4226  014652  102001                        BVC     ADD1B
4227  014654  100401                        BMI     .+4
4228  014656  104000              ADD1B:    HLT
4229
4230  014660  062714  000002               ADD     #2,(R4)
4231  014664  005714                        TST     (R4)            ;CHECK FINAL RESULT
4232  014666  001401                        BEQ     .+4
4233  014670  104000                        HLT
4234                              ;;*****************************************************************
4235                              ;*TEST 21        CHECK BINARY BYTE OPS USING ADDRESS MODE 1
4236                              ;;*****************************************************************
4237  014672                      TST21:
4238  014672  000004                        SCOPE
4239  014674  112737  000021  001202       MOVB    #21,@#STSTNM
4240  014702  000402                        BR      .+6
4241  014704  000000                        .WORD   0
4242  014706  000000                        .WORD   0
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```
4243  014710  010705                      MOV     PC,R5
4244  014712  005745                      TST     -(R5)
4245  014714  005045                      CLR     -(R5)           ;(R5)=000000
4246  014716  010502                      MOV     R5,R2
4247  014720  005042                      CLR     -(R2)           ;(R2)=000000
4248  014722  005202                      INC     R2              ;R2 POINTS TO ODD BYTE
4249  014724  105112                      COMB    (R2)            ;(R2)=177400
4250
4251  014726  000277                      SCC
4252  014730  111215                      MOVB    (R2),(R5)       ;(R2)=177400,(R5)=000377,CC=1001
4253  014732  103005                      BCC     MOVB1
4254  014734  102404                      BVS     MOVB1
4255  014736  001403                      BEQ     MOVB1
4256  014740  100002                      BPL     MOVB1
4257  014742  105215                      INCB    (R5)            ;CHECK RESULT
4258  014744  001401                      BEQ     .+4
4259  014746  104000              MOVB1:  HLT
4260
4261  014750  106312                      ASLB    (R2)            ;SHIFT (R2) UNTIL
4262  014752  102376                      BVC     .-2             ;(R2)=000000
4263  014754  106012                      RORB    (R2)            ;(R2)=100000
4264  014756  105315                      DECB    (R5)            ;(R5)=00377
4265  014760  106015                      RORB    (R5)            ;(R5)=000177
4266  014762  000257                      CCC
4267  014764  121512                      CMPB    (R5),(R2)       ;(R5)=000177,(R2)=100000, CC=1010
4268  014766  102001                      BVC     CMPB1
4269  014770  100401                      BMI     .+4
4270  014772  104000              CMPB1:  HLT
4271
4272  014774  005003                      CLR     R3
4273  014776  000261                      SEC
4274  015000  006003                      ROR     R3              ;R3=100000
4275  015002  050315                      BIS     R3,(R5)         ;(R5)=100177
4276  015004  000273                      +SEC!SEV!SEN            ;SET C,V, & N
4277  015006  131215                      BITB    (R2),(R5)       ;(R2)=100000,(R5)=100177, CC=0101
4278  015010  103002                      BCC     BITB1
4279  015012  102401                      BVS     BITB1
4280  015014  001401                      BEQ     .+4
4281  015016  104000              BITB1:  HLT
4282
4283  015020  151215                      BISB    (R2),(R5)       ;(R2)=100000,(R5)=100377, CC=1001
4284  015022  103001                      BCC     BISB1
4285  015024  100401                      BMI     .+4
4286  015026  104000              BISB1:  HLT
4287
4288  015030  141215                      BICB    (R2),(R5)       ;(R2)=100000,(R5)=100177, CC=0001
4289  015032  103002                      BCC     BICB1
4290  015034  001401                      BEQ     BICB1
4291  015036  100001                      BPL     .+4
4292  015040  104000              BICB1:  HLT
4293
4294  015042  105112                      COMB    (R2)            ;(R2)=077400,(R5)=100177
4295  015044  121215                      CMPB    (R2),(R5)
4296  015046  001401                      BEQ     .+4
4297  015050  104000                      HLT
4298
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 4299  015052  141512                BICB    (R5),(R2)       ;(R5)=100177,(R2)=000000, CC=0100
 4300  015054  001002                BNE     BICB1A
 4301  015056  105712                TSTB    (R2)
 4302  015060  001401                BEQ     .+4
 4303  015062  104000          BICB1A: HLT
 4304
 4305  015064  000402                BR      .+6             ;RESERVE TWO WORDS FOR DATA
 4306  015066  000000                .WORD   0               ;SOURCE DATA
 4307  015070  000000                .WORD   0               ;DEST DATA
 4308  015072  010705                MOV     PC,R5
 4309  015074  005745                TST     -(R5)
 4310  015076  105045                CLRB    -(R5)           ;R5 POINTS TO DEST ODD BYTE
 4311  015100  010504                MOV     R5,R4
 4312  015102  105044                CLRB    -(R4)           ;R4 POINTS TO DEST EVEN BYTE
 4313  015104  010403                MOV     R4,R3
 4314  015106  105043                CLRB    -(R3)           ;R3 POINTS TO SOURCE ODD BYTE
 4315  015110  010302                MOV     R3,R2
 4316  015112  105042                CLRB    -(R2)           ;R2 POINTS TO SOURCE EVEN BYTE
 4317
 4318                          ;COMMENTS ARE LEAST SIGNIFICANT 4 BITS OF BYTES POINTED TO BY R2,R3
 4319                          ;R4, AND R5 RESPECTIVELY AND THE REMAINING BITS ARE 0'S.
 4320  015114  000261                SEC                     ;SET CARRY
 4321                                                        ;(R2),(R3),(R4),(R5)
 4322  015116  106112                ROLB    (R2)            ;0001,0000,0000,0000
 4323  015120  111214                MOVB    (R2),(R4)       ;0001,0000,0001,0000
 4324  015122  106112                ROLB    (R2)            ;0010,0000,0001,0000
 4325  015124  111213                MOVB    (R2),(R3)       ;0010,0010,0001,0000
 4326  015126  106112                ROLB    (R2)            ;0100,0010,0001,0000
 4327  015130  111315                MOVB    (R3),(R5)       ;0100,0010,0001,0010
 4328  015132  106112                ROLB    (R2)            ;1000,0010,0001,0010
 4329  015134  106113                ROLB    (R3)            ;1000,0100,0001,0010
 4330  015136  151215                BISB    (R2),(R5)       ;1000,0100,0001,1010
 4331  015140  131512                BITB    (R5),(R2)       ;1000,0100,0001,1010
 4332  015142  001426                BEQ     BIN1
 4333  015144  151314                BISB    (R3),(R4)       ;1000,0100,0101,1010
 4334  015146  131413                BITB    (R4),(R3)       ;1000,0100,0101,1010
 4335  015150  001423                BEQ     BIN1
 4336  015152  105213                INCB    (R3)            ;1000,0101,0101,1010
 4337  015154  121314                CMPB    (R3),(R4)       ;1000,0101,0101,1010
 4338  015156  001020                BNE     BIN1
 4339  015160  106113                ROLB    (R3)            ;1000,1010,0101,1010
 4340  015162  121315                CMPB    (R3),(R5)       ;1000,1010,0101,1010
 4341  015164  001015                BNE     BIN1
 4342  015166  106212                ASRB    (R2)            ;0100,1010,0101,1010
 4343  015170  131214                BITB    (R2),(R4)       ;0100,1010,0101,1010
 4344  015172  001412                BEQ     BIN1
 4345  015174  106015                RORB    (R5)            ;0100,1010,0101,0101
 4346  015176  121415                CMPB    (R4),(R5)       ;0100,1010,0101,0101
 4347  015200  001007                BNE     BIN1
 4348  015202  105314                DECB    (R4)            ;0100,1010,0100,0101
 4349  015204  141214                BICB    (R2),(R4)       ;0100,1010,0000,0101
 4350  015206  001004                BNE     BIN1
 4351  015210  111314                MOVB    (R3),(R4)       ;0100,1010,1010,0101
 4352  015212  106213                ASRB    (R3)            ;0100,0101,1010,0101
 4353  015214  141315                BICB    (R3),(R5)       ;0100,0101,1010,0101
 4354  015216  001401                BEQ     .+4
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4355  015220  104000                  BIN1:   HLT
4356                                  ;;*****************************************************************
4357                                  ;*TEST 22       CHECK BINARY WORD OPS USING ADDRESS MODE 2 & 4
4358                                  ;;*****************************************************************
4359  015222                          TST22:
4360  015222  000004                         SCOPE
4361  015224  112737  000022  001202        MOVB    #22,@#$TSTNM
4362  015232  012704  015070                MOV     #BICB1A+6,R4
4363  015236  012702  015066                MOV     #BICB1A+4,R2
4364  015242  063702  001550                ADD     @#FACTOR,R2
4365  015246  063704  001550                ADD     @#FACTOR,R4
4366  015252  010405                        MOV     R4,R5           ;SET DESTINATION REGISTER
4367  015254  012715  000001                MOV     #1,(R5)
4368  015260  012712  177777                MOV     #-1,(R2)
4369  015264  000257                        CCC
4370  015266  000262                        SEV
4371  015270  062225                        ADD     (R2)+,(R5)+     ;(R2)=177777,(R5)=000000, CC=0101
4372  015272  103002                        BCC     ADD2
4373  015274  102401                        BVS     ADD2
4374  015276  001401                        BEQ     .+4
4375  015300  104000                  ADD2:   HLT
4376
4377  015302  000262                        SEV                     ;SET V
4378  015304  024527  000001                CMP     -(R5),#1        ;(R5)=000000, CC=1001
4379  015310  103002                        BCC     CMP2
4380  015312  102401                        BVS     CMP2
4381  015314  100401                        BMI     .+4
4382  015316  104000                  CMP2:   HLT
4383
4384  015320  054225                        BIS     -(R2),(R5)+     ;(R2)=177777,(R5)=177777,CC=1001
4385  015322  103001                        BCC     BIS2
4386  015324  100401                        BMI     .+4
4387  015326  104000                  BIS2:   HLT
4388  015330  000277                        SCC
4389  015332  000244                        CLZ
4390  015334  162245                        SUB     (R2)+,-(R5)     ;(R2)=177777,(R5)=000000, CC=0100
4391  015336  103402                        BCS     SUB2
4392  015340  102401                        BVS     SUB2
4393  015342  001401                        BEQ     .+4
4394  015344  104000                  SUB2:   HLT
4395
4396  015346  005442                        NEG     -(R2)           ;(R2)=000001
4397  015350  005115                        COM     (R5)            ;(R5)=177777
4398  015352  000277                        SCC
4399  015354  000250                        CLN
4400  015356  042225                        BIC     (R2)+,(R5)+     ;(R2)=000001,(R5)=177776, CC=1001
4401  015360  103003                        BCC     BIC2
4402  015362  102402                        BVS     BIC2
4403  015364  001401                        BEQ     BIC2
4404  015366  100401                        BMI     .+4
4405  015370  104000                  BIC2:   HLT
4406
4407  015372  012742  125252                MOV     #125252,-(R2)
4408  015376  012245                        MOV     (R2)+,-(R5)
4409  015400  005125                        COM     (R5)+           ;(R5)=052525
4410  015402  000262                        SEV
```

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 4411  015404  034245                        BIT     -(R2),-(R5)     ;(R2)=125252,(R5)=052525, CC=0101
 4412  015406  103002                        BCC     BITT2
 4413  015410  102401                        BVS     BITT2
 4414  015412  001401                        BEQ     .+4
 4415  015414  104000                BITT2:  HLT
 4416
 4417  015416  000262                        SEV
 4418  015420  052225                        BIS     (R2)+,(R5)+     ;(R2)=125252,(R5)=177777, CC=1001
 4419  015422  103002                        BCC     BIS2A
 4420  015424  102401                        BVS     BIS2A
 4421  015426  100401                        BMI     .+4
 4422  015430  104000                BIS2A:  HLT
 4423
 4424  015432  042745  125252              BIC     #125252,-(R5)   ;(R5)=052525
 4425  015436  005125                        COM     (R5)+           ;(R5)=125252
 4426  015440  024245                        CMP     -(R2),-(R5)
 4427  015442  001401                        BEQ     .+4
 4428  015444  104000                        HLT
 4429
 4430  015446  005012                        CLR     (R2)
 4431  015450  005122                        COM     (R2)+           ;(R2)=177777
 4432  015452  162742  000001              SUB     #1,-(R2)        ;(R2)=177776, CC=1000
 4433  015456  103402                        BCS     SUB2A
 4434  015460  102401                        BVS     SUB2A
 4435  015462  100401                        BMI     .+4
 4436  015464  104000                SUB2A:  HLT
 4437  015466  010702                        MOV     PC,R2           ;GET CURRENT PC
 4438  015470  010205                        MOV     R2,R5           ;MOVE TO R5
 4439  015472  124245                1$:     CMPB    -(R2),-(R5)     ;COMPARE ALL PREVIOUS MEMORY ADDRESSES
 4440  015474  001401                        BEQ     .+4
 4441  015476  104000                        HLT                     ;ERROR!
 4442  015500  020237  001554              CMP     R2,@#FRSTAD     ;CHECK FOR LOW LIMIT
 4443  015504  001372                        BNE     1$
 4444                                  ;;*****************************************************************
 4445                                  ;*TEST 23       CHECK BINARY BYTE OPS USING ADDRESS MODE 2 & 4
 4446                                  ;*****************************************************************
 4447  015506                        TST23:
 4448  015506  000004                        SCOPE
 4449  015510  112737  000023  001202        MOVB    #23,@#STSTNM
 4450  015516  000402                        BR      .+6             ;RESERVE TWO WORDS
 4451  015520  000000                        .WORD   0               ;SOURCE DATA
 4452  015522  000000                        .WORD   0               ;DESTINATION DATA
 4453  015524  010703                        MOV     PC,R3
 4454  015526  005743                        TST     -(R3)
 4455
 4456                                  ;FIRST CHECK AUTO INCREMENT/DECREMENT
 4457  015530  010300                        MOV     R3,R0
 4458  015532  010002                        MOV     R0,R2
 4459  015534  005302                        DEC     R2
 4460  015536  010604                        MOV     SP,R4
 4461  015540  010605                        MOV     SP,R5
 4462  015542  005745                        TST     -(R5)
 4463
 4464  015544  114046                        MOVB    -(R0),-(SP)
 4465  015546  020506                        CMP     R5,SP
 4466  015550  001021                        BNE     BINB
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4467  015552  020200                        CMP     R2,R0
4468  015554  001017                        BNE     BINB
4469  015556  122026                        CMPB    (R0)+,(SP)+
4470  015560  020406                        CMP     R4,SP
4471  015562  001014                        BNE     BINB
4472  015564  020003                        CMP     R0,R3
4473  015566  001012                        BNE     BINB
4474  015570  154640                        BISB    -(SP),-(R0)
4475  015572  020506                        CMP     R5,SP
4476  015574  001007                        BNE     BINB
4477  015576  020002                        CMP     R2,R0
4478  015600  001005                        BNE     BINB
4479  015602  142620                        BICB    (SP)+,(R0)+
4480  015604  020406                        CMP     R4,SP
4481  015606  001002                        BNE     BINB
4482  015610  020003                        CMP     R0,R3
4483  015612  001401                        BEQ     .+4
4484  015614  104000              BINB:     HLT
4485  015616  010003                        MOV     R0,R3
4486  015620  112743  000200                MOVB    #200,-(R3)
4487  015624  112743  000377                MOVB    #377,-(R3)      ;(R3)=100377
4488  015630  010304                        MOV     R3,R4
4489  015632  112744  000177                MOVB    #177,-(R4)
4490  015636  112744  000000                MOVB    #0,-(R4)        ;(R4)=077400
4491  015642  001401                        BEQ     .+4
4492  015644  104000                        HLT
4493
4494  015646  152324                        BISB    (R3)+,(R4)+     ;(R3)=100377,(R4)=077777
4495  015650  100401                        BMI     .+4
4496  015652  104000                        HLT
4497
4498  015654  122324                        CMPB    (R3)+,(R4)+
4499  015656  103402                        BCS     CMPB2
4500  015660  102001                        BVC     CMPB2
4501  015662  100001                        BPL     .+4
4502  015664  104000              CMPB2:    HLT
4503
4504  015666  000261                        SEC
4505  015670  134344                        BITB    -(R3),-(R4)
4506  015672  103002                        BCC     BITB2
4507  015674  102401                        BVS     BITB2
4508  015676  001401                        BEQ     .+4
4509  015700  104000              BITB2:    HLT
4510
4511  015702  000244                        CLZ
4512  015704  144344                        BICB    -(R3),-(R4)     ;(R3)=100377,(R4)=077400
4513  015706  001401                        BEQ     .+4
4514  015710  104000                        HLT
4515                          ;;*****************************************************************
4516                          ;*TEST 24       CHECK BINARY WORD OPS USING ADDRESS MODES 3 & 5
4517                          ;;*****************************************************************
4518  015712                  TST24:
4519  015712  000004                        SCOPE
4520  015714  112737  000024  001202        MOVB    #24,@#$TSTNM
4521  015722  000404                        BR      2$              ;RESERVE SPACE FOR DATA AND ADDRESSES
4522  015724  000000                        .WORD   0               ;CONTAINS ADDRESS OF SOURCE DATA
```

```
4523  015726  000000                        .WORD   0               ;CONTAINS ADDRESS OF DEST DATA
4524  015730  000000                        .WORD   0               ;CONTAINS SOURCE DATA
4525  015732  000000                        .WORD   0               ;CONTAINS DEST DATA
4526  015734  010701                2$:     MOV     PC,R1
4527  015736  010100                        MOV     R1,R0           ;SET SCOPE PTR
4528  015740  024040                        CMP     -(R0),-(R0)     ;ADJUST R0
4529  015742  010005                        MOV     R0,R5           ;R5 POINTS TO DEST DATA
4530  015744  024545                        CMP     -(R5),-(R5)     ;SUB 4 FROM R5
4531  015746  010015                        MOV     R0,(R5)         ;R5 POINTS TO ADDRESS OF DEST DATA
4532  015750  010502                        MOV     R5,R2
4533  015752  010004                        MOV     R0,R4           ;R4 POINTS TO DEST DATA
4534  015754  005740                        TST     -(R0)
4535  015756  010003                        MOV     R0,R3           ;R3 POINTS TO SOURCE DATA
4536  015760  010042                        MOV     R0,-(R2)        ;R2 POINTS TO ADDRESS OF SOURCE DATA
4537  015762  005013                        CLR     (R3)            ;PRESET SOURCE DATA
4538  015764  005014                        CLR     (R4)            ;PRESET DEST DATA
4539
4540  015766  000277                        SCC
4541  015770  000244                        CLZ
4542  015772  163235                        SUB     @(R2)+,@(R5)+   ;(R3)=000000,(R4)=000000, CC=0100
4543  015774  103402                        BCS     SUB3
4544  015776  102401                        BVS     SUB3
4545  016000  001401                        BEQ     .+4
4546  016002  104000                SUB3:   HLT
4547
4548  016004  052752  100000              BIS     #100000,@-(R2)  ;(R3)=100000
4549  016010  062755  000001              ADD     #1,@-(R5)       ;(R4)=000001
4550  016014  163235                        SUB     @(R2)+,@(R5)+   ;(R3)=100000,(R4)=100001, CC=1011
4551  016016  103002                        BCC     SUB3A
4552  016020  102001                        BVC     SUB3A
4553  016022  100401                        BMI     .+4
4554  016024  104000                SUB3A:  HLT
4555
4556  016026  005414                        NEG     (R4)            ;(R4)=077777
4557  016030  035255                        BIT     @-(R2),@-(R5)   ;(R3)=100000,(R4)=077777
4558  016032  001401                        BEQ     .+4
4559  016034  104000                        HLT
4560  016036  023235                        CMP     @(R2)+,@(R5)+
4561  016040  102401                        BVS     .+4
4562  016042  104000                        HLT
4563  016044  005152                        COM     @-(R2)
4564  016046  000257                        CCC
4565  016050  063255                        ADD     @(R2)+,@-(R5)
4566  016052  102001                        BVC     ADD3
4567  016054  100401                        BMI     .+4
4568  016056  104000                ADD3:   HLT
4569  016060  000261                        SEC
4570  016062  045235                        BIC     @-(R2),@(R5)+   ;(R3)=077777,(R4)=100000
4571  016064  103001                        BCC     BIC3
4572  016066  100401                        BMI     .+4
4573  016070  104000                BIC3:   HLT
4574
4575  016072  005155                        COM     @-(R5)          ;(R4)=077777
4576  016074  023235                        CMP     @(R2)+,@(R5)+   ;(R3)=077777,(R4)=077777
4577  016076  001401                        BEQ     .+4
4578  016100  104000                        HLT
```

```
                                ;;*****************************************************************
                                ;*TEST 25       CHECK BINARY BYTE OPS USING ADDRESS MODES 3 & 5
                                ;;*****************************************************************
016102                          TST25:
                                        SCOPE
016102  000004
016104  112737  000025  001202          MOVB    #25,@#$TSTNM
016112  000406                          BR      1$              ;RESERVE SPACE FOR ADDRESS AND DATA
016114  000000                          .WORD   0               ;CONTAINS ADDRESS OF SOURCE DATA (EVEN BYTE)
016116  000000                          .WORD   0               ;CONTAINS ADDRESS OF SOURCE DATA (ODD BYTE)
016120  000000                          .WORD   0               ;CONTAINS ADDRESS OF DEST DATA (EVEN BYTE)
016122  000000                          .WORD   0               ;CONTAINS ADDRESS OF DEST DATA (ODD BYTE)
016124  000000                          .WORD   0               ;CONTAINS SOURCE DATA
016126  000000                          .WORD   0               ;CONTAINS DEST DATA

016130  010700                  1$:     MOV     PC,R0
016132  024040                          CMP     -(R0),-(R0)     ;R0=ADDRESS OF DEST DATA
016134  010003                          MOV     R0,R3           ;R3     "       "
016136  010305                          MOV     R3,R5           ;R5     "       "
016140  005743                          TST     -(R3)           ;SUB 2 FROM R3
016142  010043                          MOV     R0,-(R3)        ;R3 POINTS TO ADDRESS OF DEST DATA
016144  005213                          INC     (R3)            ;ODD BYTE
016146  010043                          MOV     R0,-(R3)        ;EVEN BYTE
016150  010304                          MOV     R3,R4
016152  005740                          TST     -(R0)           ;R0=ADDRESS OF SOURCE DATA
016154  010044                          MOV     R0,-(R4)        ;R4 POINTS TO ADDRESS OF SOURCE DATA
016156  005214                          INC     (R4)            ;ODD BYTE
016160  010044                          MOV     R0,-(R4)        ;EVEN BYTE

016162  000261                          SEC                     ;SET CARRY
016164  012734  177001                  MOV     #177001,@(R4)+
016170  112734  000200                  MOVB    #200,@(R4)+     ;SOURCE DATA=100001
016174  115433                          MOVB    @-(R4),@(R3)+
016176  115433                          MOVB    @-(R4),@(R3)+   ;DEST DATA=000600
016200  103401                          BCS     .+4
016202  104000                          HLT                     ;ERROR! MOV DOES AFFECT C BIT IN PSW
016204  022715  000600                  CMP     #600,(R5)       ;CHECK DEST DATA
016210  001401                          BEQ     .+4
016212  104000                          HLT                     ;ERROR! INCORRECT RESULT
016214  024343                          CMP     -(R3),-(R3)     ;POINT R4 BACK TO EVEN BYTE
016216  153433                          BISB    @(R4)+,@(R3)+
016220  153433                          BISB    @(R4)+,@(R3)+   ;DEST DATA=100601
016222  022715  100601                  CMP     #100601,(R5)    ;CHECK RESULT
016226  001401                          BEQ     .+4
016230  104000                          HLT                     ;ERROR! INCORRECT DEST DATA AFTER BISB
016232  145453                          BICB    @-(R4),@-(R3)
016234  145453                          BICB    @-(R4),@-(R3)
016236  133433                          BITB    @(R4)+,@(R3)+
016240  001002                          BNE     BITB3
016242  135433                          BITB    @-(R4),@(R3)+
016244  001001                          BNE     .+4
016246  104000                  BITB3:  HLT

016250  123453                          CMPB    @(R4)+,@-(R3)
016252  001002                          BNE     CMPB3
016254  123453                          CMPB    @(R4)+,@-(R3)
016256  001401                          BEQ     .+4
```

```
4635  016260  104000                    CMPB3:  HLT
4636                                    ;;*****************************************************************
4637                                    ;*TEST 26        CHECK BINARY OPS USING ADDRESS MODE 6
4638                                    ;;*****************************************************************
4639  016262                            TST26:
4640  016262  000004                            SCOPE
4641  016264  112737  000026  001202            MOVB    #26,@#$TSTNM
4642  016272  000402                            BR      .+6                     ;RESERVE TWO LOCATIONS
4643  016274  000000                    SDATA:  .WORD   0                       ;RESERVED FOR SOURCE DATA
4644  016276  000000                    DDATA:  .WORD   0                       ;RESERVED FOR DESTINATION DATA
4645
4646  016300  013702  001550                    MOV     @#FACTOR,R2             ;GET RELOCATION FACTOR AND USE AS AN
4647  016304  010205                            MOV     R2,R5                   ;INDEX VALUE TO POINT TO DATA
4648  016306  005065  016276                    CLR     DDATA(5)                ;PRESET DESTINATION DATA
4649  016312  012762  000001  016274            MOV     #1,SDATA(2)             ;THIS ROUTSINE PUT A 1 BIT INTO EVERY
4650  016320  056265  016274  016276  1$:       BIS     SDATA(2),DDATA(5)               ;OTHER BIT POSITION IN THE DEST-
4651  016326  006362  016274                    ASL     SDATA(2)                        ;INATION ADDRESS (52525)
4652  016332  006362  016274                    ASL     SDATA(2)
4653  016336  103370                            BCC     1$
4654  016340  022765  052525  016276           CMP     #52525,DDATA(5) ;CHECK RESULT
4655  016346  001401                            BEQ     .+4
4656  016350  104000                            HLT                             ;ERROR! INCORRECT RESULT
4657  016352  012762  177777  016274            MOV     #-1,SDATA(2)
4658  016360  046562  016276  016274            BIC     DDATA(5),SDATA(2)       ;SOURCE DATA=125252
4659  016366  036565  016274  016276            BIT     SDATA(2),DDATA(5)
4660  016374  001401                            BEQ     .+4
4661  016376  104000                            HLT                             ;ERROR! BIT INST FAILED
4662  016400  006365  016276                    ASL     DDATA(5)                ;DDATA=125252
4663  016404  026265  016274  016276           CMP     SDATA(2),DDATA(5)
4664  016412  001401                            BEQ     .+4
4665
4666  016414  104000                            HLT                             ;ERROR! CMP INST FAILED
4667  016416  000257                            CCC
4668  016420  066265  016274  016276           ADD     SDATA(2),DDATA(5)
4669  016426  103002                            BCC     ADD6
4670  016430  102001                            BVC     ADD6
4671  016432  100001                            BPL     .+4
4672  016434  104000                    ADD6:   HLT
4673
4674  016436  006362  016274                    ASL     SDATA(2)                ;SDATA=52524
4675  016442  166265  016274  016276           SUB     SDATA(2),DDATA(5)
4676  016450  103401                            BCS     SUB6
4677  016452  001401                            BEQ     .+4
4678  016454  104000                    SUB6:   HLT
4679
4680  016456  112700  000377                    MOVB    #377,R0                 ;R0=177777 (MOVB %R EXTENDS SIGN)
4681  016462  010062  016274                    MOV     R0,SDATA(2)
4682  016466  012765  177777  016276           MOV     #-1,DDATA(5)
4683  016474  166500  016276                    SUB     DDATA(5),R0
4684  016500  001401                            BEQ     .+4
4685  016502  104000                            HLT
4686  016504  066265  016274  016276  1$:       ADD     SDATA(2),DDATA(5)
4687  016512  006362  016274                    ASL     SDATA(2)
4688  016516  005162  016274                    COM     SDATA(2)
4689  016522  036265  016274  016276           BIT     SDATA(2),DDATA(5)
4690  016530  001401                            BEQ     .+4
```

```
4691  016532  104000                        HLT
4692  016534  005162  016274                COM     SDATA(2)
4693  016540  026265  016274  016276        CMP     SDATA(2),DDATA(5)
4694  016546  001401                        BEQ     .+4
4695  016550  104000                        HLT
4696  016552  026200  016274                CMP     SDATA(2),R0
4697  016556  001352                        BNE     1$
4698                                ;;*****************************************************************
4699                                ;*TEST 27       CHECK BINARY BYTE OPS USING ADDRESS MODE 6
4700                                ;;*****************************************************************
4701  016560                        TST27:
4702  016560  000004                        SCOPE
4703  016562  112737  000027  001202        MOVB    #27,@#$TSTNM
4704                                ;NOTE: SDATAB(2), AND DDATAB(4) REFERENCE EVEN BYTE OF SOURCE & DEST DATA
4705                                ;AND SDATAB(3), AND DDATAB(5) FEFERENCE ODD BYTE OF SOURCE & DEST DATA
4706
4707  016570  013702  001550                MOV     @#FACTOR,R2     ;GET INDEX VALUE
4708  016574  010204                        MOV     R2,R4           ;R2 FOR SOURCE EVEN BYTE INDEX, R4 FOR
4709  016576  010403                        MOV     R4,R3           ;DEST ODD BYTE, R3 FOR SOURCE EVEN
4710  016600  005203                        INC     R3              ;AND R5 FOR DEST ODD BYTE
4711  016602  010305                        MOV     R3,R5
4712  016604  000261                        SEC                             ;SET CARRY
4713  016606  012762  125252  016730        MOV     #125252,SDATAB(2)
4714  016614  112763  177125  016730        MOVB    #177125,SDATAB(3)       ;SOURCE DATA = 052652
4715  016622  016264  016730  016732        MOV     SDATAB(2),DDATAB(4)
4716  016630  052764  125125  016732        BIS     #125125,DDATAB(4)       ;DEST DATA = 177777
4717  016636  136263  016730  016730        BITB    SDATAB(2),SDATAB(3)
4718  016644  001401                        BEQ     .+4
4719  016646  104000                BITB6:  HLT
4720
4721  016650  146264  016730  016732        BICB    SDATAB(2),DDATAB(4)
4722  016656  103401                        BCS     .+4
4723  016660  104000                        HLT                     ;ERROR MOV,BIS,BIT;BIC DO NOT AFFECT 'C'
4724  016662  126364  016730  016732        CMPB    SDATAB(3),DDATAB(4)
4725  016670  001401                        BEQ     .+4
4726  016672  104000                        HLT
4727
4728  016674  146365  016730  016732        BICB    SDATAB(3),DDATAB(5)
4729  016700  126265  016730  016732        CMPB    SDATAB(2),DDATAB(5)
4730  016710  001401                        BEQ     .+4
4731  016712  104000                        HLT
4732
4733  016714  136564  016732  016732        BITB    DDATAB(5),DDATAB(4)
4734  016722  001401                        BEQ     .+4
4735  016724  104000                        HLT
4736  016726  000402                        BR      TST30           ;;SKIP TO NEXT TEST
4737  016730  000000                SDATAB: .WORD   0               ;RESERVED FOR SOURCE DATA
4738  016732  000000                DDATAB: .WORD   0               ;RESERVED FOR DEST DATA
4739
4740                                ;;*****************************************************************
4741                                ;*TEST 30       CHECK BINARY WORD OPS USING ADDRESS MODE 7
4742                                ;*      R2=ADDRESS OF SOURCE DATA, AND R3= ADDRESS OF DEST DATA
4743                                ;;*****************************************************************
4744  016734                        TST30:
4745  016734  000004                        SCOPE
4746  016736  112737  000030  001202        MOVB    #30,@#$TSTNM
```

```
4747  016744  000404                          BR      UB7             ;RESERVE FOUR WORDS
4748  016746  000000                  SBIN7:  .WORD   0               ;CONTAINS ADDRESS OF SOURCE DATA
4749  016750  000000                  DBIN7:  .WORD   0               ;CONTAINS ADDRESS OF DEST DATA
4750  016752  000000                          .WORD   0               ;CONTAINS SOURCE DATA
4751  016754  000000                          .WORD   0               ;CONTAINS DEST DATA
4752
4753  016756  010700                  UB7:    MOV     PC,R0
4754  016760  024040                          CMP     -(R0),-(R0)
4755  016762  010002                          MOV     R0,R2
4756  016764  024242                          CMP     -(R2),-(R2)
4757  016766  010012                          MOV     R0,(R2)
4758  016770  010203                          MOV     R2,R3
4759  016772  024043                          CMP     -(R0),-(R3)
4760  016774  010013                          MOV     R0,(R3)
4761
4762  016776  000261                          SEC
4763  017000  012777  100000  177740          MOV     #100000,@SBIN7  ;SOURCE DATA = 100000
4764  017006  017777  177734  177734          MOV     @SBIN7,@DBIN7   ;DEST DATA = 100000
4765  017014  103001                          BCC     MOV7
4766  017016  100401                          BMI     .+4
4767  017020  104000                  MOV7:   HLT
4768  017022  006377  177722                  ASL     @DBIN7          ;DEST DATA = 000000
4769  017026  102001                          BVC     .+4
4770  017030  001401                          BEQ     .+4
4771  017032  104000                          HLT
4772
4773  017034  027777  177706  177706          CMP     @SBIN7,@DBIN7   ;(R2)=100000,(R3)=000000
4774  017042  103402                          BCS     CMP7
4775  017044  102401                          BVS     CMP7
4776  017046  100401                          BMI     .+4
4777  017050  104000                  CMP7:   HLT
4778
4779  017052  167777  177670  177670          SUB     @SBIN7,@DBIN7   ;(R2)=100000,(R3)=100000
4780  017060  103003                          BCC     SUB7
4781  017062  102002                          BVC     SUB7
4782  017064  001401                          BEQ     SUB7
4783  017066  100401                          BMI     .+4
4784  017070  104000                  SUB7:   HLT
4785
4786  017072  006277  177650                  ASR     @SBIN7          ;(R2)=140000
4787  017076  067777  177644  177644          ADD     @SBIN7,@DBIN7   ;(R2)=140000,(R3)=040000
4788  017104  103003                          BCC     ADD7
4789  017106  102002                          BVC     ADD7
4790  017110  001401                          BEQ     ADD7
4791  017112  100001                          BPL     .+4
4792  017114  104000                  ADD7:   HLT
4793
4794  017116  047777  177624  177624          BIC     @SBIN7,@DBIN7   ;(R2)=140000,(R3)=000000
4795  017124  001401                          BEQ     .+4
4796  017126  104000                          HLT
4797
4798  017130  057777  177612  177612          BIS     @SBIN7,@DBIN7   ;(R2)=140000,(R3)=140000
4799  017136  100401                          BMI     .+4
4800  017140  104000                          HLT
4801
4802  017142  027777  177600  177600          CMP     @SBIN7,@DBIN7
```

```
4803  017150  001401                          BEQ     .+4
4804  017152  104000                          HLT
4805                                  ;;*****************************************************************
4806                                  ;*TEST 31        SOME MISCELLANEOUS OPERATIONS INVOLVING THE PC
4807                                  ;*      NOTE: NONE OF THESE OPERATIONS SHOULD AFFECT THE PC
4808                                  ;;*****************************************************************
4809  017154                          TST31:
4810  017154  000004                          SCOPE
4811  017156  112737  000031  001202          MOVB    #31,@#$TSTNM
4812  017164  005000                          CLR     R0
4813  017166  005067  000072                  CLR     1$
4814  017172  010707                          MOV     PC,PC
4815  017174  120707                          CMPB    PC,PC
4816  017176  030707                          BIT     PC,PC
4817  017200  060007                          ADD     R0,PC
4818  017202  105707                          TSTB    PC
4819  017204  005507                          ADC     PC
4820  017206  021007                          CMP     (R0),PC
4821  017210  131007                          BITB    (R0),PC
4822  017212  062707  000000                  ADD     #0,PC
4823  017216  023707  001550                  CMP     @#FACTOR,PC
4824  017222  133707  001550                  BITB    @#FACTOR,PC
4825  017226  000240                          NOP
4826                                  ;THE NEXT TWO INSTRUCTION CAUSE THE PROGRAM TO JUMP TO THE UNRELOCATED
4827                                  ;CODE AND TO RETURN ON THE FOLLOWING INST (IF THE CODE IS RELOCATED)
4828  017230  163707  001550                  SUB     @#FACTOR,PC     ;JUMPS TO UNRELOCATED CODE
4829  017234  063707  001550                  ADD     @#FACTOR,PC     ;RETURNS
4830  017240  000240                          NOP
4831  017242  024607                          CMP     -(SP),PC
4832  017244  132607                          BITB    (SP)+,PC
4833  017246  026707  000012                  CMP     1$,PC
4834  017252  166707  000006                  SUB     1$,PC
4835  017256  046707  000002                  BIC     1$,PC
4836  017262  000401                          BR      .+4             ;BRANCH OVER 1$
4837  017264  000000                  1$:     0
4838  017266  000004                  RELE2:  SCOPE
4839  017270  010702                          MOV     PC,R2
4840  017272  062702  000012                  ADD     #12,R2
4841  017276  012707  036574                  MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
4842  017302  000000                  REL22:  .WORD   0
4843                                  ;2222222222222 LAST ADDRESS OF CODE TO BE RELOCATED 22222222222
4844
4845                                  ;;*****************************************************************
4846                                  ;*TEST 32        CHECK BINARY BYTE OPS USING ADDRESS MODE 0
4847                                  ;;*****************************************************************
4848  017304                          TST32:
4849  017304  012767  000001  162012          MOV     #1,$TIMES       ;;DO 1 ITERATION
4850  017312  000004                          SCOPE
4851  017314  112737  000032  001202          MOVB    #32,@#$TSTNM
4852
4853                                          .SBTTL  START OF SECTION 3
4854                                  ;3333333333333 FIRST ADDRESS TO BE RELOCATED 333333333
4855  017322  112737  000032  001202  REL3:   MOVB    #$TN-1,@#$TSTNM
4856  017330  010700                          MOV     PC,R0           ;GET PC
4857  017332  005740                          TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL3
4858  017334  010037  001554                  MOV     R0,@#FRSTAD     ;SAVE
```

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4859  017340  010700                          MOV     PC,R0           ;GET CURRENT PC
4860  017342  162700  017342                  SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
4861  017346  010037  001550                  MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
4862  017352  010737  001212                  MOV     PC,@#SLPERR     ;SET LOOP ADDRESS
4863  017356  062737  000026  001212          ADD     #26,@#SLPERR    ;ADJUST
4864  017364  013737  001212  001210          MOV     @#SLPERR,@#SLPADR
4865  017372  105737  001544                  TSTB    @#NEXEC         ;BR IF TEST CODE TO BE EXECUTED
4866  017376  001402                          BEQ     .+6
4867  017400  000167  002230                  JMP     RELE3
4868  017404  012703  125252                  MOV     #125252,R3
4869  017410  010304                          MOV     R3,R4           ;R3=R4=125252
4870  017412  140304                          BICB    R3,R4           ;R3=125252,R4=125000
4871  017414  022704  125000                  CMP     #125000,R4      ;CHECK RESULT
4872  017420  001401                          BEQ     .+4
4873  017422  104000                          HLT
4874
4875  017424  005004                          CLR     R4              ;R3=125252,R4=0
4876  017426  150304                          BISB    R3,R4           ;R3=125252,R4=000252
4877  017430  022704  000252                  CMP     #252,R4         ;CHECK RESULT
4878  017434  001401                          BEQ     .+4
4879  017436  104000                          HLT
4880
4881  017440  110404                          MOVB    R4,R4           ;R4=177652
4882  017442  022704  177652                  CMP     #177652,R4      ;CHECK RESULT
4883  017446  001401                          BEQ     .+4
4884  017450  104000                          HLT
4885
4886  017452  132704  177525                  BITB    #177525,R4
4887  017456  001401                          BEQ     .+4
4888  017460  104000                          HLT
4889
4890  017462  105104                          COMB    R4              ;R4=177525
4891  017464  110404                          MOVB    R4,R4           ;R4=000125
4892  017466  022704  000125                  CMP     #125,R4         ;CHECK RESULT
4893  017472  001401                          BEQ     .+4
4894  017474  104000                          HLT
4895
4896  017476  150304                          BISB    R3,R4           ;R3=125252,R4=000377
4897  017500  105204                          INCB    R4
4898  017502  001401                          BEQ     .+4
4899  017504  104000                          HLT
4900                          ;;*****************************************************************
4901                          ;*TEST 33       CHECK BINARY BYTE OPS USING ADDRESS MODE 7
4902                          ;;*****************************************************************
4903  017506                  ST33:
4904  017506  000004                          SCOPE
4905  017510  112737  000033  001202          MOVB    #33,@#STSTNM
4906  017516  000406                          BR      BINB7           ;RESERVE SPACE FOR ADDRESSES & DATA
4907  017520  000000          SBINB7: .WORD   0               ;CONTAINS ADDRESS OF SOURCE EVEN BYTE
4908  017522  000000                  .WORD   0               ;CONTAINS ADDRESS OF SOURCE ODD BYTE
4909  017524  000000                  .WORD   0               ;CONTAINS ADDRESS OF DEST EVEN BYTE
4910  017526  000000                  .WORD   0               ;CONTAINS ADDRESS OF DEST ODD BYTE
4911  017530  000000          DBINB7: .WORD   0               ;CONTAINS SOURCE DATA
4912  017532  000000                  .WORD   0               ;CONTAINS DEST DATA
4913
4914  017534  010700          BINB7:  MOV     PC,R0
```

```
4915  017536  024040                          CMP     -(R0),-(R0)     ;R0 = ADDRESS OF DEST DATA
4916  017540  010060  177772                  MOV     R0,-6(R0)       ;LOAD ADDRES OF DEST EVEN BYTE DATA
4917  017544  010060  177774                  MOV     R0,-4(R0)
4918  017550  005260  177774                  INC     -4(R0)          ;LOAD ADDRESS OF DEST ODD BYTE DATA
4919  017554  005740                          TST     -(R0)           ;R0=ADDRESS OF SOURCE DATA
4920  017556  010060  177770                  MOV     R0,-10(R0)      ;LOAD ADDRESS OF SOURCE EVEN BYTE DATA
4921  017562  010060  177772                  MOV     R0,-6(R0)
4922  017566  005260  177772                  INC     -6(R0)          ;LOAD ADDRESS OF SOURCE ODD BYTE DATA
4923
4924  017572  005002                          CLR     R2              ;SET INDEX REGISTERS
4925  017574  012703  000002                  MOV     #2,R3           ;@SBINB7(2);@SBINB7(3) REFERENCE EVEN &
4926  017600  012704  177774                  MOV     #-4,R4          ;ODD BYTE SOURCE DATA; @DBINB7(4);@DBINB7(5)
4927  017604  012705  177776                  MOV     #-2,R5          ;REFERENCE DEST EVEN& ODD BYTE DATA
4928
4929
4930  017610  005020                          CLR     (R0)+           ;PRESET SOURCE DATA
4931  017612  005010                          CLR     (R0)            ;PRESET DEST DATA
4932  017614  013746  001550                  MOV     @#FACTOR,-(SP)  ;GET RELOCATION FACTOR
4933  017620  061602                          ADD     (SP),R2         ;AND ADD TO INDEX VALUES
4934  017622  061603                          ADD     (SP),R3
4935  017624  061604                          ADD     (SP),R4
4936  017626  062605                          ADD     (SP)+,R5
4937
4938  017630  112773  177777  017520          MOVB    #-1,@SBINB7(3)  ;SRC DATA = 177400
4939  017636  132772  000377  017520          BITB    #377,@SBINB7(2) ;CHECK THAT EVEN BYTE WAS NOT AFFECTED
4940  017644  001401                          BEQ     .+4             ;BY MOVB INSTRUCTION
4941  017646  104000                          HLT
4942
4943  017650  157374  017520  017530          BISB    @SBINB7(3),@DBINB7(4)
4944  017656  105274  017530                  INCB    @DBINB7(4)      ;CHECK THAT BIS SET ALL BITS
4945  017662  001401                          BEQ     .+4
4946  017664  104000                          HLT
4947
4948  017666  105375  017530                  DECB    @DBINB7(5)      ;DEST DATA = 177400
4949  017672  005274  017530                  INC     @DBINB7(4)      ;DEST DATA = 177401
4950  017676  127375  017520  017530          CMPB    @SBINB7(3),@DBINB7(5)
4951  017704  001401                          BEQ     .+4
4952  017706  104000                          HLT
4953
4954  017710  147375  017520  017530          BICB    @SBINB7(3),@DBINB7(5)
4955  017716  001401                          BEQ     .+4
4956  017720  104000                          HLT
4957
4958  017722  105073  017520                  CLRB    @SBINB7(3)      ;SRC DATA = 000000
4959                                ;THIS ROUTINE SETS ALL BITS IN THE SOURCE ODD BYTE BY BISING A BIT FROM
4960                                ;THE DEST EVEN BYTE INTO THE SOURCE ODD BYTE
4961  017726  157473  017530  017520  BIS7:   BISB    @DBINB7(4),@SBINB7(3)
4962  017734  106174  017530                  ROLB    @DBINB7(4)
4963  017740  103372                          BCC     BIS7
4964  017742  022772  177400  017520          CMP     #177400,@SBINB7(2)      ;CHECK RESULT
4965  017750  001401                          BEQ     .+4
4966  017752  104000                          HLT
4967
4968  017754  000372  017520                  SWAB    @SBINB7(2)      ;SRC DATA = 000377
4969  017760  112775  000200  017530          MOVB    #200,@DBINB7(5) ;DEST DATA = 100000
4970
```

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MAINDEC-11-D0KDC-A PDP 11/6X SERIES CPU EXERCISER      MACY11 27(1006)  07-FEB-77  10:08  PAGE 111
D0KDCA.P11    07-FEB-77 09:58          T33     CHECK BINARY BYTE OPS USING ADDRESS MODE 7

 4971  017766  147572  017530  017520  BIC7:   BICB    @DBINB7(5),@SBINB7(2)
 4972  017774  106075  017530                  RORB    @DBINB7(5)
 4973  020000  103372                          BCC     BIC7
 4974  020002  005772  017520                  TST     @SBINB7(2)
 4975  020006  001401                          BEQ     .+4
 4976  020010  104000                          HLT
 4977
 4978  020012  012702  000001          0AERR:  MOV     #1,R2           ;LOAD R2 WITH ODD #
 4979  020016  010703                          MOV     PC,R3
 4980  020020  000401                          BR      .+4             ;RESERVE SPACE FOR A WORD
 4981  020022  000000                          .WORD   0               ;WILL CONTAIN AN ODD ADDRESS
 4982  020024  005723                          TST     (R3)+           ;STEP R3 TO POINT TO WORD ABOVE
 4983  020026  010313                          MOV     R3,(R3)
 4984  020030  005213                          INC     (R3)            ;AND MAKE ODD
 4985  020032  012737  020160  000004          MOV     #1$,@#ERRVEC    ;SET ODD ADDRESS & RESERVED INSTRUCTION
 4986  020040  063737  001550  000004          ADD     @#FACTOR,@#ERRVEC
 4987  020046  013737  000004  000010          MOV     @#ERRVEC,@#RESVEC       ;TO TRAP TO 1$ BELOW
 4988
```

```
  4989  020054  000277                        SCC                     ;SET ALL CC'S
```

```
 4990  020056  160212                          SUB     R2,(R2)
 4991  020060  104000                          HLT
 4992  020062  060222                          ADD     R2,(R2)+
 4993  020064  104000                          HLT
 4994  020066  006342                          ASL     -(R2)
 4995  020070  104000                          HLT
 4996  020072  106512                          MFPD    (R2)
 4997  020074  104000                          HLT
 4998  020076  170412                          CLRF    (R2)
 4999  020100  104000                          HLT
 5000  020102  042202                          BIC     (R2)+,R2
 5001  020104  104000                          HLT
 5002  020106  164202                          SUB     -(R2),R2
 5003  020110  104000                          HLT
 5004  020112  155202                          BISB    @-(R2),R2
 5005  020114  104000                          HLT
 5006  020116  105532                          ADCB    @(R2)+
 5007  020120  104000                          HLT
 5008  020122  163302                          SUB     @(R3)+,R2
 5009  020124  104000                          HLT
 5010  020126  005733                          TST     @(R3)+
 5011  020130  104000                          HLT
 5012  020132  106533                          MFPD    @(R3)+
 5013  020134  104000                          HLT
 5014  020136  170453                          CLRD    @-(R3)
 5015  020140  104000                          HLT
 5016  020142  137702  177775                  BITB    @.+1,R2
 5017  020146  104000                          HLT
 5018  020150  105477  177773                  NEGB    @.-1
 5019  020154  104000                          HLT
 5020  020156  000406                          BR      2$
 5021
 5022  020160  062716  000002          1$:     ADD     #2,(SP)         ;ADJUST RETURN PC
 5023  020164  052766  000017  000002          BIS     #17,2(SP)       ;SET CONDITION CODES ON RETURN
 5024  020172  000002                          RTI
 5025
 5026  020174  012706  000700          2$:     MOV     #USESTK,SP      ;RESET STACK PTR
 5027  020200  012737  055064  000004          MOV     #ERPRT,@#ERRVEC ;RESET TIME OUT VECTOR
 5028  020206  012737  054774  000010          MOV     #RESERR,@#RESVEC
 5029                          ;;*****************************************************************
 5030                          ;TEST 34        CHECK JUMP INSTRUCTIONS
 5031                          ;;*****************************************************************
 5032  020214                  TST34:
 5033  020214  000004                          SCOPE
 5034  020216  112737  000034  001202          MOVB    #34,@#STSTNM
 5035  020224  010700                          MOV     PC,R0
 5036  020226  062700  000012                  ADD     #12,R0          ;SET ADDRESS FOR JMP INST
 5037  020232  000277                          SCC                     ;SET CC'S
 5038  020234  000110                          JMP     (R0)
 5039  020236  000402                          BR      .+6
 5040  020240  000250                          CLN                     ;JMP INST JUMPS HERE
 5041  020242  000775                          BR      .-4
 5042
 5043  020244  103003                          BCC     JMP1
 5044  020246  102002                          BVC     JMP1
 5045  020250  001001                          BNE     JMP1
```

```
5046  020252  100001                        BPL     .+4
5047  020254  104000              JMP1:     HLT                     ;ERROR! INCORRECT CC'S AFTER JMP
5048
5049  020256  005002                        CLR     R2              ;SET INDICATOR
5050  020260  010703                        MOV     PC,R3
5051  020262  000401                        BR      .+4             ;RESERVE WORD FOR JMP ADDRESS
5052  020264  000000                        .WORD   0               ;CONTAINS ADDRESS FOR JMP INST
5053  020266  005723                        TST     (R3)+
5054  020270  010313                        MOV     R3,(R3)
5055  020272  010300                        MOV     R3,R0
5056  020274  062713  000022                ADD     #22,(R3)        ;(R3) IS JMP ADDRESS
5057  020300  010300                        MOV     R3,R0
5058  020302  000133                        JMP     @(R3)+          ;JUMP TO ADDRESS CONTAINED IN R3
5059  020304  000402                        BR      .+6
5060  020306  005102                        COM     R2              ;COMPLEMENT INDICATOR
5061  020310  000775                        BR      .-4
5062  020312  005202                        INC     R2              ;CHECK INDICATOR
5063  020314  001003                        BNE     JMP3
5064  020316  005720                        TST     (R0)+
5065  020320  020003                        CMP     R0,R3           ;CHECK AUTO-INC R3
5066  020322  001401                        BEQ     .+4
5067  020324  104000              JMP3:     HLT
5068
5069  020326  005002                        CLR     R2              ;SET INDICATOR
5070  020330  010704                        MOV     PC,R4           ;SET UP JMP REGISTER
5071  020332  010400                        MOV     R4,R0           ;SET UP CHECK REGISTER
5072  020334  000402                        BR      1$
5073  020336  005102                        COM     R2              ;COMPLEMENT INDICATOR
5074  020340  000403                        BR      2$
5075  020342  022424              1$:       CMP     (R4)+,(R4)+
5076  020344  005724                        TST     (R4)+           ;R4=JMP ADDRESS
5077  020346  000144                        JMP     -(R4)           ;USE R4 AS ADDRESS
5078  020350  005202              2$:       INC     R2              ;CHECK INDICATOR
5079  020352  001003                        BNE     JMP4
5080  020354  022020                        CMP     (R0)+,(R0)+
5081  020356  020004                        CMP     R0,R4           ;CHECK AUTO-DEC R4
5082  020360  001401                        BEQ     .+4
5083  020362  104000              JMP4:     HLT
5084
5085  020364  010703                        MOV     PC,R3
5086  020366  000401                        BR      .+4             ;RESERVE WORD FOR JMP ADDRESS
5087  020370  020000              1$:       .WORD   0               ;CONTAINS JUMP ADDRESS
5088  020372  005723                        TST     (R3)+
5089  020374  010313                        MOV     R3,(R3)
5090  020376  062723  000016              ADD     #16,(R3)+
5091  020402  010300                        MOV     R3,R0           ;LOAD CHECK REGISTER
5092  020404  000402                        BR      3$
5093  020406  005102              2$:       COM     R2
5094  020410  000401                        BR      4$
5095  020412  000153              3$:       JMP     @-(R3)          ;JUMP TO 2$ VIA 1$ ABOVE
5096  020414  005202              4$:       INC     R2              ;CHECK INDICATOR
5097  020416  001003                        BNE     JMP5
5098  020420  005740                        TST     -(R0)
5099  020422  020003                        CMP     R0,R3           ;CHECK AUTO-DEC R3
5100  020424  001401                        BEQ     .+4
5101  020426  104000              JMP5:     HLT
```

```
5102
5103  020430  000402                        BR      2$
5104  020432  005102                1$:     COM     R2              ;COMPLEMENT INDICATOR
5105  020434  000402                        BR      3$
5106  020436  000167  177770        2$:     JMP     1$
5107  020442  005202                3$:     INC     R2
5108  020444  001401                        BEQ     .+4
5109  020446  104000                JMP6:   HLT
5110
5111  020450  012767  020466  000020        MOV     #1$,7$          ;SET UP JMP ADDRESS
5112  020456  063767  001550  000012        ADD     @#FACTOR,7$     ;ADD RELOCATION FACTOR
5113  020464  000402                        BR      2$              ;GO TO JMP  @7$ INST
5114  020466  005102                1$:     COM     R2              ;COMPLEMENT INDICATOR
5115  020470  000403                        BR      3$              ;GO TO CHECK ROUTINE
5116  020472  000177  000000        2$:     JMP     @7$             ;JMP TO 1$ ABOVE VIA 7$
5117  020476  000000                7$:     .WORD   0               ;CONTAINS JMP ADDRESS
5118  020500  005202                3$:     INC     R2              ;CHECK INDICATOR
5119  020502  001401                        BEQ     .+4
5120  020504  104000                JMP7:   HLT
5121                                ;;*****************************************************************
5122                                ;*TEST 35        CHECK JSR INSTRUCTIONS
5123                                ;;*****************************************************************
5124  020506                        TST35:
5125  020506  000004                        SCOPE
5126  020510  112737  000035  001202        MOVB    #35,@#$TSTNM
5127  020516  013705  001550        JSR1:   MOV     @#FACTOR,R5     ;GET RELOCATION FACTOR
5128  020522  012702  020554                MOV     #3$,R2          ;FORM DEST ADRS
5129  020526  060502                        ADD     R5,R2           ;ADD RELOCATION FACTOR
5130  020530  000277                        SCC                     ;PRESET CC'S
5131  020532  000242                        CLV
5132  020534  004512                        JSR     R5,(R2)         ;GO TO 3$ VIA R2
5133  020536  005702                1$:     TST     R2              ;CHECK INDICATOR
5134  020540  001017                        BNE     4$              ;R2 SHOULD=0
5135  020542  023705  001550                CMP     @#FACTOR,R5     ;CHECK THAT RTS  R5 RESTORED R5
5136  020546  001014                        BNE     4$
5137  020550  000414                        BR      JSR3            ;GO TO NEXT TEST
5138  020552  000205                2$:     RTS     R5              ;RETURN FROM SUBROUTINE
5139  020554  103011                3$:     BCC     4$              ;CHECK THAT JSR DID NOT
5140  020556  102410                        BVS     4$
5141  020560  001007                        BNE     4$              ;AFFECT CC'S
5142  020562  100006                        BPL     4$
5143  020564  005002                        CLR     R2              ;CLEAR INDICATOR
5144  020566  012704  020536                MOV     #1$,R4          ;GET UNRELOCATED RETURN ADDRESS
5145  020572  061604                        ADD     (SP),R4         ;ADD RELOCATION FACTOR (OLD R5)
5146  020574  020405                        CMP     R4,R5           ;CHECK THAT OLD R5 WAS PLACED ON THE
5147  020576  001765                        BEQ     2$              ;STACK,& THAT NEW R5 CONTAINS RETURN PC
5148  020600  104000                4$:     HLT                     ;ERROR! ABOVE
5149
5150                                ;CHECK JSR INSTRUCTION ADDRESS MODE 3
5151  020602  013704  001550        JSR3:   MOV     @#FACTOR,R4     ;GET RELOCATION FACTOR
5152  020606  005000                        CLR     R0              ;SET INDICATOR
5153  020610  012705  020630                MOV     #1$,R5
5154  020614  060405                        ADD     R4,R5           ;SET UP JSR DEFERRED ADRS
5155  020616  010502                        MOV     R5,R2
5156  020620  012715  020646                MOV     #5$,(R5)
5157  020624  060415                        ADD     R4,(R5)         ;(R5)=DEST ADRS
```

```
                                        BR      2$              ;RESERVE WORD FOR ADDRESS
                                1$:     .WORD   0               ;CONTAINS DEST ADRS FOR JSR
                                2$:     JSR     R4,@(R5)+       ;JSR TO 5$ VIA 1$ ABOVE
                                3$:     INC     R0              ;CHECK INDICATOR
                                        BNE     6$
                                        BR      JSR4
                                4$:     COM     R0              ;COMPLEMENT INDICATOR
                                        RTS     4               ;RETURN FROM SUBROUTINE
020634                          5$:     MOV     #3$,R3          ;GET UNRELOCATED RETURN ADDRESS
                                        ADD     (SP),R3         ;ADD RELOCATION FACTOR (OLD R4)
                                        CMP     R4,R3
                                        BNE     6$
                                        TST     (R2)+
                                        CMP     R2,R5           ;CHECK AUTO-INC R5
                                        BEQ     4$              ;GO TO RTS
                                6$:     HLT                     ;ERROR ABOVE

                                ;CHECK JSR INST ADDRESS MODE 4
001550                          JSR4:   MOV     @#FACTOR,R4
                                        MOV     R4,R5
                                        MOV     PC,R3
                                        BR      2$
                                1$:     BR      4$
                                2$:     CMP     (R3)+,(R3)+
                                        SCC
                                        JSR     R4,-(R3)        ;GO TO 2$
                                3$:     HLT
                                        BR      JSR6            ;GO TO NEXT TEST
                                4$:     BCC     5$
                                        BVC     5$
                                        BNE     5$
                                        BPL     5$
020712                                  MOV     #3$,R2          ;GET UNRELOCATED RETURN ADDRESS
                                        ADD     (SP),R2         ;ADD RELOCATION FACTOR (OLD R4)
                                        CMP     R2,R4           ;CHECK THAT CALCULATED RETURN
                                        BNE     5$              ;PC = NEW R4
                                        TST     (R4)+
                                        RTS     R4
                                5$:     HLT

                                ;TEST JSR INST ADDRESS MODE 6
                                JSR6:   BR      2$
                                1$:     BR      3$
                                2$:     MOV     PC,R0
177770                                  JSR     PC,1$
                                        BMI     JSR7            ;GO TO NEXT TEST
                                        HLT                     ;ERROR ON CC'S
                                3$:     CMP     (R0)+,(R0)+
                                        CMP     R0,(SP)         ;CHECK THAT RETURN ADDRESS IS ON THE
                                        BEQ     .+4             ;STACK
                                        HLT
                                        SEN                     ;SET N
                                        RTS     PC

                                ;TEST JSR INST ADDRESS MODE 7
001550                          JSR7:   MOV     @#FACTOR,-(SP)  ;GET RELOCATION FACTOR
```

```
5214  021004  062716  021024            ADD     #1$,(SP)        ;FORM ADDRESS OF 1$ BELOW
5215  021010  000277                    SCC                     ;SET ALL CC'S
5216  021012  004076  000000            JSR     R0,@(SP)        ;JSR TO 1$
5217  021016  003003                    BGT     3$
5218  021020  102002                    BVC     3$
5219  021022  000402                    BR      4$
5220
5221  021024  000200            1$:     RTS     R0              ;RETURN
5222  021026  104000            3$:     HLT                     ;ERROR!! INCORRECT CC'S
5223  021030                    4$:
5224                            ;;**************************************************************
5225                            ;*TEST 36       CHECK IOT TRAP (AND ROLB/ASLB)
5226                            ;*      THIS TEST CHECKS THAT THE PSW IS CORRECT AFTER THE IOT AND THAT THE
5227                            ;*      'NEW'PSW (FROM IOTVEC+2) IS CORRECT.
5228                            ;;**************************************************************
5229  021030                    TST36:
5230  021030  000004                    SCOPE
5231  021032  112737  000036  001202    MOVB    #36,@#$TSTNM
5232  021040  012705  000022    IOTTST: MOV     #IOTVEC+2,R5
5233  021044  005000                    CLR     R0
5234  021046  052740  000200            BIS     #PR4,-(R0)              ;SET PRIORITY LEVEL 4 IN PSW
5235  021052  011015                    MOV     (R0),(R5)               ;SET IOTVEC+2 = PSW
5236  021054  011504                    MOV     (R5),R4                 ;SAVE IN R4
5237  021056  010746                    MOV     PC,-(SP)
5238  021060  062716  000036            ADD     #1$-.,(SP)
5239  021064  012645                    MOV     (SP)+,-(R5)             ;LOAD IOT TRAP VECTOR
5240  021066  042710  000357            BIC     #PR7+17,(R0)
5241  021072  052710  000244            BIS     #PR5+4,(R0)             ;PSW=X XXX X00 101 1XX 000
5242  021076  012003                    MOV     (R0)+,R3                ;R3 = PSW ABOVE
5243  021100  010340                    MOV     R3,-(R0)                ;RESTORE PSW (MOV CHANGED IT)
5244  021102  000004                    IOT
5245  021104  012737  046720  000020  10$:     MOV     #$SCOPE,@#IOTVEC        ;RESTORE IOT VECTOR
5246  021112  104000                    HLT                             ;ERROR! IOT FAILED TO TRAP
5247  021114  000447                    BR      TST37           ;;GO TO NEXT TEST
5248
5249  021116  012002            1$:     MOV     (R0)+,R2                ;GET PSW AFTER IOT TRAP
5250                                                                    ;NOTE: R0=0
5251  021120  012725  046720            MOV     #$SCOPE,(R5)+           ;RESTORE IOTVEC
5252  021124  012715  000200            MOV     #PR4,(R5)               ;AND IOTVEC+2
5253  021130  010746                    MOV     PC,-(SP)                ;FORM PC OF 10$ ABOVE
5254  021132  062716  177752            ADD     #10$-.,(SP)
5255  021136  022626                    CMP     (SP)+,(SP)+             ;CHECK RETURN PC ON STACK
5256  021140  001026                    BNE     99$
5257  021142  022603                    CMP     (SP)+,R3                ;CHECK SAVED PSW
5258  021144  001024                    BNE     99$
5259  021146  032703  140000            BIT     #UM,R3                  ;BRANCH TO 3$ IF IN USER MODE
5260  021152  100403                    BMI     3$
5261  021154  020204                    CMP     R2,R4                   ;CHECK PSW AFTER IOT
5262  021156  001017                    BNE     99$
5263  021160  000404                    BR      4$
5264
5265
5266  021162  052704  030000    3$:     BIS     #PUM,R4                 ;SET PREV USER MODE
5267  021166  020204                    CMP     R2,R4                   ;CHECK PSW AFTER IOT
5268  021170  001012                    BNE     99$
5269
```

```
5270  021172  005002                  4$:     CLR     R2
5271  021174  000261                          SEC
5272  021176  106100                          ROLB    R0                      ;ROTATE R0
5273  021200  102376                          BVC     .-2                     ;UNTIL V SETS (R0=200)
5274
5275  021202  106300                          ASLB    R0                      ;SHIFT SHOULD SET CARRY
5276  021204  103004                          BCC     99$
5277  021206  102003                          BVC     99$
5278  021210  001002                          BNE     99$
5279  021212  005700                          TST     R0
5280  021214  001401                          BEQ     .+4
5281  021216  104000                  99$:    HLT                             ;ERROR! ROL/ASL FAILED TO SET
5282                                                                          ;CC'S PROPERLY (IF R2=0) OR IN-
5283                                                                          ;CORRECT PSW AFTER IOT (IF R2 NOT 0)
5284  021220  042704  000340                  BIC     #PR7,R4
5285  021224  010437  177776                  MOV     R4,@#PSW                ;RESTORE PSW
5286  021230  012706  000700                  MOV     #USESTK,SP              ;RESTORE STACK PTR
5287                                  ;;**********************************************************************
5288                                  ;*TEST 37        CHECK EMT TRAP SEQUENCE
5289                                  ;;**********************************************************************
5290  021234                          TST37:
5291  021234  000004                          SCOPE
5292  021236  112737  000037  001202          MOVB    #37,@#$TSTNM
5293                                          .EQUIV  IOT,HLT                 ;REDEFINE IOT CALL
5294  021244  012737  047160  000020          MOV     #$ERROR,@#IOTVEC        ;SETUP VECTOR
5295  021252  012737  000340  000022          MOV     #PR7,@#IOTVEC+2
5296  021260  005000                          CLR     R0
5297  021262  010746                          MOV     PC,-(SP)
5298  021264  062716  000030                  ADD     #EMT1-.,(SP)
5299  021270  012637  000030                  MOV     (SP)+,@#EMTVEC
5300  021274  000262                          SEV                             ;SET V
5301  021276  013737  177776  000032          MOV     @#PSW,@#EMTVEC+2        ;RETAIN CURRENT PSW ON TRAP
5302  021304  000265                          +SEZ!SEC
5303  021306  104000                          EMT                             ;TRAP TO EMT1
5304  021310  001433                          BEQ     EMT1C                   ;GO TO EMT1C
5305  021312  000004                          HLT                             ;ERROR! INCORRECT CC'S WERE SET ON RETURN
5306  021314  102027                  EMT1:   BVC     EMT1B                   ;'V' SHOULD'VE SET ON EMT TRAP
5307  021316  105100                          COMB    R0                      ;R0=000377,CC'S=1001
5308  021320  105500                          ADCB    R0                      ;R0=000000,CC'S=0101
5309  021322  106000                          RORB    R0                      ;R0=000200,CC'S=1010
5310  021324  102023                          BVC     EMT1B
5311  021326  100022                          BPL     EMT1B
5312  021330  000257                          CCC
5313  021332  105400                          NEGB    R0                      ;R0=000200,CC'S=1010
5314  021334  102017                          BVC     EMT1B
5315  021336  100016                          BPL     EMT1B
5316  021340  000242                          CLV                             ;CLEAR 'V'
5317  021342  000261                          SEC                             ;AND SET 'C'
5318  021344  105300                          DECB    R0                      ;R0=000177,CC'S=0011
5319  021346  102012                          BVC     EMT1B
5320  021350  100411                          BMI     EMT1B
5321  021352  000242                          CLV                             ;CLEAR 'V'
5322  021354  105200                          INCB    R0                      ;R0=000200,CC'S=1011
5323  021356  103006                          BCC     EMT1B
5324  021360  102005                          BVC     EMT1B
5325  021362  100004                          BPL     EMT1B
```

```
5326  021364  000242                        CLV                     ;CLEAR 'V'
5327  021366  106200                        ASRB    R0              ;SHIFT R0 UNTIL 'V' CLEARS
5328  021370  102776                        BVS     .-2
5329  021372  000401                        BR      .+4
5330  021374  000004              EMT1B:    HLT                     ;ERROR!
5331  021376  000002                        RTI                     ;EXIT WITH R0=000377
5332  021400  105500              EMT1C:    ADCB    R0              ;R0=000000
5333  021402  103003                        BCC     EMT1D
5334  021404  001002                        BNE     EMT1D
5335  021406  005700                        TST     R0
5336  021410  001401                        BEQ     .+4
5337  021412  000004              EMT1D:    HLT
5338  021414  012737  047160  000030        MOV     #$ERROR,@#EMTVEC        ;RESTORE EMT TO ERROR
5339  021422  012737  000340  000032        MOV     #PR7,@#EMTVEC+2         ;SET PRIORITY 7 ON ERROR
5340  021430  012737  046720  000020        MOV     #$SCOPE,@#IOTVEC        ;RESTORE IOT VECTOR
5341  021436  005037  000022                CLR     @#IOTVEC+2
5342                                        .EQUIV  ERROR,HLT               ;REDEFINE HLT CALL
5343                                ;;**************************************************************
5344                                ;*TEST 40        CHECK TRAP INSTRUCTION TRAP SEQUENCE
5345                                ;;**************************************************************
5346  021442                        T$T40:
5347  021442  000004                        SCOPE
5348  021444  112737  000040  001202        MOVB    #40,@#$TSTNM
5349  021452  052737  000340  177776        BIS     #PR7,@#PSW              ;LOCK OUT LINE CLOCK
5350  021460  052737  000340  000016        BIS     #PR7,@#TBITVEC+2
5351  021466  010746                        MOV     PC,-(SP)
5352  021470  062716  000056                ADD     #TRAP1-.,(SP)
5353  021474  012637  000034                MOV     (SP)+,@#TRAPVEC
5354  021500  000270                        SEN                             ;SET N
5355  021502  013737  177776  000036        MOV     @#PSW,@#TRAPVEC+2       ;RETAIN CURRENT PSW ON TRAP
5356  021510  000261                        SEC                             ;SET CARRY
5357  021512  010700                        MOV     PC,R0
5358  021514  000264                        SEZ                     ;SET Z BIT
5359  021516  104400                        TRAP                    ;TRAP TO TRAP1
5360  021520  103404                        BCS     .+12
5361  021522  012737  053566  000034        MOV     #$TRAP,@#TRAPVEC        ;RESTORE TRAP VECTOR
5362  021530  104000                        HLT
5363  021532  001404                        BEQ     .+12
5364  021534  012737  053566  000034        MOV     #$TRAP,@#TRAPVEC        ;RESTORE TRAP VECTOR
5365  021542  104000                        HLT
5366  021544  000420                        BR      TRAP1C
5367  021546  100404              TRAP1:    BMI     .+12            ;N BIT GOT SET ON TRAP
5368  021550  012737  053566  000034        MOV     #$TRAP,@#TRAPVEC        ;RESTORE TRAP VECTOR
5369  021556  104000                        HLT
5370  021560  062700  000004                ADD     #4,R0
5371  021564  020016                        CMP     R0,(SP)         ;CHECK LOW BYTE OF RETURN PC ON
5372  021566  001404                        BEQ     .+12            ;STACK
5373  021570  012737  053566  000034        MOV     #$TRAP,@#TRAPVEC        ;RESTORE TRAP VECTOR
5374  021576  104000                        HLT
5375  021600  124646                        CMPB    -(SP),-(SP)
5376  021602  032626                        BIT     (SP)+,(SP)+
5377  021604  000002                        RTI                     ;RETURN TO INST FOLLOWING TRAP (1$)
5378
5379  021606  012702  000036      TRAP1C:   MOV     #TRAPVEC+2,R2           ;RESTORE VECTORS
5380  021612  012712  000340                MOV     #PR7,(R2)
5381  021616  012742  053566                MOV     #$TRAP,-(R2)
```

```
5382  021622  042737  000340  000016          BIC     #PR7,@#TBITVEC+2
5383  021630  105037  177776                  CLRB    @#PSW                   ;GO BACK TO PRIORITY 0
5384
5385  021634  000004                  RELE3:  SCOPE
5386  021636  010702                          MOV     PC,R2
5387  021640  062702  000012                  ADD     #12,R2
5388  021644  012707  036574                  MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
5389  021650  000000                  REL33:  .WORD   0
5390                                  ;3333333333333 LAST ADDRESS OF CODE TO BE RELOCATED 33333333333
5391
5392                                  ;;*****************************************************************
5393                                  ;*TEST 41        CHECK STACK OVERFLOW
5394                                  ;;*****************************************************************
5395  021652                          TST41:
5396  021652  012767  000001  157444          MOV     #1,$TIMES       ;;DO 1 ITERATION
5397  021660  000004                          SCOPE
5398  021662  112737  000041  001202          MOVB    #41,@#$TSTNM
5399
5400                                          .SBTTL  START OF SECTION 4
5401                                  ;444444444444 FIRST ADDRESS TO BE RELOCATED 444444444
5402  021670  112737  000041  001202  REL4:   MOVB    #$TN-1,@#$TSTNM
5403  021676  010700                          MOV     PC,R0                   ;GET PC
5404  021700  005740                          TST     -(R0)                   ;R0 CONTAINS THE ADDRESS OF REL4
5405  021702  010037  001554                  MOV     R0,@#FRSTAD             ;SAVE
5406  021706  010700                          MOV     PC,R0                   ;GET CURRENT PC
5407  021710  162700  021710                  SUB     #.,R0                   ;SUBTRACT RELOCATION FACTOR
5408  021714  010037  001550                  MOV     R0,@#FACTOR             ;SAVE RELOCATION FACTOR
5409  021720  010737  001212                  MOV     PC,@#$LPERR             ;SET LOOP ADDRESS
5410  021724  062737  000026  001212          ADD     #26,@#$LPERR            ;ADJUST
5411  021732  013737  001212  001210          MOV     @#$LPERR,@#$LPADR
5412  021740  105737  001544                  TSTB    @#NEXEC                 ;BR IF TEST CODE TO BE EXECUTED
5413  021744  001402                          BEQ     .+6
5414  021746  000167  001326                  JMP     RELE4
5415
5416  021752  013767  177776  000330  OVFLW:  MOV     @#PSW,7$                ;SAVE STATUS IN 7$ BELOW
5417  021760  005037  177776                  CLR     @#PSW                   ;SET KERNEL MODE
5418  021764  004737  054112                  JSR     PC,@#CLRTBIT            ;GO CLEAR 'T' BIT IF SET
5419  021770  052737  000340  177776          BIS     #PR7,@#PSW              ;SET PRIORITY LEVEL 7 TO BLOCK CLOCK
5420  021776  010746                          MOV     PC,-(SP)                ;PUSH CURRENT PC ONTO STACK
5421  022000  062716  000146                  ADD     #2$-.,(SP)              ;FORM ADDRESS OF 2$ BELOW
5422  022004  011637  000004                  MOV     (SP),@#ERRVEC           ;SET ERROR VECTOR
5423  022010  012737  000340  000006          MOV     #340,@#ERRVEC+2         ;SET PRIORITY LEVEL 7 ON TRAP
5424  022016  013727  000014                  MOV     @#BPTVEC,(PC)+          ;SAVE BPT VECTOR ADRS
5425  022022  000000                  43$:    .WORD   0
5426  022024  062716  000100                  ADD     #41$-2$,(SP)            ;FORM ADDRESS OF 41$ BELOW
5427  022030  012637  000014                  MOV     (SP)+,@#BPTVEC          ;SET BPT TRAP VECTOR TO 41$
5428  022034  012737  000340  000016          MOV     #340,@#RPTVEC+2
5429
5430  022042  012703  000376                  MOV     #376,R3
5431  022046  010313                          MOV     R3,(R3)                 ;LOAD 376 INTO ADDRESS 376
5432  022050  010306                          MOV     R3,SP                   ;SET STACK PTR AT BOUNDARY
5433  022052  032767  140000  000230          BIT     #UM,7$                  ;CHECK IF ENTERED TEST IN KERNEL
5434  022060  001015                          BNE     1$                      ;MODE. BRANCH IF NOT IN KERNEL
5435
5436                                  ;THE BELOW INSTRUCTIONS SHOULD NOT CAUSE AN OVERFLOW TRAP
5437  022062  005716                          TST     (SP)                    ;BECAUSE TST IS A NON MODIFYING INST
```

```
5438  022064  021666  177776                  CMP     (SP),-2(SP)     ;SO IS COMPARE
5439  022070  012656                          MOV     (SP)+,@-(SP)    ;BECAUSE OF ADDRESS MODE 5
5440  022072  057636  000000                  BIS     @(SP),@(SP)+    ;BECAUSE OF ADDRESS MODE 3
5441  022076  054676  000000                  BIS     -(SP),@(SP)     ;BECAUSE OF ADDRESS MODE 7
5442  022102  005006                          CLR     SP
5443  022104  013766  020000  020000          MOV     @#20000,20000(SP)
5444  022112  000423                          BR      3$              ;BRANCH OVER NON KERNEL MODE TESTS
5445
5446                                  ;NOTE:  NO OVERFLOW TRAP WILL OCCUR IF NOT IN KERNEL MODE!!!
5447  022114  156737  000171  177777  1$:     BISB    7$+1,@#PSW+1    ;RESTORE MODE BITS IN PSW
5448  022122  012706  000376                  MOV     #376,SP         ;SET STACK PTR
5449  022126  016646  177776                  MOV     -2(SP),-(SP)    ;SHOULD NOT TRAP
5450  022132  051616                          BIS     (SP),(SP)
5451  022134  061666  177776                  ADD     (SP),-2(SP)
5452  022140  105037  177777                  CLRB    @#PSW+1         ;SET KERNEL MODE
5453  022144  000451                          BR      6$              ;EXIT TEST
5454
5455                                  ;ERROR SERVICE ROUTINE
5456  022146  012600                  2$:     MOV     (SP)+,R0        ;SAVE PC OF INSTRUCTION THAT TRAPPED
5457  022150  012602                          MOV     (SP)+,R2        ;SAVE PSW
5458  022152  012706  000700                  MOV     #USESTK,SP      ;SET STACK PTR
5459  022156  104000                          HLT                     ;ERROR! AN INSTRUCTION THAT WAS NOT
5460                                                                  ;SUPPOESED TO TRAP TRAPPED
5461                                                                  ;R0 CONTAINS PC, R2 CONTAINS PSW
5462  022160  000443                          BR      6$              ;EXIT TEST
5463                                  ;THE BELOW INSTRUCTIONS WILL CAUSE A STACK OVERFLOW
5464                                  ;STACK PTR IS AT 376
5465  022162  062737  000066  000004  3$:     ADD     #4$-2$,@#ERRVEC ;SET ERROR VECTOR TO 4$
5466  022170  010306                          MOV     R3,SP           ;SET STACK PTR AT 376
5467  022172  112702  000001                  MOVB    #1,R2
5468  022176  005000                          CLR     R0
5469  022200  005016                          CLR     (SP)            ;SETS BIT 0 IN R0
5470  022202  006302                          ASL     R2              ;SHIFT INDICATOR BIT
5471  022204  105226                          INCB    (SP)+           ;SETS BIT 1 IN R0
5472  022206  006302                          ASL     R2
5473  022210  060746                          ADD     PC,-(SP)        ;SETS BIT 2 IN R0
5474  022212  006302                          ASL     R2
5475  022214  000003                          BPT                     ;SETS BIT 3 IN R0
5476  022216  006302                          ASL     R2
5477  022220  004767  000014                  JSR     PC,40$          ;SETS BIT 4 IN R0
5478  022224  006302                          ASL     R2
5479  022226  050666  177776                  BIS     SP,-2(SP)       ;SETS BIT 5 IN R0
5480  022232  000410                          BR      5$
5481
5482                                  ;PROGRAM WILL TRAP HERE ON OVERFLOW TRAP
5483  022234  050200                  4$:     BIS     R2,R0           ;SET APPROPRIATE BIT IN R0
5484  022236  000002                          RTI                     ;RETURN FROM TRAP
5485
5486  022240  052700  001000          40$:    BIS     #1000,R0                ;SET IND THAT JSR WAS EXECUTED
5487  022244  000207                          RTS     PC
5488
5489  022246  052700  000400          41$:    BIS     #400,R0                 ;SET IND THAT BPT WAS EXECUTED
5490  022252  000002                          RTI
5491
5492                                  ;CHECK THAT ABOVE INSRUCTIONS DID TRAP
5493  022254  012706  000700          5$:     MOV     #USESTK,SP      ;SET STACK PTR
```

```
5494  022260  022700  001477          CMP     #1477,R0        ;EACH INSTRUCTION SET A BIT IN R0
5495  022264  001401                  BEQ     .+4             ;R0= 1477
5496  022266  104000                  HLT
5497
5498                                  ;EXIT ROUTINE
5499  022270  012706  001200  6$:     MOV     #KERSTK,SP      ;SET KERNEL STACK PTR
5500  022274  016737  177522  000014  MOV     43$,@#BPTVEC    ;RESTORE BPT VECTOR
5501  022302  005037  000016          CLR     @#BPTVEC+2
5502  022306  012746                  MOV     (PC)+,-(SP)     ;PUSH OLD PSW ONTO STACK
5503  022310  000000          7$:     .WORD   0               ;CONTAINS SAVED PSW
5504  022312  010746                  MOV     PC,-(SP)        ;PUSH CURRENT PC ONTO STACK
5505  022314  062716  000006          ADD     #6,(SP)         ;ADD OFFSET
5506  022320  000002                  RTI
5507  022322  012706  000700          MOV     #USESTK,SP      ;SET STACK PTR
5508  022326  012737  055064  000004  MOV     #ERPRT,@#ERRVEC ;RESET TIME OUT VECTOR
5509  022334  013737  177776  000006  MOV     @#PSW,@#ERRVEC+2
5510  022342  052737  000340  000006  BIS     #PR7,@#ERRVEC+2
5511                                  ;;*****************************************************************
5512                                  ;*TEST 42        CHECK THAT ALL RESERVED INSTRUCTIONS TRAP
5513                                  ;;*****************************************************************
5514  022350                  1ST42:
5515  022350  000004                  SCOPE
5516  022352  112737  000042  001202  MOVB    #42,@#$TSTNM
5517  022360  012702  022450  RESTRP: MOV     #5$,R2          ;GET ADDRESS OF RESERVED INSTRUCTION TABLE
5518  022364  063702  001550          ADD     @#FACTOR,R2
5519  022370  012737  022426  000010  MOV     #4$,@#RESVEC    ;SET RESERVED INSTRUCTION TRAP
5520  022376  063737  001550  000010  ADD     @#FACTOR,@#RESVEC
5521  022404  012203          1$:     MOV     (R2)+,R3        ;GET FIRST RESERVED INSTRUCTION
5522  022406  001437                  BEQ     7$              ;0 TERMINATES THE TABLE
5523  022410  012204                  MOV     (R2)+,R4        ;GET LAST RESERVED INSTRUCTION IN GROUP
5524  022412  010317          2$:     MOV     R3,(PC)         ;EXECUTE RESERVED INSTRUCTION
5525  022414  000000          3$:     .WORD   0               ;CONTAINS RESERVED INSTRUCTION
5526  022416  104000                  HLT                     ;ERROR! INSTRUCTION IN R3
5527  022420  104000                  HLT                     ;(2$) ABOVE FAILED TO CAUSE A
5528  022422  104000                  HLT                     ;RESERVED INSTRUCTION TRAP
5529  022424  000405                  BR      41$
5530  022426  012716  022440  4$:     MOV     #41$,(SP)       ;ADJUST RETURN PC
5531  022432  063716  001550          ADD     @#FACTOR,(SP)   ;TO RETURN TO 41$
5532  022436  000002                  RTI                     ;RETURN TO 41$
5533  022440  020304          41$:    CMP     R3,R4           ;HAS GROUP OF RESERVED INSTRUCTIONS
5534  022442  001760                  BEQ     1$              ;BEEN EXECUTED
5535  022444  005203                  INC     R3              ;INCREMENT THIS RESERVED INSTRUCTION
5536  022446  000761                  BR      2$              ;TO NEXT ONE AND EXECUTE
5537                                  ;TABLE OF 11/6X RESERVED INSTRUCTIONS (0 TERMINATES THE TABLE)
5538  022450  000007          5$:     7                       ;GROUP 1
5539  022452  000077                  77                      ;  "
5540  022454  000210                  210                     ;GROUP 2
5541  022456  000237                  237                     ;  "
5542  022460  007000                  7000                    ;GROUP 3
5543  022462  007777                  7777                    ;  "
5544  022464  075040                  75040                   ;GROUP 4
5545  022466  076577                  76577                   ;  "
5546                                                          ;MED INST. = 076600
5547  022470  076601                  76601                   ;GROUP 5
5548  022472  076677                  76677                   ;  "
5549                                                          ;XFC INSTS. = 0767XX
```

```
                                                        ;(76700-76777)
022474  106400                          106400          ;GROUP 6
022476  106477                          106477          ;   "
022500  106700                          106700          ;GROUP 7
022502  107777                          107777          ;   "
022504  000000                          0               ;0 TERMINATES THE TABLE

022506  012737  054774  000010  7$:     MOV     #RESERR,@#RESVEC        ;RESTORE RESERVED TRAP
                        ;;*************************************************************
                        ;*TEST 43       CHECK THAT ALL BITS IN THE PSW CAN BE SET AND CLEARED
                        ;;*************************************************************
022514                  TST43:
022514  000004                  SCOPE
022516  112737  000043  001202          MOVB    #43,@#$TSTNM
022524  105737  001545          PSWCHK: TSTB    @#MMON          ;IF MEM MGMT IS ON SKIP THIS TEST
022530  001103                  BNE     4$
022532  013767  177776  000166          MOV     @#PSW,3$        ;SAVE STATUS
022540  005037  177776                  CLR     @#PSW           ;CLEAR MODE BITS IN PSW
022544  004737  054112                  JSR     PC,@#CLRTBIT    ;GO CLEAR 'T' BIT IF SET
022550  013746  000016                  MOV     @#TBITVEC+2,-(SP)
022554  012704  177776                  MOV     #PSW,R4         ;LOAD ADDRESS OF PSW INTO R4
022560  000250                          CLN
022562  005714                          TST     (R4)            ;CHECK THAT PSW WAS CLEARED
022564  001401                          BEQ     .+4
022566  104000                          HLT                     ;ERROR! PSW FAILED TO CLEAR
022570  012700  170357                  MOV     #170357,R0
022574  052700  170000                  BIS     #170000,R0      ;SET BITS 15-12 IF MEM MGMT
022600  012702  000001          10$:    MOV     #1,R2           ;R2 = TEST BIT
022604  030200                  1$:     BIT     R2,R0           ;CHECK IF BIT CAN BE SET/CLEARED
022606  001423                          BEQ     2$
022610  005037  000016                  CLR     @#TBITVEC+2
022614  030227  000020                  BIT     R2,#20          ;CHECK IF TEST WILL SET 'T' BIT
022620  001403                          BEQ     20$
022622  012737  000002  000016          MOV     #RTI,@#TBITVEC+2;SET RTI INTO RETURN
022630  005014                  20$:    CLR     (R4)            ;CLEAR PSW
022632  050214                          BIS     R2,(R4)         ;SET R2 INTO PSW
022634  011403                          MOV     (R4),R3         ;GET BIT
022636  020203                          CMP     R2,R3           ;CHECK THAT BIT WAS SET IN PSW
022640  001401                          BEQ     .+4
022642  104000                          HLT                     ;ERROR! BIT IN R2 FAILED TO SET IN PSW
022644  000244                          CLZ                     ;CLEAR Z BIT
022646  040214                          BIC     R2,(R4)         ;CLEAR BIT IN PSW
022650  011403                          MOV     (R4),R3         ;GET PSW RESULT
022652  001401                          BEQ     2$              ;BRANCH IF BIC ABOVE CLEARED BIT IN PSW
022654  104000                          HLT                     ;ERROR! BIT IN R2 FAILED TO CLEAR IN PSW
022656  020227  004000          2$:     CMP     R2,#4000        ;READY TO TEST BIT 12 YET?
022662  001003                          BNE     12$             ;BRANCH IF NO
022664  012702  030000                  MOV     #30000,R2       ;IF YES, SET BITS 12 & 13 TOGETHER
022670  000745                          BR      1$              ;GO TEST BITS 12 & 13 OF THE PSW
022672  020227  030000          12$:    CMP     R2,#30000       ;READY TO TEST BIT 14?
022676  001003                          BNE     13$             ;BRANCH IF NO
022700  012702  140000                  MOV     #140000,R2      ;IF YES, SET BITS 14 & 15 TOGETHER
022704  000737                          BR      1$              ;GO TEST BITS 14 & 15 OF THE PSW
022706  006302                  13$:    ASL     R2              ;SHIFT TEST BIT
022710  022702  100000                  CMP     #100000,R2      ;BRANCH IF ALL BITS NOT TESTED
022714  001333                          BNE     1$
```

```
5606  022716  005014                          CLR     (R4)                ;CLEAR STATUS
5607  022720  012637  000016                  MOV     (SP)+,@#TBITVEC+2       ;RESTORE T BIT RETURN
5608  022724  012746                          MOV     (PC)+,-(SP)         ;PUSH ORIGINAL STATUS ON STACK
5609  022726  000000                  3$:     .WORD   0                   ;CONTAINS ORIGINAL PSW
5610  022730  010746                          MOV     PC,-(SP)            ;SET RETURN PC
5611  022732  062716  000006                  ADD     #6,(SP)
5612  022736  000002                          RTI                         ;RETURN
5613  022740  013704  177776          4$:     MOV     @#PSW,R4            ;SAVE PSW IN R4
5614  022744  112737  000340  177776          MOVB    #340,@#PSW          ;SET PRIORITY LEVEL 6
5615  022752  004737  054112                  JSR     PC,@#CLRTBIT        ;GO CLEAR 'T' BIT IF SET
5616                                  ;;*****************************************************************
5617                                  ;*TEST 44        CHECK THAT ALL BITS IN THE CURRENT STACK PTR CAN BE SET CLEARED
5618                                  ;;*****************************************************************
5619  022756                          TST44:
5620  022756  000004                          SCOPE
5621  022760  112737  000044  001202          MOVB    #44,@#$TSTNM
5622  022766  010603                  CHKSP:  MOV     SP,R3               ;SAVE STACK PTR
5623  022770  000257                          CCC
5624  022772  112706  000377                  MOVB    #377,SP             ;SET STACK PTR = -1
5625  022776  006006                  1$:     ROR     SP                  ;ROTATE 0 BIT THROUGH ALL BIT
5626  023000  103776                          BCS     1$                  ;BIT POSITIONS
5627  023002  005206                          INC     SP                  ;SHOULD INCREMENT SP TO 0
5628  023004  001403                          BEQ     2$
5629  023006  010602                          MOV     SP,R2               ;SAVE ERROR STACK PTR
5630  023010  010306                          MOV     R3,SP               ;SET STACK PTR FOR TRAP
5631  023012  104000                          HLT                         ;ERROR!
5632
5633  023014  010306                  2$:     MOV     R3,SP               ;RESTORE ORIGINAL STACK PTR
5634
5635                                  ;CHECK BYTE OPERATIONS USING THE STACK
5636  023016  010600                  SPCHK:  MOV     SP,R0               ;SAVE STACK PTR
5637  023020  010003                          MOV     R0,R3
5638
5639  023022  005043                          CLR     -(R3)
5640  023024  112746  177777                  MOVB    #-1,-(SP)           ;(SP) = 377
5641  023030  022713  000377                  CMP     #377,(R3)           ;CHECK THAT ONLY EVEN BYTE WAS AFFECTED
5642  023034  001002                          BNE     1$
5643  023036  020306                          CMP     R3,SP               ;CHECK AUTO-DEC
5644  023040  001401                          BEQ     .+4
5645  023042  104000                  1$:     HLT
5646
5647  023044  105226                          INCB    (SP)+
5648  023046  005723                          TST     (R3)+               ;CHECK RESULT
5649  023050  001002                          BNE     2$
5650  023052  020006                          CMP     R0,SP               ;CHECK AUTO-INC
5651  023054  001401                          BEQ     .+4
5652  023056  104000                  2$:     HLT
5653
5654  023060  005143                          COM     -(R3)               ;(R3)=177777
5655  023062  144613                          BICB    -(SP),(R3)
5656  023064  022713  177400                  CMP     #177400,(R3)        ;CHECK RESULT
5657  023070  001002                          BNE     3$
5658  023072  020603                          CMP     SP,R3
5659  023074  001401                          BEQ     .+4
5660  023076  104000                  3$:     HLT
5661
```

```
5662  023100  132627  000377              BITB    (SP)+,#377
5663  023104  001002                      BNE     4$
5664  023106  020600                      CMP     SP,R0
5665  023110  001401                      BEQ     .+4
5666  023112  104000              4$:     HLT
5667
5668  023114  012746  000001              MOV     #1,-(SP)
5669  023120  062706  000002              ADD     #2,SP
5670  023124  012702  177401              MOV     #177401,R2
5671  023130  120246                      CMPB    R2,-(SP)
5672  023132  001004                      BNE     5$
5673  023134  122602                      CMPB    (SP)+,R2
5674  023136  001002                      BNE     5$
5675  023140  020006                      CMP     R0,SP
5676  023142  001401                      BEQ     .+4
5677  023144  104000              5$:     HLT
5678  023146  105037  177776              CLRB    @#PSW
5679  023152  010446                      MOV     R4,-(SP)        ;RESTORE ORIGINAL PSW TO STACK
5680  023154  010746                      MOV     PC,-(SP)
5681  023156  062716  000006              ADD     #6,(SP)
5682  023162  000002                      RTI
5683                              ;;**********************************************************************
5684                              ;*TEST 45        CHECK THAT 'C' BIT SETS/CLEARS PROPERLY
5685                              ;;**********************************************************************
5686  023164                      TST45:
5687  023164  000004                      SCOPE
5688  023166  112737  000045  001202      MOVB    #45,@#STSTNM
5689  023174  012727  177776      CBIT:   MOV     #177776,(PC)+   ;LOAD CONSTANT
5690  023200  000000              1$:     .WORD   0
5691  023202  010700                      MOV     PC,R0           ;GET CURRENT PC
5692  023204  162700  000004              SUB     #4,R0           ;POINT R0 TO 1$ ABOVE
5693  023210  005520              2$:     ADC     (R0)+           ;ADD 'C' BIT TO 1$ ABOVE
5694  023212  006340                      ASL     -(R0)           ;SHIFT 1$
5695  023214  102375                      BVC     2$              ;UNTIL 'V' BIT SETS
5696  023216  022767  077776  177754      CMP     #077776,1$      ;CHECK RESULT
5697  023224  001401                      BEQ     .+4
5698  023226  104000                      HLT                     ;ERROR! INCORRECT RESULT IN 1$ ABOVE
5699                                                              ;R0=ADDRESS OF DATA
5700
5701                              ;CHECK THAT CONDITION CODES ARE SET PROPERLY WHEN A NUMBER (CURRENT PC)
5702                              ;AND THAT NUMBER +1 ARE COMPARED, AND VICE VERSA.
5703  023230  010700              CMPN:   MOV     PC,R0           ;GET CURRENT PC
5704  023232  010002                      MOV     R0,R2           ;SAVE IN R2
5705  023234  005202                      INC     R2              ;MAKE R2 = R0+1
5706  023236  000277                      SCC
5707  023240  000251                      +CLC!CLN                ;CLEAR C & N BITS
5708  023242  020002                      CMP     R0,R2           ;COMPARE # WITH #+1
5709  023244  103003                      BCC     1$              ;CARRY BIT SHOULD SET
5710  023246  102402                      BVS     1$              ;V BIT SHOULD CLEAR
5711  023250  001401                      BEQ     1$              ;Z BIT SHOULD CLEAR
5712  023252  100401                      BMI     .+4             ;N BIT SHOULD SET
5713  023254  104000              1$:     HLT                     ;ERROR! COMPARE # WITH #+1 FAILED TO
5714                                                              ;SET CONDITION CODES IN PSW CORRECTLY
5715
5716  023256  000277                      SCC                     ;SET CONDITION CODES IN PSW
5717  023260  120200                      CMPB    R2,R0           ;COMPARE #+1 WITH #
```

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5718  023262  103403                        BCS     2$              ;C BIT SHOULD CLEAR
5719  023264  102402                        BVS     2$              ;V BIT SHOULD CLEAR
5720  023266  001401                        BEQ     2$              ;Z BIT SHOULD CLEAR
5721  023270  100001                        BPL     .+4             ;N BIT SHOLD CLEAR
5722  023272  104000              2$:       HLT                     ;ERROR! COMPARE #+1 WITH # FAILED TO SET
5723                                                                ;CONDITION CODES IN PSW CORRECTLY
5724  023274  105037  177776              CLRB    @#PSW           ;ENSURE PRIORITY 0
5725  023300  000004              RELE4:    SCOPE
5726  023302  010702                        MOV     PC,R2
5727  023304  062702  000012              ADD     #12,R2
5728  023310  012707  036574              MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
5729  023314  000000              REL44:    .WORD   0
5730                                      ;444444444444444 LAST ADDRESS OF CODE TO BE RELOCATED 444444444444
5731
5732                                      ;;*****************************************************************
5733                                      ;*TEST 46        CHECK EXTENDED INSTRUCTION SET
5734                                      ;;*****************************************************************
5735  023316                              TST46:
5736  023316  012767  000001  156000      MOV     #1,$TIMES       ;;DO 1 ITERATION
5737  023324  000004                      SCOPE
5738  023326  112737  000046  001202      MOVB    #46,@#$TSTNM
5739
5740                                      .SBTTL  START OF SECTION 5
5741                                      ;5555555555555 FIRST ADDRESS TO BE RELOCATED 555555555
5742  023334  112737  000046  001202  REL5:  MOVB  #$TN-1,@#$TSTNM
5743  023342  010700                      MOV     PC,R0           ;GET PC
5744  023344  005740                      TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL5
5745  023346  010037  001554              MOV     R0,@#FRSTAD     ;SAVE
5746  023352  010700                      MOV     PC,R0           ;GET CURRENT PC
5747  023354  162700  023354              SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
5748  023360  010037  001550              MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
5749  023364  010737  001212              MOV     PC,@#$LPERR     ;SET LOOP ADDRESS
5750  023370  062737  000026  001212      ADD     #26,@#$LPERR    ;ADJUST
5751  023376  013737  001212  001210      MOV     @#$LPERR,@#$LPADR
5752  023404  105737  001544              TSTB    @#NEXEC         ;BR IF TEST CODE TO BE EXECUTED
5753  023410  001402                      BEQ     .+6
5754  023412  000167  001366              JMP     RELE5
5755  023416  005000              EXTINST:CLR     R0
5756  023420  000277                      SCC                     ;PRESET CC'S
5757  023422  006700                      SXT     R0              ;EXTEND SIGN (1) INTO R0
5758  023424  103005                      BCC     SXT0            ;CHECK RESULT CC'S
5759  023426  102404                      BVS     SXT0
5760  023430  001403                      BEQ     SXT0
5761  023432  100002                      BPL     SXT0
5762  023434  005200                      INC     R0              ;CHECK RESULT
5763  023436  001401                      BEQ     .+4
5764  023440  104000              SXT0:   HLT
5765
5766  023442  010700                      MOV     PC,R0
5767  023444  010002                      MOV     R0,R2
5768  023446  012703  177777              MOV     #-1,R3
5769  023452  005102                      COM     R2
5770  023454  000243                      +CLV!CLC                ;CLEAR C AND V BITS
5771  023456  074003                      XOR     R0,R3           ;R3 SHOULD CONTAIN COMPLEMENT OF R0
5772  023460  103404                      BCS     XOR0            ;CHECK THAT C WAS NOT AFFECTED
5773  023462  102403                      BVS     XOR0            ;AND THAT V WAS CLEARED
```

```
5774  023464  000402                      BEQ     XORO
5775  023466  020203                      CMP     R2,R3           ;CHECK RESULT
5776  023470  001401                      BEQ     .+4
5777  023472  104000              XORO:   HLT                     ;ERROR!   XOR FAILED
5778
5779  023474  010700                      MOV     PC,R0
5780  023476  022020                      CMP     (R0)+,(R0)+     ;SET ADDRESS REGISTER
5781  023500  000401                      BR      1$              ;RESERVE WORD FOR TEST DATA
5782  023502  000000                      .WORD   0               ;CONTAINS TEST DATA
5783  023504  005700              1$:     TST     R0              ;EXTEND SIGN OF ADDRESS INTO
5784  023506  006710                      SXT     (R0)            ;ADDRESS (R0)=-1 IF MSB R0=1
5785  023510  005002                      CLR     R2              ;OTHERWISE, (R0)=0
5786  023512  005700                      TST     R0              ;CHECK SIGN OF ADDRESS
5787  023514  100001                      BPL     .+4
5788  023516  005102                      COM     R2              ;COMPLEMENT CHECK REG IF NEG
5789  023520  021002                      CMP     (R0),R2         ;CHECK RESULT OF SXT
5790  023522  001401                      BEQ     .+4
5791  023524  104000              SXT1:   HLT                     ;ERROR!   SXT FAILED TO EXTEND SIGN PROPERLY
5792
5793  023526  012710  100000              MOV     #100000,(R0)    ;PRESET DATA
5794  023532  011002                      MOV     (R0),R2
5795  023534  000277                      SCC                     ;PRESET CC'S
5796  023536  074210                      XOR     R2,(R0)         ;XOR 100000 WITH 100000 RESULT = 0
5797  023540  103007                      BCC     XOR1            ;CHECK CC'S AFTER XOR
5798  023542  102406                      BVS     XOR1
5799  023544  001005                      BNE     XOR1
5800  023546  100404                      BMI     XOR1
5801  023550  005710                      TST     (R0)            ;CHECK RESULT (0)
5802  023552  001002                      BNE     XOR1
5803  023554  005402                      NEG     R2              ;CHECK THAT REG WAS NOT AFFECTED
5804  023556  102401                      BVS     .+4
5805  023560  104000              XOR1:   HLT
5806
5807  023562  010702                      MOV     PC,R2
5808  023564  022222                      CMP     (R2)+,(R2)+
5809  023566  000401                      BR      SXT4            ;PRESERVE WORD FOR DATA
5810  023570  000000                      .WORD   0               ;RESERVED FOR DATA
5811  023572  012722  125252      SXT4:   MOV     #125252,(R2)+   ;PRESET DATA
5812  023576  006742                      SXT     -(R2)           ;EXTEND SIGN
5813  023600  074722                      XOR     PC,(R2)+
5814  023602  010700                      MOV     PC,R0           ;GET PC
5815  023604  005740                      TST     -(R0)           ;SUBTRACT 2 FROM PC
5816  023606  005100                      COM     R0              ;R0=RESULT OF XOR PC-1 ABOVE
5817  023610  074042                      XOR     R0,-(R2)        ;CHECK RESULT OF SXT AND XOR ABOVE
5818  023612  001401                      BEQ     .+4
5819  023614  104000              XOR24:  HLT                     ;ERROR!   SXT & XOR ABOVE INCORRECT
5820
5821  023616  012704  000001              MOV     #1,R4           ;SET R4
5822  023622  006767  000060              SXT     XOR6A           ;PRESET DATA=0
5823  023626  074467  000054      2$:     XOR     R4,XOR6A
5824  023632  100423                      BMI     XOR6
5825  023634  006304                      ASL     R4              ;SHIFT R4
5826  023636  102373                      BVC     2$              ;UNTIL V SETS (R4=100000)
5827  023640  100020                      BPL     XOR6            ;BRANCH IF 'N' IS CLEAR
5828  023642  074467  000040              XOR     R4,XOR6A        ;XOR6A=177777
5829  023646  100015                      BPL     XOR6
```

```
5830  023650  074767  000032                  XOR     PC,XOR6A        ;XOR PC WITH XOR6A (177777)
5831  023654  010767  000030                  MOV     PC,XOR6B        ;FORM PC AS USED IN XOR ABOVE
5832  023660  162767  000004  000022          SUB     #4,XOR6B
5833  023666  005167  000016                  COM     XOR6B
5834  023672  026767  000012  000006          CMP     XOR6B,XOR6A     ;XOR6A SHOULD = COMPLEMENT OF PC
5835  023700  001401                          BEQ     .+4
5836  023702  104000                  XOR6:   HLT                     ;ERROR!  XOR TESTS ABOVE FAILED
5837
5838  023704  000402                          BR      .+6
5839
5840  023706  000000                  XOR6A:  .WORD   0               ;CONTAINS DATA USED BY TEST ABOVE
5841  023710  000000                  XOR6B:  .WORD   0
5842
5843
5844  023712  012700  077777                  MOV     #077777,R0      ;SET SOURCE OPERAND FOR ADD
5845  023716  006767  177764                  SXT     XOR6A           ;CLEAR XOR6A
5846  023722  001004                          BNE     SXT6            ;CHECK CC'S AFTER EXTENDING ZERO'S
5847  023724  100403                          BMI     SXT6
5848  023726  103402                          BCS     SXT6
5849  023730  102401                          BVS     SXT6
5850  023732  000401                          BR      .+4
5851  023734  104000                  SXT6:   HLT                     ;ERROR!  SXT FAILED
5852
5853  023736  012702  000001                  MOV     #1,R2           ;SET DEST OPERAND FOR ADD
5854  023742  013703  001550                  MOV     @#FACTOR,R3     ;LOAD INDEX REGISTER
5855  023746  060002                          ADD     R0,R2           ;RESULT OF ADD=100000
5856  023750  006763  023706                  SXT     XOR6A(3)        ;EXTEND SIGN OF ADD ABOVE
5857  023754  001403                          BEQ     SXT6A
5858  023756  005267  177724                  INC     XOR6A           ;CHECK RESULT OF SXT
5859  023762  001401                          BEQ     .+4
5860  023764  104000                  SXT6A:  HLT                     ;ERROR!  SXT ABOVE FAILED TO EXTEND
5861                                                                  ;SIGN
5862  023766  010703                          MOV     PC,R3
5863  023770  000402                          BR      .+6             ;PRESERVE 2 WORDS FOR DATA
5864  023772  000000                  SXRA:   .WORD   0               ;RESERVED WORD FOR DATA
5865  023774  000000                  SXRB:   .WORD   0               ;RESERVED WORD FOR DATA
5866  023776  005723                          TST     (R3)+
5867  024000  010304                          MOV     R3,R4           ;R3 = ADDRESS OF SXRA
5868  024002  000250                          CLN                     ;CLEAR N BIT
5869  024004  006724                          SXT     (R4)+           ;EXTEND ZEROS INTO SXRA
5870  024006  001401                          BEQ     .+4
5871  024010  104000                  SXT2:   HLT                     ;ERROR!  SXT FAILED
5872
5873  024012  010467  177754                  MOV     R4,SXRA         ;SXRA = ADDRESS OF SXRB
5874  024016  000257                          CCC                     ;CLEAR CONDITION CODES
5875  024020  006733                          SXT     @(R3)+          ;EXTEND ZEROS INTO SXRB
5876  024022  001401                          BEQ     .+4
5877  024024  104000                  SXT3:   HLT                     ;ERROR!
5878
5879  024026  000270                          SEN                     ;SET N BIT
5880  024030  006753                          SXT     @-(R3)          ;EXTEND ONES INTO SXRB
5881  024032  100401                          BMI     .+4
5882  024034  104000                  SXT5:   HLT                     ;ERROR!
5883
5884  024036  012704  025252                  MOV     #025252,R4      ;R4 = 025252
5885  024042  074433                          XOR     R4,@(R3)+       ;SXRB = 152525 (COMPLEMENT OF R4)
```

```
5896  024044  005002                          CLR     R2
5897  024046  074253                          XOR     R2,@-(R3)       ;SXRB REMAINS UNCHANGED
5898  024050  001405                          BEQ     XOR35           ;CHECK CONDITION CODES
5899  024052  100004                          BPL     XOR35
5890  024054  005104                          COM     R4              ;R4 = 152525
5891  024056  020467  177712                  CMP     R4,SXRB         ;CHECK XOR
5892  024062  001401                          BEQ     .+4
5893  024064  104000              XOR35:      HLT                     ;ERROR!  XOR FAILED
5894
5895  024066  005743                          TST     -(R3)           ;R3 = ADDRESS OF SXRA-2
5896  024070  000250                          CLN                     ;CLEAR N BIT
5897  024072  006773  000002                  SXT     @2(R3)          ;SXRB = 0
5898  024076  001401                          BEQ     .+4
5899  024100  104000              SXT7:       HLT                     ;ERROR!  SXT FAILED
5900
5901  024102  074473  000002                  XOR     R4,@2(R3)       ;SXRB = R4
5902  024106  020473  000002                  CMP     R4,@2(R3)       ;CHECK XOR
5903  024112  001401                          BEQ     .+4
5904  024114  104000              XOR7:       HLT                     ;ERROR!  XOR FAILED
5905                                ;;*****************************************************************
5906                                ;*TEST 47        SOB TEST
5907                                ;*      NOTE:   DO NOT INSERT ANY CODE IN FOLLOWING SOB TESTS
5908                                ;               SINCE IT TESTS THE MAXIMUM BRANCH WIDTH OF THE INSTRUCTION.
5909                                ;;*****************************************************************
5910  024116                        TST47:
5911  024116  000004                          SCOPE
5912  024120  112737  000047  001202          MOVB    #47,@#$TSTNM
5913
5914  024126  005005                          CLR     R5              ;CLEAR ERROR INDICATOR
5915  024130  000407                          BR      SOB0            ;BRANCH TO SOB TEST
5916
5917  024132  005004              SOB10:      CLR     R4              ;R4 = 0
5918  024134  005705                          TST     R5              ;CHECK ERROR INDICATOR
5919  024136  001401                          BEQ     .+4             ;SOB BRANCHED CORRECTLY
5920  024140  104000                          HLT                     ;ERROR!
5921
5922  024142  005005              SOB9:       CLR     R5              ;CLEAR INDICATOR (R5)
5923  024144  006004                          ROR     R4              ;ROTATE RIGHT R4
5924  024146  000467                          BR      SOB8
5925
5926  024150  012700  000010      SOB0:       MOV     #10,R0          ;R0=10
5927  024154  000277                          SCC                     ;SET CONDITION CODES
5928  024156  001012              SOB1:       BNE     SOB2            ;CHECK CONDITION CODES AFTER SOB
5929  024160  100011                          BPL     SOB2            ;SOB SHOULD NOT EFFECT THE
5930  024162  102010                          BVC     SOB2            ;CONDITION CODES.
5931  024164  103007                          BCC     SOB2
5932  024166  077005                          SOB     R0,SOB1
5933  024170  001005                          BNE     SOB2            ;CHECK CONDITION CODES AFTER
5934  024172  100004                          BPL     SOB2            ;SOB FALLS THROUGH,
5935  024174  102003                          BVC     SOB2            ;SOB SHOULD NOT EFFECT
5936  024176  103002                          BCC     SOB2            ;CONDITION CODES.
5937  024200  005700                          TST     R0              ;CHECK IF R0=0
5938  024202  001401                          BEQ     .+4
5939  024204  104000              SOB2:       HLT                     ;ERROR!
5940
5941  024206  012702  000100                  MOV     #100,R2         ;R2=100
```

```
5942  024212  012700  000101          MOV     #101,R0         ;SET CHECK REGISTER, R0=101
5943  024216  001414          SOB3:   BEQ     SOB4            ;CHECK CONDITION CODES AFTER
5944  024220  100413                  BMI     SOB4            ;SOB BRANCH,
5945  024222  102412                  BVS     SOB4            ;SOB SHOULD NOT EFFECT
5946  024224  103411                  BCS     SOB4            ;CONDITION CODES.
5947  024226  005300                  DEC     R0              ;DECREMENT CHECK REGISTER
5948  024230  020002                  CMP     R0,R2           ;CHECK THAT SOB DECREMENTS
5949  024232  001006                  BNE     SOB4
5950  024234  000257                  CCC                     ;SET CONDITION CODES BEFORE SOB
5951  024236  077211                  SOB     R2,SOB3         ;BRANCH TO SOB3 UNTIL R2=0
5952  024240  001403                  BEQ     SOB4            ;CHECK CONDITION CODES AFTER
5953  024242  100402                  BMI     SOB4            ;SOB FALLS THROUGH
5954  024244  005702                  TST     R2              ;CHECK IF R2=0
5955  024246  001401                  BEQ     .+4
5956  024250  104000          SOB4:   HLT                     ;ERROR!
5957
5958  024252  012700  000001  SOB5:   MOV     #1,R0           ;R0=1
5959  024256  000401                  BR      .+4
5960  024260  104000                  HLT                     ;ERROR!
5961  024262  077002                  SOB     R0,.-2          ;SOB SHOULD NOT BRANCH
5962
5963  024264  005700                  TST     R0              ;CHECK IF R0=0 AFTER SOB
5964  024266  001401                  BEQ     .+4
5965  024270  104000                  HLT                     ;ERROR!
5966
5967  024272  012704  100000  SOB5A:  MOV     #100000,R4      ;R4=100000
5968  024276  000403                  BR      1$
5969  024300  005204          3$:     INC     R4              ;R4=100000
5970  024302  100403                  BMI     2$              ;N BIT SHOULD BE SET
5971  024304  104000                  HLT                     ;ERROR!   SOB DID NOT
5972                                                          ;INCREMENT PROPERLY
5973
5974  024306  077404          1$:     SOB     R4,3$           ;SOB SHOULD BRANCH
5975  024310  104000                  HLT                     ;ERROR!  SOB DID NOT BRANCH
5976
5977  024312  012703  000100  2$:     MOV     #100,R3         ;R3=100
5978  024316  077301          SOB6:   SOB     R3,SOB6         ;USE SOB TO BRANCH TO ITSELF
5979  024320  005703                  TST     R3              ;CHECK IF R3=0
5980  024322  001703                  BEQ     SOB10
5981  024324  104000          SOB7:   HLT                     ;ERROR!
5982
5983  024326  005705          SOB8:   TST     R5              ;CHECK INDICATOR (R5)
5984                                                          ;IF SOB BRANCHES INCORRECTLY
5985                                                          ;WHEN CHECKING MAX. BRANCH,
5986                                                          ;R5 WILL NOT BE CLEARED AT
5987                                                          ;THIS POINT INDICATING AN ERROR.
5988
5989  024330  001401                  BEQ     .+4             ;BRANCH IF SOB BRANCHES CORRECTLY
5990  024332  104000                  HLT                     ;ERROR!
5991
5992  024334  005205                  INC     R5              ;SET INDICATOR (R5)
5993  024336  077477                  SOB     R4,SOB9         ;TEST MAX. BRANCH OF SOB
5994  024340  005704                  TST     R4              ;CHECK IF R4=0
5995  024342  001401                  BEQ     .+4
5996  024344  104000                  HLT                     ;ERROR!
5997                  ;;*************************************************************
```

```
                                        ;*TEST 50       CHECK THE MARK INSTRUCTION
                                        ;;*****************************************************************
024346                                  TST50:
                                                SCOPE
024346  000004
024350  112737  000050  001202                  MOVB    #50,@#$TSTNM
024356  010602                          MRKTST: MOV     SP,R2
024360  010705                                  MOV     PC,R5           ;THE STACK LOOKS LIKE THIS AFTER
024362  010500                                  MOV     R5,R0           ;THE JSR INSTRUCTION
024364  010546                                  MOV     R5,-(SP)        ; -2(SP)= R0    THIS IS A
024366  010746                                  MOV     PC,-(SP)        ; -4(SP)= PC    STRING
024370  010746                                  MOV     PC,-(SP)        ; -6(SP)= PC+2  OF
024372  010746                                  MOV     PC,-(SP)        ;-10(SP)= PC+4  FIVE
024374  010746                                  MOV     PC,-(SP)        ;-12(SP)= PC+6  DUMMY
024376  010746                                  MOV     PC,-(SP)        ;-14(SP)= PC+10 ARGUMENTS
024400  012746  006405                          MOV     #MARK+5,-(SP)   ;-16(SP)= MARK 5
024404  010605                                  MOV     SP,R5           ;-20(SP)= PC PUSHED BY JSR
024406  004767  000002                          JSR     PC,MARK1
024412  000403                                  BR      .+10
024414  000205                          MARK1:  RTS     R5
024416  104000                                  HLT                     ;ERROR! SHOULD BE DOING MARK 5 INST.
024420  000407                                  BR      MARKEX
024422  020602                                  CMP     SP,R2
024424  001402                                  BEQ     .+6
024426  104000                                  HLT                     ;ERROR! SP NOT RETURNED TO PROPER
024430  000403                                  BR      MARKEX          ;VALUE BY MARK INSTRUCTION
024432  020005                                  CMP     R0,R5
024434  001401                                  BEQ     .+4
024436  104000                                  HLT                     ;ERROR! DID NOT RESTORE R5 FROM STACK
024440  010206                          MARKEX: MOV     R2,SP           ;RESTORE SP
                                        ;;*****************************************************************
                                        ;*TEST 51       RTT/RTI TEST
                                        ;*      RTT/RTI TEST INSURES THAT CP DOES THE INSTRUCTION FOLLOWING
                                        ;*      AN RTT IF THE "T"BIT IS SET IN THE PSW,BUT DOES HONOR
                                        ;*      THE TRAP IMMEDIATELY IF IT EXECUTES AN RTI
                                        ;*      INSTRUCTION SEQUENCE-RTT
                                        ;*      2$:     RTT                     ;NO 'T' TRAP AFTER RTT
                                        ;*              INC     R0              ;R0=000001
                                        ;*                                      ;'T' TRAP TO 5$ AFTER INC
                                        ;*      5$:     COM     R0              ;R0=177776
                                        ;*              MOV     SAVPSW,2(SP)    ;CLEAR 'T' BIT IN RETURN PSW
                                        ;*              RTI                     ;RETURN TO INSTRUCTION FOLLOWING INC
                                        ;*              CMP     #RTT,2$         ;CHECK
                                        ;*                      ETC
                                        ;*      INSTRUCTION SQUENCE-RTI
                                        ;*      2$:     R I                     ;'T' TRAP AFTER RTI
                                        ;*      5$:     COM     R0              ;R0=177777
                                        ;*              MOV     SAVPSW,2(SP)    ;CLEAR 'T' BIT IN RETURN PSW
                                        ;*              RTI                     ;RETURN TO INC INSTRUCTION
                                        ;*              INC     R0              ;R0=000000
                                        ;*              CMP     #RTT,2$         ;CHECK
                                        ;*                      ETC
                                        ;;*****************************************************************
024442                                  TST51:
                                                SCOPE
024442  000004
024444  112737  000051  001202                  MOVB    #51,@#$TSTNM
```

```
6054  024452  013767  177776  000174  RTT1:   MOV     @#PSW,SAVPSW            ;SAVE PSW
6055  024460  032767  000020  000166          BIT     #20,SAVPSW              ;CHECK IF "T"BIT SET
6056  024466  001143                          BNE     RTT2EX                  ;BRANCH TO EXIT
6057  024470  010746                  1$:     MOV     PC,-(SP)                ;GET CURRENT PC
6058  024472  062716  000116                  ADD     #5$-.,(SP)              ;FORM RELOCATED PC
6059  024476  012637  000014                  MOV     (SP)+,@#TBITVEC         ;LOAD INTO TRAP VECTOR
6060  024502  016746  000146                  MOV     SAVPSW,-(SP)            ;GET CURRENT PSW
6061  024506  011637  000016                  MOV     (SP),@#TBITVEC+2
6062  024512  052737  000340  177776          BIS     #PR7,@#PSW              ;SET PRIORITY LEVEL 7
6063  024520  005000                          CLR     R0
6064  024522  052716  000360                  BIS     #PR7+20,(SP)            ;SET "T"BIT IN PSW ON STACK
6065  024526  010746                          MOV     PC,-(SP)                ;PUT THE PC ON THE STACK
6066  024530  062716  000006                  ADD     #6,(SP)                 ;ADJUST PC FOR NEXT INSTRUCTION
6067  024534  000006                  2$:     RTT
6068  024536  005200                          INC     R0                      ;DONE TO SEE IF INSTR. FOLLOWING
6069                                                                          ;RTT IS EXECUTED IF T-BIT SET
6070  024540  042737  000340  177776          BIC     #PR7,@#PSW              ;SET PRIORITY LEVEL 0
6071  024546  022767  000006  177760          CMP     #RTT,2$
6072  024554  001005                          BNE     3$                      ;CHECK IF INC WAS EXECUTED
6073  024556  022700  177776                  CMP     #177776,R0              ;CHECK IF COM-R0 EXECUTED
6074  024562  001406                          BEQ     4$
6075  024564  104000                          HLT                             ;ERROR!R0 NOT COMPLIMENTED
6076  024566  000415                          BR      6$                      ;EXIT TEST
6077  024570  005700                  3$:     TST     R0                      ;TEST IF TRAPED BEFORE INC INST.
6078                                                                          ;WAS EXECUTED
6079  024572  001413                          BEQ     6$
6080  024574  104000                          HLT                             ;ERROR!
6081  024576  000411                          BR      6$                      ;EXIT TEST
6082  024600  012767  000002  177726  4$:     MOV     #RTI,2$
6083  024606  000730                          BR      1$
6084  024610  005100                  5$:     COM     R0                      ;RTT CHECK
6085  024612  016766  000036  000002          MOV     SAVPSW,2(SP)
6086  024620  000002                          RTI
6087  024622  012767  000006  177704  6$:     MOV     #RTT,2$
6088  024630  012737  001534  000014          MOV     #$RTRN,@#TBITVEC                ;RESTORE 'T' TRAP VECTOR
6089  024636  005037  000016                  CLR     @#TBITVEC+2
6090  024642                          RTT1EX:
6091                                  ;;*****************************************************************
6092                                  ;*TEST 52        SECOND RTT TEST
6093                                  ;;*****************************************************************
6094  024642                          TST52:
6095  024642  000004                          SCOPE
6096  024644  112737  000052  001202          MOVB    #52,@#STSTNM
6097  024652  000401                          BR      RTT2A
6098  024654  000000                  SAVPSW: .WORD   0
6099  024656  016700  177772          RTT2A:  MOV     SAVPSW,R0               ;GET SAVED PSW
6100  024662  105000                          CLRB    R0                      ;CLEAR PRIOITY LEVEL,T, AND COND CODES
6101  024664  012702  140000                  MOV     #UM,R2
```

```
6102  024670  074002                    XOR     R0,R2
6103  024672  001423                    BEQ     2$                      ;USER MODE
6104  024674  032700  140000            BIT     #UM,R0
6105  024700  001036                    BNE     RTT2EX
```

```
6106
6107                                        ;TEST THAT RTT CLEARS BITS 12,13 & PRIORITY LEVEL BITS IN KERNEL MODE
6108  024702  012737  030240  177776        MOV     #PUM+PR5,@#PSW          ;GO TO KERNEL MODE
6109  024710  012746  000100                MOV     #PR2,-(SP)
6110  024714  010746                       MOV     PC,-(SP)
6111  024716  062716  000006                ADD     #1$-.,(SP)              ;FORM NEW PC
6112  024722  000006                       RTT
6113  024724  013700  177776  1$:           MOV     @#PSW,R0                ;NOW USING REG SET 0
6114  024730  022700  000100                CMP     #PR2,R0         ;TESTS THE PSW AFTER THE RTT
6115  024734  001420                       BEQ     RTT2EX
6116  024736  104000                       HLT                             ;ERROR! INCORRECT PSW AFTER THE RTT
6117  024740  000416                       BR      RTT2EX
6119
6119                                        ;TEST TO INSURE THAT RTI DOES NOT CLEAR BITS 12-15 IN USER MODE
6120  024742  052737  030340  177776  2$:   BIS     #PUM+PR7,@#PSW
6121  024750  005046                       CLR     -(SP)
6122  024752  010746                       MOV     PC,-(SP)
6123  024754  062716  000006                ADD     #5$-.,(SP)
6124  024760  000002                       RTI                             ;ATTEMPS TO INSERT A PSW OF 0
6125  024762  022737  170340  177776  5$:   CMP     #UM+PUM+PR7,@#PSW
6126  024770  001402                       BEQ     RTT2EX
6127  024772  104000                       HLT                             ;ERROR! RTI CLEARED BITS IN PSW
6128  024774  000400                       BR      RTT2EX
6129
6130  024776  016737  177652  177776  RTT2EX: MOV     SAVPSW,@#PSW
6131  025004  000004                  RELE5:  SCOPE
6132  025006  010702                       MOV     PC,R2
6133  025010  062702  000012                ADD     #12,R2
6134  025014  012707  036574                MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
6135  025020  000000                  REL55:  .WORD   0
6136                                      ;5555555555555 LAST ADDRESS OF CODE TO BE RELOCATED 55555555555
6137
6138                                      ;;*****************************************************************
6139                                      ;*TEST 53       CHECK ASH, ASHC, MUL, AND DIV INSTRUCTIONS
6140                                      ;;*****************************************************************
6141  025022                          TST53:
6142  025022  012767  000001  154274        MOV     #1,$TIMES       ;;DO 1 ITERATION
6143  025030  000004                       SCOPE
6144  025032  112737  000053  001202        MOVB    #53,@#$TSTNM
6145
6146                                        .SBTTL  START OF SECTION 6
6147                                      ;6666666666666 FIRST ADDRESS TO BE RELOCATED 666666666
6148  025040  112737  000053  001202  REL6:  MOVB    #$TN-1,@#$TSTNM
6149  025046  010700                       MOV     PC,R0                   ;GET PC
6150  025050  005740                       TST     -(R0)                   ;R0 CONTAINS THE ADDRESS OF REL6
6151  025052  010037  001554                MOV     R0,@#FRSTAD             ;SAVE
6152  025056  010700                       MOV     PC,R0                   ;GET CURRENT PC
6153  025060  162700  025060                SUB     #.,R0                   ;SUBTRACT RELOCATION FACTOR
6154  025064  010037  001550                MOV     R0,@#FACTOR             ;SAVE RELOCATION FACTOR
6155  025070  010737  001212                MOV     PC,@#$LPERR             ;SET LOOP ADDRESS
6156  025074  062737  000026  001212        ADD     #26,@#$LPERR            ;ADJUST
6157  025102  013737  001212  001210        MOV     @#$LPERR,@#$LPADR
6158  025110  105737  001544                TSTB    @#NEXEC                 ;BR IF TEST CODE TO BE EXECUTED
6159  025114  001402                       BEQ     .+6
6160  025116  000167  004402                JMP     RELE6
6161  025122  012700  000001          ASHL0:  MOV     #1,R0                   ;R0 WILL BE THE SHIFT COUNT
```

```
6162  025126  012703  000021            MOV     #17.,R3         ;MAX SHIFT COUNT
6163  025132  005067  000014      1$:   CLR     2$              ;PRESET SAVED CC'S LOCATION=0
6164  025136  010002                    MOV     R0,R2           ;GET SHIFT COUNT FOR PASS
6165  025140  010705                    MOV     PC,R5           ;R5 & R4 WILL BE DATA SHIFTED BY
6166  025142  010504                    MOV     R5,R4           ;ASH & ASL INSTRUCTIONS
6167  025144  072502                    ASH     R2,R5           ;SHIFT R5
6168  025146  113727  177776            MOVB    @#PSW,(PC)+     ;SAVE CC'S
6169  025152  000000            2$:     .WORD   0               ;CONTAINS ASH CC'S IN EVEN BYTE
6170                                                            ;ASL CC'S IN ODD BYTE
6171  025154  006304            3$:     ASL     R4              ;SHIFT R4
6172  025156  113746  177776            MOVB    @#PSW,-(SP)     ;SAVE PSW ON STACK
6173  025162  132716  000002            BITB    #2,(SP)         ;CHECK IF ASL SET V BIT
6174  025166  001403                    BEQ     30$
6175  025170  152767  000002  177755    BISB    #2,2$+1         ;IF ASL SET V THEN SET V IN 2$+1
6176  025176  112637  177776    30$:    MOVB    (SP)+,@#PSW     ;RESTORE ORIGINAL PSW
6177  025202  077214                    SOB     R2,3$           ;SHIFT R4 R2 TIMES
6178  025204  153767  177776  177741    BISB    @#PSW,2$+1      ;SAVE CC'S AFTER ASL
6179  025212  020504                    CMP     R5,R4           ;CHECK ASH & ASL RESULTS
6180  025214  001004                    BNE     4$
6181  025216  126767  177730  177727    CMPB    2$,2$+1         ;CHECK ASH & ASL CC'S
6182  025224  001401                    BEQ     .+4
6183  025226  104000            4$:     HLT                     ;ERROR! INCORRECT RESULT OR CC'S
6184  025230  005200                    INC     R0              ;INCREMENT PASS SHIFT COUNT
6185  025232  020003                    CMP     R0,R3
6186  025234  001336                    BNE     1$
6187
6188  025236  012700  177777    ASHR0:  MOV     #-1,R0          ;R0 = RIGHT SHIFT COUNT FOR PASS
6189  025242  012703  177757            MOV     #-17.,R3        ;MAX SHIFT COUNT
6190  025246  010002            1$:     MOV     R0,R2           ;GET SHIFT COUNT FOR PASS
6191  025250  010705                    MOV     PC,R5           ;R5 & R4 = DATA TO BE SHIFTED
6192  025252  010504                    MOV     R5,R4           ;BY ASH & ASR INSTRUCTIONS
6193  025254  072502                    ASH     R2,R5           ;SHIFT R5 R2 TIMES
6194  025256  113727  177776            MOVB    @#PSW,(PC)+     ;SAVE CC'S IN EVEN BYTE
6195  025262  000000            2$:     .WORD   0               ;CONTAINS ASH CC'S IN EVEN BYTE
6196                                                            ;ASR CC'S IN ODD BYTE
6197  025264  005402                    NEG     R2
6198  025266  006204            3$:     ASR     R4              ;SHIFT R4
6199  025270  077202                    SOB     R2,3$           ;SHIFT R4 R2 TIMES
6200  025272  113767  177776  177763    MOVB    @#PSW,2$+1      ;SAVE CC'S AFTER ASR
6201  025300  142767  000002  177755    BICB    #2,2$+1         ;ASH RIGHT WILL NOT SET V ASR MAY SET V
6202  025306  020504                    CMP     R5,R4           ;CHECK ASH & ASR RESULTS
6203  025310  001004                    BNE     4$
6204  025312  126767  177744  177743    CMPB    2$,2$+1         ;CHECK ASH & ASR CC'S
6205  025320  001401                    BEQ     .+4
6206  025322  104000            4$:     HLT
6207  025324  005300                    DEC     R0              ;DECREMENT PASS SHIFT COUNT
6208  025326  020003                    CMP     R0,R3
6209  025330  001346                    BNE     1$
6210
6211  025332  012746  000037    ASHCLO: MOV     #31.,-(SP)      ;PUT MAX SHIFT COUNT ON STACK
6212  025336  012746  000001            MOV     #1,-(SP)        ;PUT LEFT SHIFT COUNT ON STACK
6213  025342  011600            1$:     MOV     (SP),R0         ;GET PASS SHIFT COUNT
6214  025344  010705                    MOV     PC,R5           ;CURRENT PC IS DATA TO BE SHIFTED
6215  025346  010503                    MOV     R5,R3           ;ASHC SHIFTS R4,R5;ASL,ROL SHIFTS R2,R3
6216  025350  005004                    CLR     R4
6217  025352  005002                    CLR     R2
```

```
6218  025354  073400                          ASHC    R0,R4           ;SHIFT R4 LEFT AS SPECIFIED BY R0
6219  025356  006303                  2$:     ASL     R3              ;SHIFT R2,R3 LEFT
6220  025360  006102                          ROL     R2              ;AS SPECIFIED BY R0
6221  025362  077003                          SOB     R0,2$
6222  025364  020402                          CMP     R4,R2           ;CHECK RESULTS
6223  025366  001002                          BNE     3$
6224  025370  020503                          CMP     R5,R3
6225  025372  001401                          BEQ     .+4
6226  025374  104000                  3$:     HLT
6227  025376  005216                          INC     (SP)            ;INCREMENT NEXT PASS SHIFT COUNT
6228  025400  021666  000002                  CMP     (SP),2(SP)      ;REACHED MAX COUNT (31.)
6229  025404  001356                          BNE     1$
6230  025406  022626                          CMP     (SP)+,(SP)+     ;RESTORE STACK PTR
6231
6232  025410  012746  177740          ASHCR0: MOV     #-32.,-(SP)     ;PUT MAX RIGHT SHIFT COUNT ON STACK
6233  025414  012746  177777                  MOV     #-1,-(SP)       ;PUT PASS SHIFT COUNT ON STACK
6234  025420  011600                  1$:     MOV     (SP),R0         ;GET PASS SHIFT COUNT
6235  025422  010702                          MOV     PC,R2           ;R2,R3 & R4,R5 ARE THE DATA REGISTERS
6236  025424  010204                          MOV     R2,R4           ;TO BE SHIFTED BY TEST
6237  025426  005003                          CLR     R3
6238  025430  005005                          CLR     R5
6239  025432  000262                          SEV                     ;SET V BIT IN PSW
6240  025434  073200                          ASHC    R0,R2           ;SHIFT R2,R3 RIGHT R0 TIMES
6241  025436  102410                          BVS     3$              ;SHIFT RIGHT CLEARS V
6242  025440  005400                          NEG     R0              ;NEGATE SHIFT COUNT FOR SOB
6243  025442  006204                  2$:     ASR     R4              ;SHIFT R4,R5 RIGHT R0 TIMES
6244  025444  006005                          ROR     R5
6245  025446  077003                          SOB     R0,2$
6246  025450  020204                          CMP     R2,R4           ;CHECK RESULT
6247  025452  001002                          BNE     3$
6248  025454  020305                          CMP     R3,R5
6249  025456  001401                          BEQ     .+4
6250  025460  104000                  3$:     HLT
6251  025462  005316                          DEC     (SP)            ;SET SHIFT COUNT FOR NEXT PASS
6252  025464  021666  000002                  CMP     (SP),2(SP)      ;CHECK IF MAX SHIFT COUNT
6253  025470  001353                          BNE     1$
6254  025472  022626                          CMP     (SP)+,(SP)+     ;RESTORE STACK PTR
6255                                  ;;*****************************************************************
6256                                  ;*TEST 54       CHECK MUL
6257                                  ;*      THE BELOW TEST OF THE MUL INSTRUCTION MULTIPLIES THE CURRENT PC
6258                                  ;*      BY 1,2,4,8 ETC AND SHIFTS THE SAME PC VALUE USING AN ASHC LEFT BY
6259                                  ;*      0,1,2,3,ETC AND COMPARES THE RESULTS. CONDITION CODE RESULTS ARE NOT CHECKED.
6260                                  ;;*****************************************************************
6261  025474                          TST54:
6262  025474  000004                          SCOPE
6263  025476  112737  000054  001202          MOVB    #54,@#$TSTNM
6264  025504  012700  000001          MUL0:   MOV     #1,R0           ;R0 CONTAINS MULTIPLIER FOR MUL
6265  025510  012706  000700                  MOV     #USESTK,SP      ;SETUP THE STACK
6266  025514  005016                          CLR     (SP)            ;(SP) CONTAINS SHIFT VALUE FOR ASHC
6267  025516  010702                  1$      MOV     PC,R2           ;R3,R2 & R5,R4 ARE DATA REGISTERS
6268  025520  010227                          MOV     R2,(PC)+        ;SAVE MULTIPICAND
6269  025522  000000                          .WORD   0               ;CONTAINS ORIGINAL MULTIPICAND
6270  025524  005003                          CLR     R3
6271  025526  005004                          CLR     R4
6272  025530  010205                          MOV     R2,R5           ;FOR MUL AND ASHC
6273  025532  100001                          BPL     .+4             ;IF MULTPICAND IS NEG THEN SET R4 = -1
```

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6274  025534  005104                  COM     R4              ;FOR ASHC
6275  025536  000277                  SCC                     ;PRESET CC'S
6276  025540  070200                  MUL     R0,R2           ;MULTIPLY R2 BY R0 LEAVE PRODUCT
6277                                                          ;IN R2,R3 MSH IN R2,LSH IN R3
6278  025542  102406                  BVS     2$
6279  025544  001405                  BEQ     2$              ;PRODUCT WILL NEVER BE = 0
6280  025546  073416                  ASHC    (SP),R4         ;'MULTIPLY' R4,R5 BY (SP) LEAVE PRODUCT
6281                                                          ;IN R4,R5 MSH IN R4,LSH IN R5
6282  025550  020204                  CMP     R2,R4           ;CHECK MSH RESULT
6283  025552  001002                  BNE     2$
6284  025554  020305                  CMP     R3,R5           ;CHECK LSH RESULT
6285  025556  001401                  BEQ     .+4
6286  025560  104000            2$:   HLT
6287  025562  005216                  INC     (SP)            ;INCREMENT ASHC SHIFT COUNT
6288  025564  006300                  ASL     R0              ;SHIFT MUL MULTIPLIER
6289  025566  102353                  BVC     1$
6290                            ;CHECK MUL INST WITH MULTIPLIER (R0) = 100000
6291  025570  010702                  MOV     PC,R2           ;R2 = MULTIPICAND
6292  025572  005202                  INC     R2
6293  025574  010227                  MOV     R2,(PC)+        ;SAVE MULTIPICAND
6294  025576  000000                  .WORD   0               ;CONTAINS ORIGINAL MULTIPICAND
6295  025600  005103                  COM     R3
6296  025602  010204                  MOV     R2,R4           ;R4 WILL BE MSH 'PRODUCT'
6297  025604  006204                  ASR     R4              ;FORM 'PRODUCT'
6298  025606  005104                  COM     R4              ;COMPLEMENT MSH 'PRODUCT'
6299  025610  070200                  MUL     R0,R2           ;MULTIPLY R2 BY 100000 LEAVING
6300                                                          ;R2 = MSH, R3 = LSH PRODUCT
6301  025612  020204                  CMP     R2,R4           ;COMPARE MSH PRODUCTS
6302  025614  001002                  BNE     3$
6303  025616  020003                  CMP     R0,R3           ;CHECK LSH PRODUCT
6304  025620  001401                  BEQ     .+4
6305  025622  104000            3$:   HLT
6306                            ;*****************************************************************
6307                            ;*TEST 55       CHECK THE DIV INSTRUCTION
6308                            ;*      THE BELOW TEST OF THE DIV INSTRUCTION DIVIDES THE CURRENT PC BY
6309                            ;*      1,2,4,8,ETC LEAVING THE QUOTIENT/REMAINDER IN R2/R3. NEXT THE QUOTIENT
6310                            ;*      IS MULTPLIED BY 1,2,4,8,ETC AND THE REMAINDER ADDED. THE RESULT IS
6311                            ;*      THEN COMPARED WITH THE ORIGINAL CURRENT PC.
6312                            ;*****************************************************************
6313  025624                    ;ST55:
6314  025624  000004                  SCOPE
6315  025626  112737  000055  001202  DIV0:   MOVB    #55,@#$TSTNM
6316  025634  012700  000001          1$:     MOV     #1,R0           ;R0=DIVISOR
6317  025640  010716                          MOV     PC,(SP)         ;SAVE DATA ON STACK
6318  025642  011603                          MOV     (SP),R3         ;GET DATA
6319  025644  005002                          CLR     R2              ;CLEAR MSH DIVIDEND
6320  025646  000277                          SCC
6321  025650  071200                          DIV     R0,R2           ;DIVIDE R2 BY R0 LEAVING QUOTIENT IN R2
6322                                                                  ;AND REMAINDER IN R3
6323  025652  103417                          BCS     2$
6324  025654  100416                          BMI     2$
6325  025656  102007                          BVC     20$             ;BRANCH IF DIVIDE WORKED
6326  025660  022700  000001                  CMP     #1,R0           ;V BIT SHOULD ONLY SET IF DIVIDING BY 1
6327  025664  001012                          BNE     2$              ;AND THE LSH OF DIVIDEND
6328  025666  032716  100000                  BIT     #100000,(SP)    ;IS NEGATIVE
6329  025672  001407                          BEQ     2$
```

```
6330  025674  000407                          BR      3$
6331  025676  010204                  20$:    MOV     R2,R4           ;GET QUOTIENT
6332  025700  070400                          MUL     R0,R4           ;MULTIPLY QUOTIENT BY DIVISOR
6333  025702  060305                          ADD     R3,R5           ;ADD REMAINDER TO LSH PRODUCT
6334  025704  103402                          BCS     2$              ;SHOULD BE NO CARRY
6335  025706  021605                          CMP     (SP),R5         ;CHECK RESULT
6336  025710  001401                          BEQ     .+4
6337  025712  104000                  2$:     HLT                     ;ERROR! DIVIDE FAILED
6338                                                                  ;QUOTIENT IS IN R2,REMAINDER IN R3
6339                                                                  ;ORIGINAL PC IS ON STACK AND FINAL
6340                                                                  ;PRODUCT IN R4,R5 [MSH][LSH]
6341  025714  006300                  3$:     ASL     R0              ;GET NEXT DIVISOR
6342  025716  102351                          BVC     1$
6343
6344                                  ;CHECK ASH,ASHC,MUL, AND DIV INSTRUCTIONS USING ADDRESS MODE 1
6345  025720  005016                  ASHL1:  CLR     (SP)            ;(SP) = SHIFT COUNT
6346  025722  005000                          CLR     R0              ;R0 = SHIFT COUNT FOR CHECK ASH
6347  025724  012702  000020                  MOV     #16.,R2         ;R2 = MAX LEFT SHIFT COUNT
6348  025730  005067  000012          1$:     CLR     2$              ;CLEAR CC'S HOLDING ADDRESS
6349  025734  010703                          MOV     PC,R3           ;R3,R4 = DATA TO BE SHIFTED
6350  025736  010304                          MOV     R3,R4
6351  025740  072316                          ASH     (SP),R3         ;SHIFT R3 LEFT (SP) TIMES
6352  025742  013727  177776                  MOV     @#PSW,(PC)+     ;SAVE CC'S
6353  025746  000000                  2$:     .WORD   0               ;CONTAINS ASH (SP),R3 CC'S IN EVEN BYTE
6354                                                                  ;AND ASH R0,R4 CC'S IN ODD BYTE
6355  025750  072400                          ASH     R0,R4           ;SHIFT R4 LEFT R0 TIMES
6356  025752  113767  177776  177767          MOVB    @#PSW,2$+1      ;SAVE CC'S IN ODD BYTE OF 2$
6357  025760  020304                          CMP     R3,R4           ;COMPARE RESULTS
6358  025762  001004                          BNE     3$              ;BRANCH IF THEY DO NOT COMPARE
6359  025764  126767  177756  177755          CMPB    2$,2$+1         ;CHECK CC'S AFTER ASH INSTRUCTIONS
6360  025772  001401                          BEQ     .+4
6361  025774  104000                  3$:     HLT                     ;ERROR! EITHER RESULTS OF SHIFT OR
6362                                                                  ;RESULT CC'S ARE INCORRECT
6363  025776  005200                          INC     R0              ;INCREMENT SHIFT COUNT FOR ASH R0,R4
6364  026000  005216                          INC     (SP)            ;INCREMENT SHIFT COUNT FOR ASH (SP),R3
6365  026002  020200                          CMP     R2,R0           ;CHECK FOR MAX SHIFT COUNT
6366  026004  001351                          BNE     1$
6367
6368  026006  005016                  ASHR1:  CLR     (SP)            ;(SP) = SHIFT COUNT FOR ASH (SP),R4
6369  026010  005000                          CLR     R0              ;R0 = SHIFT COUNT FOR ASH R0,R5
6370  026012  005402                          NEG     R2              ;R2 = MAX RIGHT SHIFT COUNT (SET BY
6371                                                                  ;ABOVE TEST TO 16. NOW = -16.
6372  026014  005067  000012          1$:     CLR     2$              ;CLEAR CC'S HOLDING ADDRESS
6373  026020  010704                          MOV     PC,R4           ;R4,R5 = DATA TO BE SHIFTED RIGHT
6374  026022  010405                          MOV     R4,R5
6375  026024  072416                          ASH     (SP),R4         ;SHIFT R4 RIGHT (SP) TIMES
6376  026026  013727  177776                  MOV     @#PSW,(PC)+     ;SAVE CC'S
6377  026032  000000                  2$:     .WORD   0               ;CONTAINS ASH (SP),R4 CC'S IN EVEN BYTE
6378                                                                  ;AND ASH R0,R5 CC'S IN ODD BYTE
6379  026034  072500                          ASH     R0,R5           ;SHIFT R5 RIGHT R0 TIMES
6380  026036  113767  177776  177767          MOVB    @#PSW,2$+1      ;SAVE CC'S IN ODD BYTE 2$
6381  026044  020405                          CMP     R4,R5           ;CHECK RESULTS
6382  026046  001004                          BNE     3$
6383  026050  126767  177756  177755          CMPB    2$,2$+1         ;CHECK RESULT CC'S
6384  026056  001401                          BEQ     .+4
6385  026060  104000                  3$:     HLT                     ;ERROR! EITHER RESULTS OR RESULT CC'S
```

```
                                                        ;DID NOT COMPARE
026062  005300                    DEC     R0              ;DECREMENT SHIFT COUNT
026064  005316                    DEC     (SP)            ;DECREMENT SHIFT COUNT FOR ASH (SP),R4
026066  020002                    CMP     R0,R2           ;CHECK FOR MAX RIGHT SHIFT
026070  001351                    BNE     1$
                        ;;*****************************************************************
                        ;*TEST 56       DIVIDE AGAIN
                        ;*      THE BELOW TEST CHECKS THE DIVIDE INSTRUCTION BY DIVIDING
                        ;*      THE CURRENT PC BY ITSELF+1. THE QUOTIENT (IN R2) ALWAYS = 0,
                        ;*      AND THE REMAINDER (IN R3) ALWAYS = THE CURRENT PC.
                        ;;*****************************************************************
026072                  ;ST56:
026072  000004                    SCOPE
026074  112737  000056  001202    MOVB    #56,@#$TSTNM
026102  010703          DIV1:     MOV     PC,R3           ;CURRENT PC IS LSH DIVIDEND
026104  006702                    SXT     R2              ;EXTEND SIGN TO R2 (MSH DIVIDEND)
026106  010304                    MOV     R3,R4           ;SAVE ORIGINAL DIVIDEND
026110  010316                    MOV     R3,(SP)         ;PUT ON STACK
026112  005216                    INC     (SP)            ;ADD 1 (WILL BE DIVISOR)
026114  100002                    BPL     1$              ;BRANCH IF POSITIVE
026116  162716  000002            SUB     #2,(SP)         ;MAKE DIVISOR 1 LESS THAN DIVIDEND
026122  071216          1$:       DIV     (SP),R2         ;DIVIDE R2 BY (SP)
026124  103410                    BCS     2$              ;CHECK CONDITION CODES
026126  102407                    BVS     2$
026130  001006                    BNE     2$
026132  100405                    BMI     2$
026134  005702                    TST     R2              ;CHECK QUOTIENT (R2 = 0)
026136  001361                    BNE     DIV1
026140  010416                    MOV     R4,(SP)         ;GET ORIGINAL DIVISOR
026142  020316                    CMP     R3,(SP)         ;CHECK REMAINDER
026144  001401                    BEQ     .+4
026146  104000          2$:       HLT                     ;REPORT ERROR
```

```
                        ;*
                        ;*      THIS SECTION OF THE MED TESTS EXERCISES CERTAIN SCRATCH
                        ;*      PAD REGISTERS USING MED READS AND WRITES.  THEIR ORIGINAL
                        ;*      CONTENTS ARE RESTORED BUT:
                        ;*
                        ;*      ******************** IMPORTANT NOTE ********************
                        ;*      *                                                      *
                        ;*      *  THE CONSOLE MUST NOT !!! BE USED DURING THESE MED   *
                        ;*      *  TESTS. NO INTERRUPTS OR TRAPS CAN BE ALLOWED EITHER *
                        ;*      *  (THE T-BIT IS CLEARED FOR THESE TESTS)              *
                        ;*      ********************************************************
                        ;*

                        ;;*****************************************************************
                        ;*TEST 57       CHECK MED IS ILLEGAL IN USER
                        ;*      THE NEXT TWO TESTS BELOW CHECK TO SEE THAT THE "MED"
                        ;*      (MAINTENANCE, EXAM, AND DEPOSIT) INSTRUCTION WILL EXECUTE
                        ;*      WHEN IN KERNEL MODE AND THAT IT IS ILLEGAL IN
                        ;*      USER MODE
```

```
6442                                    ;;*****************************************************************
6443  026150                            ;TST57:
6444  026150  000004                           SCOPE
6445  026152  112737  000057  001202           MOVB    #57,@#$TSTNM
6446  026160  012737  000001  001324           MOV     #1,@#$TIMES     ;DO 1 ITERATION
6447  026166  013737  177776  002362  MED1:    MOV     @#PSW,@#PSWHOL  ;SAVE PSW
6448  026174  004737  054112                   JSR     PC,@#CLRTBIT    ;GO CLEAR "T-BIT" IF SET
6449  026200  012700  000340                   MOV     #340,R0         ;SET "VECTOR+2'S" UP FOR MED TESTS
6450  026204  010037  000006                   MOV     R0,@#6
6451  026210  010037  000012                   MOV     R0,@#12
6452  026214  010037  000022                   MOV     R0,@#22
6453  026220  010037  000032                   MOV     R0,@#32
6454  026224  010037  000116                   MOV     R0,@#116
6455  026230  012737  140340  177776           MOV     #140340,@#PSW   ;GO TO USER MODE
6456  026236  012706  000700                   MOV     #USESTK,SP      ;SETUP USER STACK PTR.
6457  026242  010746                           MOV     PC,-(SP)        ;GET CURRENT PC
6458  026244  062716  000032                   ADD     #2$-.,(SP)
6459  026250  011637  000004                   MOV     (SP),@#ERRVEC   ;SET ERROR TRAP VECTOR TO 2$ BELOW
6460  026254  012637  000010                   MOV     (SP)+,@#RESVEC  ;LOAD RESERVED INST. TRAP VECTOR
6461  026260  012701  177777                   MOV     #-1,R1          ;LOAD R1 WITH A -1
6462  026264  005000                           CLR     R0              ;CLEAR R0
6463  026266  076600                           MED                     ;TRY TO DO MAINT. EXAMINE
6464  026270  000041                           .WORD   041             ;MED READ CODE FOR R1
6465  026272  104000                   1$:     HLT                     ;ERROR - MED INST. NOT ILLEGAL IN USER
6466  026274  000407                           BR      4$
6467  026276  005700                   2$:     TST     R0              ;IS R0 UNCHANGED?
6468  026300  001401                           BEQ     3$              ;BRANCH IF YES
6469  026302  104000                           HLT                     ;ERROR - MED INSTRUCTION WAS EXECUTED
6470                                                                   ;BEFORE TRAPPING
6471  026304  010716                   3$:     MOV     PC,(SP)         ;REPLACE RETURN PC WITH
6472  026306  062716  000006                   ADD     #4$-.,(SP)      ;ADDRESS OF 4$ BELOW
6473  026312  000002                           RTI                     ;RETURN (TO 4$)
6474  026314  012737  055064  000004  4$:     MOV     #ERPRT,@#ERRVEC;RESTORE ERROR TRAP VECTOR
6475  026322  012737  054774  000010           MOV     #RESERR,@#RESVEC;RESTORE RESERVED INST. TRAP VECTOR
6476                                    ;;*****************************************************************
6477                                    ;*TEST 60       CHECK MED DOESN'T AFFECT PSW
6478                                    ;;*****************************************************************
6479  026330                            ;TST60:
6480  026330  000004                           SCOPE
6481  026332  112737  000060  001202           MOVB    #60,@#$TSTNM
6482
6483  026340  005037  177776           MED0:   CLR     @#PSW           ;GO TO KERNEL MODE
6484  026344  000257                           CCC                     ;CLEAR CONDITION CODE BITS
6485  026346  076600                           MED                     ;DO MAINT. EXAMINE OF R1
6486  026350  000041                           .WORD   041             ;MED READ CODE FOR R1
6487  026352  103403                           BCS     MEDHLT
6488  026354  102402                           BVS     MEDHLT
6489  026356  100401                           BMI     MEDHLT
6490  026360  001001                           BNE     .+4
6491  026362  104000                   MEDHLT: HLT                     ;ERROR CC-BITS IN PSW AFFECTED BY MED
6492
6493                                    ;;*****************************************************************
6494                                    ;*TEST 61       MED TEST - R/W DATA PATTERNS TO REGS
6495                                    ;*      THIS PARTICULAR MED TEST WRITES DATA PATTERNS
6496                                    ;*      TO THOSE INTERNAL REGS. WHICH CAN BE WRITTEN
6497                                    ;*      AND READ WITHOUT SPECIAL CONSIDERAIONS.  REGISTERS
```

```
6498                                    ;*      REQUIRING SPECIAL TESTS ARE TESTED IN LATER
6499                                    ;*      MED TESTS.
6500                                    ;*      TABLE II CONTAINS THE REGISTER ADDRESSES.
6501                                    ;*
6502                                    ;;**********************************************************************
6503  026364                            TST61:
6504  026364  000004                           SCOPE
6505  026366  112737  000061  001202           MOVB    #61,@#STSTNM
6506  026374  012737  000340  177776   MEDT1:  MOV     #340,@#PSW      ;KERNEL MODE-PRIORITY 7
6507  026402  012701  002502                   MOV     #TBL2,R1        ;INITIALIZE ADDRESS POINTER
6508  026406  012737  125252  002476   1$:     MOV     #125252,@#MEDTP2
6509  026414  111167  000036                   MOVB    (R1),11$        ;PUT WRITE CODE BY "WRITE-MED'S"
6510  026420  112167  000054                   MOVB    (R1)+,13$       ;AND POINT R1 TO READ CODE
6511  026424  111167  000006                   MOVB    (R1),10$        ;PUT READ CODE BY "READ-MED'S"
6512  026430  112167  000030                   MOVB    (R1)+,12$       ;R1 NOW POINTS TO NEXT REG.
6513  026434  076600                   2$:     MED                     ;MED-READ THE INTERNAL REG.
6514  026436  000000                   10$:    .WORD   0               ;MED-READ CODE
6515  026440  010037  002472                   MOV     R0,@#MEDTP0     ;SAVE ITS ORIGINAL CONTENTS
6516  026444  010137  002474                   MOV     R1,@#MEDTP1     ;SAVE ADDR. PTR. VALUE
6517  026450  013700  002476                   MOV     @#MEDTP2,R0     ;LOAD R0 WITH DATA TO BE WRITTEN
6518  026454  076600                           MED                     ;MED-WRITE THE TEST DATA
6519  026456  000000                   11$:    .WORD   0               ;MED-WRITE CODE
6520  026460  005000                           CLR     R0              ;CLEAR R0
6521  026462  076600                           MED                     ;MED-READ THE DATA BACK
6522  026464  000000                   12$:    .WORD   0               ;MED-READ CODE
6523  026466  010037  002500                   MOV     R0,@#MEDTP3     ;SAVE DATA READ FOR COMPARISON
6524  026472  013700  002472                   MOV     @#MEDTP0,R0     ;LOAD ORIGINAL DATA IN R0
6525  026476  076600                           MED                     ;MED-WRITE ORG. DATA TO REG.
6526  026500  000000                   13$:    .WORD   0               ;MED-WRITE CODE
6527  026502  023737  002476  002500           CMP     @#MEDTP2,@#MEDTP3  ;DID DATA READ=DATA WRITTEN?
6528  026510  001401                           BEQ     3$              ;BRANCH IF YES
6529  026512  104000                           HLT                     ;INT. REG. READ BACK WRONG DATA
6530                                                                   ;MEDCODE WILL BE AT 12$
6531                                                                   ;DATA EXPECTED IS IN MEDTP2
6532                                                                   ;DATA RECEIVED IS IN MEDTP3
6533  026514  005137  002476           3$:     COM     @#MEDTP2        ;CHANGE DATA PATTERN
6534  026520  013701  002474                   MOV     @#MEDTP1,R1     ;RESTORE ADDR. POINTER
6535  026524  022737  125252  002476           CMP     #125252,@#MEDTP2  ;BOTH DATA PATTERNS BEEN USED?
6536  026532  001340                           BNE     2$              ;BRANCH IF NO
6537  026534  005711                           TST     (R1)            ;END OF ADDR. TABLE?
6538  026536  001323                           BNE     1$              ;BRANCH IF NO
6539
6540
6541
6542
6543                                    ;;**********************************************************************
6544                                    ;*TEST 62       MED TEST - CSP CONSTANTS CHECK
6545                                    ;*
6546                                    ;*      THIS TEST CHECKS THE CONSTANT VALUES LOCATED
6547                                    ;*      IN THE C SCRATCH PAD.  THE CONSTANTS ARE READ
6548                                    ;*      WITH A MED INSTRUCTION AND COMPARED TO THEIR
6549                                    ;*      EXPECTED VALUE.  THE ADDRESSES OF THESE CONSTANTS
6550                                    ;*      AND THE VALUES EXPECTED ARE IN TABLE VII.
6551                                    ;*
6552                                    ;;**********************************************************************
6553  026540                            TST62:
```

```
6554  026540  000004                          SCOPE
6555  026542  112737  000062  001202          MOVB    #62,@#$TSTNM
6556
6557  026550  170000                  MEDT10: CFCC                    ;EXECUTE FLT. PT INST. SO FLT. PT.
6558                                                                  ;CONSTANTS ARE LOADED INTO CSP
6559  026552  012701  003034                  MOV     #TBL7,R1        ;SETUP TABLE POINTER
6560  026556  012167  000006          10$:    MOV     (R1)+,1$        ;LOAD MED READ CODE AT 1$
6561  026562  001412                          BEQ     11$             ;EXIT IF END OF TEST
6562  026564  005000                          CLR     R0
6563  026566  076600                          MED                     ;READ INTERNAL CONTENTS INTO R0
6564  026570  000000                  1$:     .WORD   0
6565  026572  020021                          CMP     R0,(R1)+        ;DID I READ THE CONSTANT I EXPECTED
6566  026574  001770                          BEQ     10$             ;BRANCH IF YES
6567  026576  016137  177776  002476          MOV     -2(R1),@#MEDTP2 ;SAVE CONSTANT VALUE EXPECTED
6568  026604  104000                          HLT                     ;CSP LOCATION HELD WRONG VALUE
6569                                                                  ;MEDCODE IS AT 1$
6570                                                                  ;DATA EXPECTED IS IN MEDTP2
6571                                                                  ;DATA RECEIVED IS IN R0 OR THE LOC. ITSELF
6572  026606  000763                          BR      10$             ;BRANCH BACK TO TEST NEXT CONSTANT
6573  026610                          11$:
6574
6575
6576                                  ;;*****************************************************************
6577                                  ;*TEST 63       MED TEST - MICROBK CHECK OF MICRO-POINTS
6578                                  ;*
6579                                  ;*      THIS TEST USES THE MICROBREAK REGISTER AND THE
6580                                  ;*      INFORMATION IN TABLE V TO CHECK THAT THE
6581                                  ;*      CORRECT MED-FLOW IS ENTERED WHEN EACH
6582                                  ;*      REGISTER IS ACCESSED BY A MED INSTRUCTION.
6583                                  ;*      THE MICROBREAK REG. IS SETUP TO CAUSE A TRAP TO
6584                                  ;*      LOC. 4 WHEN ITS CONTENTS EQUAL THE ADDRESS
6585                                  ;*      OF THE MIRCOWORD BEING EXECUTED.
6586                                  ;*
6587                                  ;*          NOTE:  THE MICRO BREAK - TRAP-TO-4 CAPABILITY
6588                                  ;*                 IS TRIED AT THE BEGINNING OF THE TEST.
6589                                  ;*                 IF IT DOESN'T WORK, AN ERROR IS PRINTED
6590                                  ;*                 AND THE TEST IS SKIPPED
6591                                  ;*
6592                                  ;;*****************************************************************
6593  026610                          TST63:
6594  026610  000004                          SCOPE
6595  026612  112737  000063  001202          MOVB    #63,@#$TSTNM
6596  026620  012737  000071  177770  MEDT11: MOV     #SWB01,@#UBREAK ;LOAD MICROBK. REG. WITH AN MICRO ADDR.
6597  026626  012737  055172  000004          MOV     #BKROUT,@#4     ;LOAD ADDR. OF MICROBK. ROUTINE IN 4
6598  026634  005037  055200                  CLR     @#BKFLAG        ;CLEAR MICROBK. TRAP FLAG
6599  026640  076600                          MED
6600  026642  000022                          RDWHAMI
6601  026644  042700  100001                  BIC     #BIT15+BIT0,R0  ;ENSURE LOG "CONTINUOUS" MODE
6602  026650  052700  001000                  BIS     #BIT9,R0
6603  026654  076600                          MED                     ;MED-WRITE THE WHAMI REG TO
6604  026656  000222                  10$:    WRWHAMI                 ;ENABLE MICROBK-TRAP-TO-4
6605  026660  076600                          MED
6606  026662  000144                          RDFLAG
6607  026664  052700  100000                  BIS     #BIT15,R0
6608  026670  076600                          MED                     ;MED-WRITE THE FLAG REG TO
6609  026672  000344                  11$:    WRFLAG                  ;ENABLE MICROBK TRAPPING
```

```
6610  026674  000300                        SWAB    R0              ;MICROBK TRAP SHOULD OCCUR ON SWAB
6611  026676  005737  055200                TST     @#BKFLAG        ;DID TRAP TO 4 OCCUR?
6612  026702  001020                        BNE     1$              ;BRANCH IF YES
6613  026704  104000                        HLT                     ;MICROBREAK TRAP DIDN'T WORK
6614                                                                ;WHEN TRIED TO TRAP IN "SWAB" ROUTINE
6615                                                                ;THEREFORE REST OF TEST IS SKIPPED
6616  026706  104401  026714                TYPE    ,65$            ;;TYPE ASCIZ STRING
6617  026712  000413                        BR      64$             ;;GET OVER THE ASCIZ
6618                                ;;65$:    .ASCIZ  <15><12>?SKIP TO NEXT TEST?<15><12>
6619  026742                                64$:
6620  026742  000444                        BR      50$             ;SKIP TO END OF TEST
6621
6622
6623  026744  076600                1$:     MED                     ;READ THE LOG CUA REG.
6624  026746  000103                        RDLCUA
6625  026750  042700  100007                BIC     #100007,R0      ;MASK OFF NON-ADDRESS BITS
6626  026754  020027  000710                CMP     R0,#SWB1A       ;WAS CORRECT MICRO ADDR. LOGGED?
6627                                                                ;(MICRO ADDR. TRAPPED ON SHIFTED RIGHT)
6628  026760  001401                        BEQ     16$             ;BRANCH IF YES
6629  026762  104000                        HLT                     ;LOG CUA DID NOT CONTAIN MICRO
6630  026764                        16$:                            ;ADDR. IT SHOULD HAVE CONTAINED AFTER
6631                                                                ;MICROBREAKING ON "SWB01"
6632  026764  012701  002734                MOV     #TBL5,R1        ;INTIALIZE TABLE PTR. (R1)
6633  026770  012702  002762                MOV     #TBL6,R2
6634  026774  105711                2$:     TSTB    (R1)            ;IS OPERATION CODE = 0
6635  026776  001426                        BEQ     50$             ;BRANCH IF YES, END OF TABLE
6636  027000  111167  000030                MOVB    (R1),12$        ;IF NO, LOAD WRITE CODE AFTER MED
6637  027004  011237  177770        4$:     MOV     (R2),@#UBREAK   ;LOAD MICROBK REG. WITH MICROADDR.
6638  027010  005037  055200                CLR     @#BKFLAG        ;CLEAR MICROBK TRAP-TO-4 FLAG
6639  027014  076600                        MED
6640  027016  000144                        RDFLAG
6641  027020  052700  100000                BIS     #BIT15,R0
6642  027024  076600                        MED                     ;MED WRITE TO FLAG REG TO
6643  027026  000344                15$:    WRFLAG                  ;ENABLE MICROBK TRAPPING
6644  027030  005000                        CLR     R0              ;CLEAR R0 IN CASE MICROBK DOESN'T OCCUR
6645  027032  076600                        MED
6646  027034  000000                12$:    .WORD   0
6647  027036  005737  055200                TST     @#BKFLAG        ;DID WE TRAP-TO-4? (FLAG NOT = 0)
6648  027042  001001                        BNE     20$             ;BRANCH IF YES TO NEXT ENTRY
6649  027044  104000                        HLT                     ;MICROBK. TRAP-TO-4 DID NOT OCCUR
6650                                                                ;MEDCODE IS AT 12$
6651                                                                ;MICROADDRESS IS AT ADDRESS CONTAINED IN R2)
6652
6653  027046  105721                20$:    TSTB    (R1)+
6654  027050  005722                        TST     (R2)+
6655  027052  000750                        BR      2$              ;BRANCH BACK TO 2$
6656
6657  027054  076600                50$:    MED                     ;TEST IS OVER, DISABLE TRAPPING
6658  027056  000022                        RDWHAMI
6659  027060  042700  001000                BIC     #BIT9,R0
6660  027064  076600                        MED                     ;CLEAR THE WHAMI REG. TO
6661  027066  000222                14$:    WRWHAMI                 ;    DISABLE MICROBK. TRAP-TO-4
6662  027070  012737  055064  000004        MOV     #ERPRT,@#4      ;RESTORE NORMAL ERROR ROUTINE
6663
6664
6665                                ;*      THE FOLLOWING TESTS WILL BE EXECUTED WHEN RELOCATED
```

```
6666                                    ;*
6667
6668
6669                                    ;;*****************************************************************
6670                                    ;*TEST 64       PHYSICAL ADDRESS & ODD ADDRESS ERROR LOGGING
6671                                    ;*      THIS TEST CHECKS THAT THE PROPER PHYSICAL ADDRESS BITS
6672                                    ;*      <17:00> ARE LOGGED UPON ERROR.  THE ERROR IS CAUSED BY
6673                                    ;*      FORCING AN ODD ADDRESS TRAP.  THE ERROR LOG MODE USED
6674                                    ;*      IS "LOG FIRST".  ALSO, THE ODD ADDRESS ERROR BITS IN
6675                                    ;*      THE LOG JAM AND CPU ERROR REGISTER ARE CHECKED.
6676                                    ;*****************************************************************
6677  027076                            ;ST64:
6678  027076  000004                           SCOPE
6679  027100  112737  000064  001202           MOVB    #64,@#STSTNM
6680  027106  010700                           MOV     PC,R0           ;SETUP NEW PC & PSW FOR THE
6681  027110  062700  000042                   ADD     #2$-.,R0        ;ODD ADDRESS SERVICE ROUTINE
6682  027114  010701                           MOV     PC,R1           ;GET CURRENT PC
6683  027116  062701  000005                   ADD     #1$+1-.,R1      ;FORM ADDRESS OF 1$+1
6684  027122  010037  000004           1$:     MOV     R0,@#4
6685  027126  076600                           MED
6686  027130  000022                           RDWHAMI
6687  027132  052700  100001                   BIS     #BIT15+BIT0,R0  ;SETUP "LOG FIRST" MODE
6688  027136  076600                           MED
6689  027140  000222                           WRWHAMI
6690  027142  005767  177755                   JST     1$+1            ;DO ODD ADDRESS INSTRUCTION TO FORCE
6691                                                                   ;A JAMUPP & TRAP TO 4
6692  027146  104000                           HLT                     ;*** ODD ADDR. TRAP DID NOT OCCUR
6693  027150  000454                           BR      10$             ;EXIT TEST
6694  027152  022626                   2$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
6695  027154  012737  055064  000004           MOV     #ERPRT,@#4      ;RESTORE OLD PC
6696  027162  032737  000100  177766           BIT     #BIT6,@#CPUERR  ;WAS ODD ADDR. ERROR RECORDED BY
6697                                                                   ;THE CPU ERROR REGISTER?
6698  027170  001001                           BNE     3$              ;BRANCH IF YES
6699  027172  104000                           HLT                     ;*** CPU ERROR REG. DID NOT
6700                                                                   ;REPORT ODD ADDRESS ERROR
6701                                                                   ;READ THE LOG JAM REGISTER
6702  027174  076600                   3$:     MED                     ;READ LOG JAM REG.
6703  027176  000100                           RDLJAM
6704  027200  032700  100004                   BIT     #BIT15+BIT2,R0  ;WAS ODD ADDR. ERROR LOGGED BY LOG JAM
6705  027204  001001                           BNE     4$              ;BRANCH IF YES
6706  027206  104000                           HLT                     ;*** LOG JAM REG.  DID NOT LOG
6707                                                                   ;ODD ADDRESS ERROR CORRECTLY
6708  027210  010137  001536           4$:     MOV     R1,@#VADR       ;STORE VIRTUAL ADDR. OF ODD ADDR. INSTRUCTION
6709  027214  004737  053724                   JSR     PC,@#CNVADR     ;CONVERT IT TO AN 18-BIT PHYSICAL ADDR.
6710  027220  005005                           CLR     R5
6711  027222  076600                           MED                     ;READ THE LOG PBA REGISTER
6712  027224  000102                           RDLPBA
6713  027226  010037  002472                   MOV     R0,@#MEDTPO
6714  027232  063737  001550  001540           ADD     @#FACTOR,@#PA1500 ;ADD RELOCATION FACTOR
6715  027240  020037  001540                   CMP     R0,@#PA1500     ;WERE BITS <15:00> OF THE PHYSICAL
6716                                                                   ;BUS ADDR. LOGGED CORRECTLY?
6717  027244  001401                           BEQ     5$              ;BRANCH IF YES
6718  027246  005205                           INC     R5
6719  027250  076600                   5$:     MED                     ;READ THE LOG SERVICE REGISTER
6720  027252  000101                           RDLSERVICE
6721  027254  000300                           SWAB    R0              ;GET "PBA 17&16" DOWN TO BIT POSITION 0&1
```

```
6722  027256  042700  177774                      BIC     #177774,R0
6723  027262  010037  002476                      MOV     R0,@#MEDTP2
6724  027266  020037  001542                      CMP     R0,@#PA1716     ;PBA (17:16) LOGGED CORRECTLY?
6725  027272  001002                              BNE     11$             ;BRANCH IF YES
6726  027274  005705                              TST     R5
6727  027276  001401                              BEQ     10$
6728  027300                                  11$:
6729  027300  104000                              HLT                     ;*** PHYSICAL BUS ADDR. (17:00)
6730                                                                      ;NOT LOGGED CORRECTLY WHEN
6731                                                                      ;ODD ADDRESS TRAP OCCURRED
6732                                                                      ;EXPECTED PBA IS IN "PA1716" & "PA1500"
6733  027302  012737  055064  000004  10$:     MOV     #ERPRT,@#4      ;RESTORE OLD PC  AT 4
6734  027310  076600                          MED
6735  027312  000022                          RDWHAMI
6736  027314  042700  100001                  BIC     #BIT15+BIT0,R0
6737  027320  076600                          MED                     ;DISABLE "LOG FIRST" MODE
6738  027322  000222                          WRWHAMI
6739
6740                                          ;*
6741                                          ;*
6742                                          ;*THE FOLLOWING TESTS WILL NOT BE EXECUTED WHEN RELOCATED
6743                                          ;*
6744
6745
6746
6747
6748
6749                                          ;;*****************************************************************
6750                                          ;*TEST 65       CHECK DISABLE PARITY ERROR TRAP
6751                                                  ;*THIS TEST CHECKS THAT PARITY ERROR TRAPS TO LOCATION 114
6752                                                  ;*ARE DISABLED WHEN BIT0 OF THE CACHE CONTROL REGISTER IS
6753                                                  ;*SET (=1).  A TRAP TO 114 SHOULD NOT OCCUR AND ERROR
6754                                                  ;*INFORMATION SHOULD NOT BE LOGGED IN THE LOG PBA, LOG
6755                                                  ;*CACHE DATA, OR LOG TAG DATA REGISTERS.  WRONG PARITY IS
6756                                                  ;*WRITTEN INTO A TEST LOCATION TO CAUSE THE PARITY ERROR
6757                                                  ;*NEEDED IN THIS TEST.
6758                                          ;;*****************************************************************
6759  027324                                  TST65:
6760  027324  000004                          SCOPE
6761  027326  112737  000065  001202          MOVB    #65,@#$TSTNM
6762  027334  012737  000001  001324          MOV     #1,@#$TIMES     ;DO 1 ITERATION
6763
6764  027342  005737  001550                  TST     @#FACTOR        ;IS RELOCATION FACTOR=0?
6765  027346  001402                          BEQ     14$             ;BRANCH IF YES
6766  027350  000167  001560                  JMP     MEDEX           ;EXIT IF RELOCATED
6767  027354  105737  001545          14$:    TSTB    @#MMON          ;IS MEM. MGMT. ON?
6768  027360  001402                          BEQ     12$             ;BRANCH IF NO
6769  027362  000167  001546                  JMP     MEDEX           ;EXIT IF RELOCATED
6770  027366                                  12$:                    ;DO NEXT 7 TESTS - NOT RELOCATED
6771
6772  027366  012701  002360                  MOV     #TLOC1,R1       ;GET POINTER TO TEST LOCATION
6773  027372  005711                          TST     (R1)            ;MAKE IT A HIT
6774  027374  012737  000100  177746          MOV     #WWP,@#CCR      ;SET WRITE WRONG PARITY BIT
6775  027402  012711  125252                  MOV     #125252,(R1)    ;WRITE TO TEST LOC. WITH WRONG PARITY
6776  027406  012737  000001  177746          MOV     #DPTRP,@#CCR    ;DISABLE PARITY ERROR TRAPS
6777                                                                  ;AND CLEAR WWP
```

```
6778  027414  012737  027446  000114          MOV     #1$,@#114       ;SETUP PARITY ERROR VECTOR
6779  027422  005000                          CLR     R0
6780  027424  076600                          MED                     ;CLEAR LOG PBA REGISTER
6781  027426  000302                          WRLPBA
6782  027430  076600                          MED                     ;CLEAR LOG CACHE DATA REGISTER
6783  027432  000306                          WRLDATA
6784  027434  076600                          MED                     ;CLEAR LOG CACHE TAG REGISTER
6785  027436  000307                          WRLTAG
6786  027440  005767  152714                  TST     TLOC1           ;READ TEST LOC1 TO FORCE PARITY ERROR
6787  027444  000406                          BR      2$              ;BRANCH IF NO TRAP OCCURS
6788  027446  012700  000200          1$:     MOV     #200,R0
6789  027452  076600                          MED                     ;CLEAN UP THE CACHE
6790  027454  000352                          352                     ;INITIALIZATION CODE
6791  027456  022626                          CMP     (SP)+,(SP)+     ;CLEAN UP STACK
6792  027460  104000                          HLT                     ;*** PARITY TRAP TO 114 OCCURRED
6793                                                                  ;WHEN IT SHOULD HAVE BEEN DISABLED
6794  027462  012700  000200          2$:     MOV     #200,R0
6795  027466  076600                          MED
6796  027470  000352                          352                     ;CLEAN UP CACHE WITH INITIALIZATION CODE
6797  027472  012711  125252                  MOV     #125252,(R1)    ;WRITE BACK GOOD PARITY IN TST LOC
6798  027476  012737  054414  000114          MOV     #.PARSRV,@#114  ;RESTORE ORIGINAL PARITY HANDLER
6799  027504  005005                          CLR     R5              ;CLEAR ERROR FLAG
6800  027506  076600                          MED                     ;READ LOG PBA REGISTER
6801  027510  000102                          RDLPBA
6802  027512  010067  152754                  MOV     R0,MEDTP0       ;SAVE COPY
6803                                                                  ;LOG PBA REG. STILL CLEAR?
6804  027516  001401                          BEQ     3$              ;BRANCH IF YES
6805  027520  005205                          INC     R5              ;OTHERWISE SET ERROR FLAG
6806  027522  076600          3$:             MED                     ;READ LOG CACHE DATA REG.
6807  027524  000106                          RDLDATA
6808  027526  010067  152742                  MOV     R0,MEDTP1       ;SAVE COPY
6809                                                                  ;LOG CACHE DATA REG. STILL CLEAR?
6810  027532  001401                          BEQ     4$              ;BRANCH IF YES
6811  027534  005205                          INC     R5              ;OTHERWISE SET ERROR FLAG
6812  027536  076600          4$:             MED                     ;READ LOG CACHE TAG REG.
6813  027540  000107                          RDLTAG
6814  027542  010067  152730                  MOV     R0,MEDTP2       ;SAVE COPY
6815                                                                  ;LOG CACHE TAG REG. STILL CLEAR?
6816  027546  001401                          BEQ     5$              ;BRANCH IF YES
6817  027550  005205                          INC     R5              ;OTHERWISE SET ERROR FLAG
6818  027552  005705          5$:             TST     R5              ;WERE ANY OF LOG REGISTERS CHANGED
6819  027554  001401                          BEQ     6$              ;BRANCH IF NO
6820  027556  104000                          HLT                     ;*** ONE OF LOG REGISTERS CHANGED
6821                                                                  ;WHEN ERROR SHOULD NOT HAVE BEEN LOGGED
6822                                                                  ;LOG PBA, LOG DATA & LOG TAG
6823                                                                  ;REGISTER SHOULD BE CLEAR.
6824  027560  005037  177746          6$:     CLR     @#CCR           ;ENABLE PARITY ERROR TRAPS
6825
6826                                  ;;*****************************************************************
6827                                  ;*TEST 66        CHECK PARITY ERROR BITS IN MEMERR REG. IN BACKUP MODE OF CACHE (TRAP)
6828
6829                                          ;*THIS TEST CHECKS THAT ALL OF THE PARITY ERROR BITS (5,6,7)
6830                                          ;*OF THE MEMORY ERROR REGISTER ARE SET TO "1" WHEN A CACHE
6831                                          ;*PARITY ERROR OCCURS IN THE BACKUP MODE.
6832                                  ;;*****************************************************************
6833  027564                          TST66:
```

```
6834  027564  000004                          SCOPE
6835  027566  112737  000066  001202          MOVB    #66,@#$TSTNM
6836  027574  012701  002360                  MOV     #TLOC1,R1       ;GET POINTER TO TEST LOCATION
6837  027600  005711                          TST     (R1)            ;MAKE IT A HIT
6838  027602  012737  000100  177746          MOV     #WWP,@#CCR      ;SET WRITE WRONG PARITY BIT
6839  027610  012711  125252                  MOV     #125252,(R1)    ;WRITE TO TEST LOC. WITH WRONG PARITY
6840  027614  042737  000100  177746          BIC     #WWP,@#CCR      ;CLEAR WWP
6841  027622  012737  027650  000114          MOV     #1$,@#114       ;SETUP NEW TEST HANDLER AT PARITY VECTOR
6842  027630  005767  152524                  TST     TLOC1           ;READ TEST LOC. TO FORCE PARITY ERROR
6843  027634  012700  000200                  MOV     #200,R0
6844  027640  076600                          MED                     ;CLEAN UP THE CACHE
6845  027642  000352                          352                     ;INITIALIZATION CODE
6846  027644  104000                          HLT                     ;*** PARITY ERROR DID NOT CAUSE TRAP
6847  027646  000405                          BR      2$              ;BRANCH TO 2$
6848  027650  012700  000200          1$:     MOV     #200,R0
6849  027654  076600                          MED                     ;CLEAN UP CACHE WITH INITIALIZATION CODE
6850  027656  000352                          352
6851  027660  022626                          CMP     (SP)+,(SP)+     ;CLEAN UP STACK
6852  027662  022737  000340  177744  2$:     CMP     #000340,@#MEMERR  ;WERE PARITY ERROR BITS (5,6,7) SET
6853                                                                  ;AND CPU ABORT BIT (15) LEFT CLEAR
6854                                                                  ;IN MEMORY ERROR REGISTER?
6855  027670  001401                          BEQ     3$              ;BRANCH IF YES
6856  027672  104000                          HLT                     ;*** MEMORY ERROR REGISTER BITS
6857                                                                  ;WERE SET INCORRECTLY
6858                                                                  ;PARITY ERROR BITS SHOULD BE SET
6859  027674  012737  054414  000114  3$:     MOV     #.PARSRV,@#114  ;RESTORE OLD PARITY HANDLER PC
6860
6861                          ;;*****************************************************************
6862                          ;*TEST 67       CHECK UNIBUS TIMEOUT, ODD ADDRESS AND LOG CONTINUOUS MODE
6863
6864                                  ;*THIS TEST CHECKS THAT THE "UNIBUS TIMEOUT" BIT (BIT4)
6865                                  ;*GETS SET IN THE CPU ERROR REGISTER WHEN A TIMEOUT OCCURS.
6866                                  ;*A TIMEOUT TRAP IS FORCED BY REFERENCING BUS ADDRESS 760000.
6867                                  ;*THEN AN ODD ADDRESS ERROR IS FORCED AND IT
6868                                  ;*IS CHECKED IF ONLY BIT (6)-ODD ADDRESS ERROR IS SET
6869                                  ;*(IN CPUERR).  THIS CHECKS THAT THE ERROR LOG IS
6870                                  ;*CONTINUOSLY UPDATED IN THE "LOG CONTINUOUS" MODE.
6871                          ;;*****************************************************************
6872  027702                  TST67:
6873  027702  000004                          SCOPE
6874  027704  112737  000067  001202          MOVB    #67,@#$TSTNM
6875  027712  012737  027726  000004          MOV     #1$,@#4         ;SETUP NEW PC
6876  027720  005737  160000                  TST     @#160000        ;FORCE A TIMEOUT TRAP TO 4 BY
6877                                                                  ;REFERENCING NON-EXISTENT ADDRESS
6878  027724  000452                          BR      6$
6879  027726  022626          1$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
6880  027730  012737  055064  000004          MOV     #ERPRT,@#4      ;RESTORE OLD PC
6881  027736  022737  000020  177766          CMP     #BIT4,@#CPUERR  ;DID "UNIBUS TIMEOUT" BIT IN CPU ERROR
6882                                                                  ;REGISTER GET SET?
6883  027744  001401                          BEQ     2$              ;BRANCH IF YES
6884  027746  104000                          HLT                     ;*** "UNIBUS TIMEOUT" BIT (BIT4) IN CPU
6885                                                                  ;ERROR REG. DID NOT SET WHEN A
6886                                                                  ;TIMEOUT WAS FORCED
6887  027750  076600          2$:     MED                     ;READ THE LOG JAM REG.
6888  027752  000100                          RDLJAM
6889  027754  022700  021200                  CMP     #BIT13+BIT9+BIT7,R0     ;DID "UNIBUS TIMEOUT" BIT (BIT7) SET?
```

```
6890                                                    ;BIT 9= POWER STATUS, ALWAYS SET
6891  027760  001401                    BEQ     3$      ;BRANCH IF YES
6892  027762  104000                    HLT             ;*** "UNIBUS TIMEOUT" BIT (BIT7)
6893                                                    ;DID NOT SET IN LOG JAM REGISTER
```

```
6894
6895  027764  076600                    3$:     MFD                     ;WHEN UNIBUS TIMEOUT WAS FORCED
6896  027766  000102                            RDLPBA                  ;READ LOG PBA
6897  027770  020027  160000                    CMP     R0,#160000      ;WAS PHYS BA LOGGED CORRECTLY?
6898  027774  001401                            BEQ     5$
6899  027776  104000                            HLT                     ;PHYSICAL BUS ADDRESS WAS
6900                                                                    ;LOGGED WRONG ON A UNIBUS
6901                                                                    ;TIMEOUT
6902                                                                    ;LOG PBA SHOULD HOLD ADDR. 160000
6903  030000  012737  030014  000004  5$:     MOV     #4$,@#4         ;SET UP PC FOR ODD ADDRESS
6904  030006  005767  177753                  TST     3$+1            ;FORCE ODD ADDRESS ERROR
6905  030012  000417                            BR      6$
6906  030014  022626                    4$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
6907  030016  012737  055064  000004          MOV     #ERPRT,@#4
6908  030024  022737  000100  177766          CMP     #BIT6,@#CPUERR  ;ODD ADDR. BUT SET 3
6909  030032  001401                            BEQ     7$
6910  030034  104000                            HLT                     ;ODD ADDRESS BIT WAS
6911                                                                    ;NOT SET IN THE CPU
6912                                                                    ;ERROR REGISTER.  IN LOG
6913                                                                    ;CONTINUOUS MODE THE
6914                                                                    ;LATEST ERROR SHOULD
6915                                                                    ;BE LOGGED
6916  030036  076600                    7$:     MFD                     ;READ LOG JAM REG.
6917  030040  000100                            RDLJAM
6918  030042  032700  000004                    BIT     #BIT2,R0        ;ODD ADR. BIT SET IN
6919  030046  001001                            BNE     6$              ;LOG JAM?
6920  030050  104000                            HLT                     ;ODD ADDRESS BIT WAS
6921                                                                    ;NOT SET IN THE LOG
6922                                                                    ;JAM REGISTER ON A
6923                                                                    ;ODD ADDRESS ERROR
6924  030052  076600                    6$:     MFD                     ;CHECK IF LAST INTERRUPT VECTOR
6925  030054  000104                            RDLFGINT                ;WAS LOGGED?
6926  030056  120027  000004                    CMPB    R0,#4
6927  030062  001401                            BEQ     8$
6928  030064  104000                            HLT                     ;LAST ERROR VECTOR WAS NOT LOGGED
6929                                                                    ;LOW BYTE OF LOG FLAG/INT REG.
6930                                                                    ;SHOULD CONTAIN LAST VEC. =004
6931  030066  012737  055064  000004  8$:     MOV     #ERPRT,@#4
6932
6933
6934
6935                                    ;;**********************************************************************
6936                                    ;*TEST 70       CHECK ILLEGAL INTERNAL ADDRESS TRAP
6937
6938                                            ;*THIS TEST CHECKS THAT A TRAP OCCURS UPON REFERENCING AN
6939                                            ;*ILLEGAL INTERNAL ADDRESS AND THAT "ILLEGAL INTERNAL ADDRESS"
6940                                            ;*BIT (BIT0) OF THE CPU ERROR REGISTER AND BITS OF LOG JAM
6941                                            ;*REGISTER GET SET.  IT ALSO CHECKS IF THE INTERRUPT VECTOR
6942                                            ;*(4) IS SAVED AS THE "LAST INTERRUPT VECTOR" IN THE LOG
6943                                            ;*FLAG/INTERRUPT REG.
6944                                    ;;**********************************************************************
6945  030074                            T$T70:
6946  030074  000004                            SCOPE
6947  030076  112737  000070  001202            MOVB    #70,@#$TSTNM
6948  030104  012737  030126  000004            MOV     #1$,@#4         ;SETUP NEW HANDLER PC
6949  030112  005037  177746                    CLR     @#CCR
```

```
6950  030116  012707  177746          MOV     #CCR,PC         ;ILLEGAL INTERNAL ADDRESS TRAP SHOULD OCCUR
6951  030122  104000                  HLT                     ;*** ILLEGAL INTERNAL ADDRESS
6952                                                          ;DID NOT RESULT IN A TRAP
6953  030124  000417                  BR      3$              ;BRANCH TO EXIT IF NO TRAP
6954  030126  022626          1$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
6955  030130  012737  055064  000004  MOV     #ERPRT,@#4      ;RESTORE OLD HANDLER PC
6956  030136  032737  000001  177766  BIT     #BIT0,@#CPUERR  ;DID "ILLEGAL INTERNAL ADDRESS" BIT (0)
6957                                                          ;IN CPU ERROR REGISTER GET SET?
6958  030144  001001                  BNE     2$              ;BRANCH IF YES
6959  030146  104000                  HLT                     ;*** ILLEGAL INTERNAL ADDRESS
6960                                                          ;BIT DID NOT SET IN CPU ERROR REG.
6961  030150  076600          2$:     MED                     ;READ LOG JAM REG.
6962  030152  000100                  RDLJAM
6963  030154  032700  000040          BIT     #BIT5,R0        ;DID "ILLEGAL INTERNAL ADDRESS" BIT (5)
6964                                                          ;IN LOG JAM REG. GET SET
6965  030160  001001                  BNE     3$              ;BRANCH IF YES
6966  030162  104000                  HLT                     ;*** ILLEGAL INTERNAL ADDRESS BIT
6967                                                          ;DID NOT SET IN LOG JAM REG.
6968  030164          3$:
6969
6970
6971                    ;;*****************************************************************
6972                    ;*TEST 71       CHECK LOG SERVICE & MEMERR LOGS LO-HI BYTE & TAG BITS, IN ABORT MODE
6973                            ;THIS TEST CHECKS THAT "LO BYTE PARITY" AND "TAG PARITY"
6974                            ;BITS CAN SET IN "LOG SERVICE" REGISTERS.  IT IS ALSO
6975                            ;CHECKED THAT THE PROPER TAG AND DATA BITS GET STORED
6976                            ;IN THE "LOG CACHE DATA, "LOG CACHE TAG/CPU" AND THE
6977                            ;"MEMORY ADDRESS REGISTER" WHEN A PARITY ERROR IS
6978                            ;FORCED.
6979                            ;IT IS CHECKED IF THE INSTRUCTION WAS ABORTED AND THE
6980                            ;LOG FLAG/INTERRUPT REGISTER LOGGED THE LAST INTERRUPT
6981                            ;VECTOR.
6982                    ;;*****************************************************************
6983  030164          ST71:
6984  030164  000004                  SCOPE
6985  030166  112737  000071  001202  MOVB    #71,@#STSTNM
6986
6987  030174  012737  000201  177746  MOV     #DPTRP+PABORT,@#CCR  ;DISABLE PARITY TRAPS (CACHE)
6988  030202  005067  152264          CLR     MEDTPO
6989  030206  012701  002360          MOV     #TLOC1,R1       ;GET POINTER TO TEST LOC.
6990  030212  012711  111000          MOV     #111000,(R1)
6991  030216  005711                  TST     (R1)            ;MAKE IT A HIT
6992  030220  052737  000100  177746  BIS     #WWP,@#CCR      ;WRITE WRONG PARITY SET
6993  030226  012711  000252          MOV     #252,(R1)       ;WRITE TEST LOCATION
6994                                                          ;WITH WRONG PARITY
6995  030232  042737  000100  177746  BIC     #WWP,@#CCR      ;CLEAR WWP
6996  030240  076600                  MED
6997  030242  000022                  RDWHAMI
6998  030244  052700  100001          BIS     #BIT15+BIT0,R0  ;ENABLE "LOG FIRST" MODE AND
6999  030250  076600                  MED                     ;ERROR LOGGING
7000  030252  000222                  WRWHAMI
7001  030254  042737  000001  177746  BIC     #DPTRP,@#CCR    ;ENABLE CACHE PARITY TRAPS
7002  030262  012737  030310  000114  MOV     #PTRP1,@#114    ;NEW PARITY TRAP SERVICE
7003  030270  016767  152064  152174  MOV     TLOC1,MEDTPO    ;READ TEST LOC, FORCE PARITY ERROR
7004  030276  012700  000200          MOV     #200,R0
7005  030302  076600                  MED                     ;CLEAN UP THE CACHE
```

```
7006  030304  000352                          352                     ;INITIALIZATION CODE
7007  030306  104000                          HLT                     ;*** CACHE PARITY ERROR TRAP
7008                                                                  ;DID NOT OCCUR WHEN
7009                                                                  ;TEST LOC WITH BAD PARITY
7010                                                                  ;WAS READ
7011
7012                                                                  ;ENTER HERE IF PARITY TRAP OCCURRED
7013  030310  012700  000200          PTRP1:  MOV     #200,R0
7014  030314  076600                          MED                     ;CLEAN UP THE CACHE
7015  030316  000352                          352                     ;INITIALIZATION CODE
7016  030320  012737  000001  177746          MOV     #DPTRP,@#CCR    ;DISABLE CACHE PARITY ERROR TRAPS
7017  030326  012737  054414  000114          MOV     #.PARSRV,@#114  ;REESTABLISH OLD SERVICE VECTORS
7018  030334  022626                          CMP     (SP)+,(SP)+
7019  030336  005767  152130                  TST     MEDTPD          ;WAS THE INSTRUCTION ABORTED ON
7020                                                                  ;CACHE PARITY ERROR (ABORT MODE)?
7021  030342  001401                          BEQ     1$              ;YES
7022  030344  104000                          HLT                     ;INSTRUCTION HAVING CACHE PARITY
7023                                                                  ;ERROR WAS NOT ABORTED, IN THE
7024                                                                  ;CACHE ABORT MODE.
7025  030346  076600                  1$:     MED                     ;READ THE "LOG SERVICE" REGISTER
7026  030350  000101                          RDLSERVICE
7027  030352  042700  177435                  BIC     #177435,R0      ;MASK ALL BITS BUT LO,HI,TAG,CACHE BITS
7028  030356  022700  000342                  CMP     #342,R0         ;LO, HI,TAG, CACHE PARITY BITS SET? IN "SERVICE"
7029  030362  001401                          BEQ     2$              ;YES
7030  030364  104000                          HLT                     ;*** "LO BYTE" PARITY ERROR
7031                                                                  ;AND "TAG" PARITY ERROR BITS
7032                                                                  ;WERE NOT LOGGED CORRECTLY IN "LOG
7033                                                                  ;SERVICE" REGISTER, WHEN PARITY
7034                                                                  ;ERROR TRAP WAS FORCED.
7035                                                                  ;CLEAR BITS ARE ACTIVE.
7036  030366  022737  100340  177744  2$:     CMP     #BIT7+BIT6+BIT5+BIT15,@#MEMERR  ;DID"LO BYTE" AND "TAG"
7037                                                                  ;PARITY ERROR BITS SET IN
7038                                                                  ;THE MEMORY ERROR REGISTER?
7039  030374  001401                          BEQ     3$              ;YES
7040  030376  104000                          HLT                     ;*** "LO BYTE" AND "TAG" PARITY
7041                                                                  ;ERROR BITS DID NOT SET
7042                                                                  ;CORRECTLY IN THE MEMORY
7043                                                                  ;ERROR REGISTER
7044  030400  076600                  3$:     MED                     ;READ "LOG PBA" REGISTER
7045  030402  000102                          RDLPBA
7046  030404  020027  002360                  CMP     R0,#TLOC1       ;DID "LOG PBA" CONTAIN CORRECT
7047                                                                  ;PHYSICAL BUS ADDRESS-WHERE
7048                                                                  ;THE PARITY ERROR OCCURRED?
7049  030410  001401                          BEQ     4$              ;YES
7050  030412  104000                          HLT                     ;*** PHYSICAL BUS ADDRESS
7051                                                                  ;(WHERE PARITY ERROR OCCURRED)
7052                                                                  ;WAS NOT LOGGED CORRECTLY
7053                                                                  ;WHEN CACHE PARITY ERROR WAS FORCED
7054                                                                  ;LOG PBA SHOULD CONTAIN ADDR. OF "TLOC1"
7055  030414  076600                  4$:     MED
7056  030416  000107                          RDLTAG                  ;READ "LOG CACHE TAG" REGISTER
7057  030420  010002                          MOV     R0,R2
7058  030422  000302                          SWAB    R2
7059  030424  012701  002360                  MOV     #TLOC1,R1       ;SHIFT RIGHT (3 TIMES) THE 16 BIT
7060  030430  000301                          SWAB    R1
7061  030432  106201                          ASRB    R1              ;PHYSICAL BUS ADDRESS OF THE
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7062  030434  106201                          ASRB    R1              ;TEST LOCATION
7063  030436  106201                          ASRB    R1
7064  030440  052701  000200                  BIS     #BIT7,R1        ;FUDGE TAG BIT
7065  030444  120102                          CMPB    R1,R2           ;WAS THE CORRECT TAG LOGGED?
7066  030446  001405                          BEQ     5$              ;YES
7067  030450  010167  152016                  MOV     R1,MEDTP0       ;EXPECTED TAG
7068  030454  010267  152014                  MOV     R2,MEDTP1       ;TAG RECEIVED
7069  030460  104000                          HLT                     ;TAG BITS WERE NOT LOGGED
7070                                                                  ;CORRECTLY, WHEN CACHE
7071                                                                  ;PARITY ERROR WAS FORCED
7072                                                                  ;EXPECTED TAG IS IN MEDTP0
7073                                                                  ;TAG RECEIVED IS IN MEDTP1
7074  030462  076600                  5$:     MED                     ;READ CACHE DATA
7075  030464  000106                          RDLDATA
7076  030466  020027  000252                  CMP     R0,#252         ;CACHE DATA LOGGED CORRECTLY?
7077  030472  001401                          BEQ     6$
7078  030474  104000                          HLT                     ;CACHE DATA WAS NOT LOGGED
7079                                                                  ;CORRECTLY, LOG DATA REG.
7080                                                                  ;SHOULD CONTAIN DATA = 252
7081
7082  030476  076600                  6$:     MED                     ;RETURN TO "LOG CONTINUOUS" MODE
7083  030500  000022                          RDWHAMI
7084  030502  042700  100001                  BIC     #BIT15+BIT0,R0
7085  030506  076600                          MED
7086  030510  000222                          WRWHAMI
7087  030512  012737  030524  000004          MOV     #7$,@#4
7088  030520  005737  160000                  TST     @#160000        ;INTERRUPT THRU 4 SHOULD LOAD "FLAG"
7089  030524  022626                  7$:     CMP     (SP)+,(SP)+
7090  030526  012737  055064  000004          MOV     #ERPRT,@#4      ;RESTORE LOC. 4
7091  030534  076600                          MED                     ;READ LOG FLAG/INTERRUPT REGISTER
7092  030536  000104                          RDLFGINT
7093  030540  120027  000114                  CMPB    R0,#114         ;DID LO BYTE CONTAIN VECTOR 114?
7094  030544  001401                          BEQ     8$
7095  030546  104000                          HLT                     ;LAST INTERRUPT VECTOR WAS NOT
7096                                                                  ;LOGGED CORRECTLY IN FLAG REGISTER
7097                                                                  ;WHEN A CACHE PARITY ERROR WAS
7098                                                                  ;FORCED.
7099                                                                  ;LOW BYTE OF LOG FLAG/INT REG.
7100                                                                  ;SHOULD BE LAST VEC. = 114
7101                                                                  ;ANY ERROR CALL DURING TEST MIGHT CAUSE
7102                                                                  ;LAST VECTOR TO LOOK WRONG
7103  030550                          8$:
7104
7105
7106                                    ;;*****************************************************************
7107                                    ;*TEST 72        CHECK "LOG FIRST" MODE OF ERROR LOGGING
7108                                            ;*THIS TEST CHECKS THE "LOG FIRST" MODE OF ERROR LOGGING.
7109                                            ;*THE "LOG FIRST" MODE IS ENABLED.  THEN A TIME-OUT TRAP
7110                                            ;*IS FORCED, BIT 4 OF CPU ERROR REGISTER SHOULD BE SET.
7111                                            ;*THEN AN ODD ADDRESS TRAP IS FORCED.  HOWEVER, THIS
7112                                            ;*TIME THE ERROR SHOULD NOT BE LOGGED; BIT 6 (ODD
7113                                            ;*ADDRESS) SHOULD NOT BE SET BECAUSE THE ERROR LOG
7114                                            ;*IS LOCKED UP AFTER THE FIRST ERROR.
7115
7116                                            ;*THEN, THE ERROR LOG IS ENABLED (BY SETTING BIT 0 OF
7117                                            ;*WHAMI).  AN ODD ADDRESS ERROR IS FORCED AGAIN AND IT IS
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                                        ;*CHECKED THAT THIS TIME THE ERROR IS LOGGED. (BIT 6-ODD
                                        ;*ADDRESS SHOULD BE SET IN CPU ERROR REGISTER).
                                ;;**************************************************************
030550                          TST72:
030550  000004                        SCOPE
030552  112737  000072  001202        MOVB    #72,@#$TSTNM

030560  076600                        MED
030562  000022                        RDWHAMI
030564  052700  100001                BIS     #BIT15+BIT0,R0  ;SET UP "LOG FIRST MODE
030570  076600                        MED
030572  000222                        WRWHAMI
030574  012737  030610  000004        MOV     #1$,@#4         ;SET UP NEW PC FOR TIMEOUT
030602  005737  160000                TST     @#160000        ;FORCE A TIMEOUT
030606  000454                        BR      5$              ;SKIP TEST IF NO TIMEOUT

030610  022626                1$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
                                                            ;BIT 4 OF CPU ERROR REGISTER
                                                            ;SHOULD HAVE SET
030612  012737  030626  000004        MOV     #2$,@#4         ;SET UP NEW PC FOR ODD ADDRESS
030620  005767  177765                TST     1$+1            ;FORCE ODD ADDRESS TRAP
030624  000445                        BR      5$              ;SKIP TEST IF NO ODD ADDRESS TRAP

030626  022626                2$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
030630  012737  055064  000004        MOV     #ERPRT,@#4
030636  022737  000020  177766        CMP     #BIT4,@#CPUERR  ;"TIMEOUT" BIT SHOULD BE STILL
                                                            ;SET, CHECK?
030644  001402                        BEQ     3$
030646  104000                        HLT                     ;*** SECOND ERROR (ODD ADDRESS)
                                                            ;UPDATED THE ERROR LOG IN
                                                            ;THE LOG FIRST MODE.  BIT 4
                                                            ;(UNIBUS TIMEOUT) SHOULD BE
                                                            ;STILL SET FROM THE FIRST
                                                            ;ERROR
030650  000433                        BR      5$              ;SKIP THE REST
030652  076600                3$:     MED                     ;READ LOG JAM REG.
030654  000100                        RDLJAM
030656  032700  100004                BIT     #BIT2+BIT15,R0  ;CHECK THAT ODD ADRES ERROR BITS NOT
030662  001401                        BEQ     6$              ;SET IN LOG JAM.  NOTE LOG FIRST
                                                            ;MODE SHOULD INHIBIT FURTHER
                                                            ;ERROR LOGGING
030664  104000                        HLT                     ;ODD ADDRESS ERROR BITS GOT SET IN LOG JAM
                                                            ;THEY SHOULD NOT BE SINCE LOG FIRST MODE
                                                            ;INHIBITS ERROR LOGGING AFTER THE FIRST ERROR
030666  076600                6$:     MED
030670  000022                        RDWHAMI
030672  052700  100001                BIS     #BIT15+BIT0,R0  ;ENABLE ERROR LOG AGAIN IN
                                                            ;LOG FIRST MODE
030676  076600                        MED
030700  000222                        WRWHAMI
030702  012737  030716  000004        MOV     #4$,@#4         ;SET UP NEW PC
030710  005767  177737                TST     3$+1            ;FORCE ODD ADDRESS TRAP
030714  000411                        BR      5$              ;SKIP IF NO TRAP
030716  022626                4$:     CMP     (SP)+,(SP)+     ;RESTORE STACK
                                                            ;RESTORE OLD PC(4)
030720  012737  055064  000004        MOV     #ERPRT,@#4
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7174  030726  022737  000100  177766        CMP     #BIT6,@#CPUERR  ;THE ERROR LOG FROM PREVIOUS
7175                                                                  ;ERROR SHOULD BE OVER WRITTEN.
7176                                                                  ;ODD ADDRESS BIT SHOULD
7177                                                                  ;BE SET, BECAUSE THE ERROR
7178  030734  001401                        BEQ     5$              ;LOG WAS ENABLED.
7179                                                                  ;OK, IF YES
7180  030736  104000                        HLT                     ;THE ERROR LOG WAS NOT UPDATED
7181                                                                  ;(UPON AN ODD ADDRESS ERROR)
7182                                                                  ;AFTER THE LOG WAS ENABLED.
7183                                                                  ;AT THIS FORMAT BIT 6 OF
7184                                                                  ;CPU ERROR REGISTER SHOULD
7185                                                                  ;BE SET.  IT WAS NOT.
7186  030740  012737  055064  000004  5$:     MOV     #ERPRT,@#4      ;RESTORE OLD PC(4)
7187  030746  076600                        MED
7188  030750  000022                        RDWHAMI
7189  030752  042700  100001                BIC     #BIT15+BIT0,R0
7190  030756  076600                        MED                     ;PUT THE LOGGING BACK INTO
7191  030760  000222                        WRWHAMI                 ;"CONTINUOUS" MODE
7192
7193
7194                                ;;*****************************************************************
7195                                ;*TEST 73       CHECK LAST INTERRUPT VECTOR IS LOGGED IN FLAG REG.
7196                                ;;*****************************************************************
7197  030762                        TST73:
7198  030762  000004                        SCOPE
7199  030764  012737  000073  001202        MOVB    #73,@#STSTNM
7200  030772  012737  000001  001324        MOV     #1,@#STIMES     ;DO 1 ITERATION
7201
7202  031000  012737  031010  000030        MOV     #1$,@#30        ;LOAD LOC. 30 WITH 1$ (EMT VEC.)
7203  031006  104010                        EMT                     ;FIRST INTERRUPT-EMT
7204  031010  022626                1$:     CMP     (SP)+,(SP)+     ;CLEAN UP STACK
7205  031012  012737  047160  000030        MOV     #$ERROR,@#30    ;RESTORE LOC. 30
7206  031020  012737  031032  000004        MOV     #2$,@#4         ;LOAD LOC. 4 WITH 2$
7207  031026  005737  160000                TST     @#160000        ;SECOND INTERRUPT-SHOULD LOAD LOG FLAG REG.
7208  031032  022626                2$:     CMP     (SP)+,(SP)+     ;CLEAN UP STACK
7209  031034  012737  055064  000004        MOV     #ERPRT,@#4      ;RESTORE LOC.  4
7210  031042  076600                        MED                     ;READ LOG FLAG/INT REG.
7211  031044  000104                        RDLFGINT
7212  031046  120027  000030                CMPB    R0,#30          ;WAS 30 LOGGED AS LAST INTRPT. VEC?
7213  031052  001401                        BEQ     3$              ;BRANCH IF YES
7214  031054  104000                        HLT                     ;LOG FLAG/INT REG DID NOT LOG VECTOR
7215                                                                  ;LOW BYTE OF LOG FLAG/INT REG.
7216                                                                  ;SHOULD BE LAST VEC. = 30
7217  031056  012737  031066  000020  3$:     MOV     #6$,@#20        ;LOAD LOC. 20  WITH 6$
7218  031064  000004                        IOT                     ;FIRST INTERRUP -  IOT
7219  031066  022626                6$:     CMP     (SP)+,(SP)+     ;CLEAN UP STACK
7220  031070  012737  046720  000020        MOV     #$SCOPE,@#20    ;RESTORE CONTENTS OF LOC 20
7221  031076  012737  031110  000004        MOV     #4$,@#4         ;LOAD LOC.  4 WITH 4$
7222  031104  005737  160000                TST     @#160000        ;INTERRUPT SHOULD LOAD LOG FLAG REG.
7223  031110  022626                4$:     CMP     (SP)+,(SP)+     ;CLEAN UP  STACK
7224  031112  012737  055064  000004        MOV     #ERPRT,@#4      ;RESTORE LOC. 4
7225  031120  076600                        MED                     ;READ LOG FLAG/INT REG.
7226  031122  000104                        RDLFGINT
7227  031124  122700  000020                CMPB    #20,R0          ;WAS 20 LOGGED AS LAST INTRPT VEC?
7228  031130  001401                        BEQ     5$              ;BRANCH IF YES
7229  031132  104000                        HLT                     ;LOG FLAG/INT REG. DID NOT LOG VECTOR
```

```
                                                        ;LOW BYTE OF LOG FLAG/INT REG.
                                                        ;SHOULD BE LAST VEC. = 20
031134                          5$:                     ;ANY ERROR CALL DURING THE TEST MIGHT
                                                        ;CAUSE LAST VECTOR TO BE WRONG
031134  013746  002362          MEDEX:  MOV     @#PSWHOL,-(SP)  ;PUSH OLD PSW ON STACK
031140  011600                          MOV     (SP),R0         ;RESET "VECTOR + 2'S"
031142  042700  000020                  BIC     #BIT4,R0
031146  052700  000340                  BIS     #PR7,R0
031152  010037  000006                  MOV     R0,@#6
031156  010037  000012                  MOV     R0,@#12
031162  010037  000032                  MOV     R0,@#32
031166  010037  000116                  MOV     R0,@#116
031172  005037  000022                  CLR     @#22
031176  010746                          MOV     PC,-(SP)        ;PUSH CURRENT PC ON STACK
031200  062716  000006                  ADD     #6,(SP)         ;ADD OFFSET TO PC
031204  000002                          RTI                     ;RESTORE ORIGINAL PSW AND CONTINUE
031206  012706  000700                  MOV     #USESTK,SP      ;SET STACK POINTER
                                ;;**************************************************************
                                ;*TEST 74       CHECK MFPI/MTPI INSTRUCTIONS
                                ;;**************************************************************
031212                          TST74:
031212  000004                          SCOPE
031214  112737  000074  001202          MOVB    #74,@#$TSTNM
031222  032737  140000  177776  MPI:    BIT     #UM,@#PSW       ;KERNEL MODE?
031230  001535                          BEQ     ENDCP           ;IF YES, EXIT TEST
031232  010746                          MOV     PC,-(SP)
031234  062716  000120                  ADD     #5$-.,(SP)
031240  012637  000250                  MOV     (SP)+,@#MMVEC   ;SET MEM MGMT ABORT VECTOR
031244  005046                          CLR     -(SP)           ;CLEAR CHECK WORD
031246  010603                          MOV     SP,R3
031250  010346                          MOV     R3,-(SP)        ;PUT ADDRESS OF CHECK WORD ON THE STACK
031252  105737  001545                  TSTB    @#MMON          ;CHECK IF MEM MGMT IS ENABLED
031256  001411                          BEQ     1$              ;BRANCH IF OFF
031260  013737  177640  177654          MOV     @#UIPAR0,@#UIPAR6       ;SET UP USER PAGE ADDR. REG.
031266  012737  006006  177614          MOV     #6006,@#UIPDR6          ;SET USER PAGE DESC REG R/W UP 6 PAGES
031274  062706  140000          10$:    ADD     #140000,SP      ;SET CURRENT MODE'S STACK POINTER
031300  000240                          NOP
031302  010746                  1$:     MOV     PC,-(SP)
031304  062716  000024                  ADD     #3$-.,(SP)
031310  012637  000020                  MOV     (SP)+,@#IOTVEC  ;SET IOT TRAP VECTOR
031314  000004                          IOT                     ;TRAP TO 3$ BELOW
031316  005266  000002                  INC     2(SP)           ;INCREMENT CHECK WORD
031322  001417                          BEQ     6$
031324  104000                  4$:     HLT                     ;ERROR! MFPI,MTPI FAILURE-FOR BETTER
031326  000415                          BR      6$              ;ISOLATION SUGGEST RUNNING MEMORY MGMT. DIAG.
031330  000240                  3$:     NOP                     ;PSW=KERNEL MODE,PREV USER MODE
031332  006506                          MFPI    SP              ;GET PREV. MODES STACK POINTER
031334  006536                          MFPI    @(SP)+          ;GET DATA (AN ADDRESS) ON PREV MODE'S STACK
031336  006576  000000                  MFPI    @(SP)           ;GET DATA (=0) FROM PREV MODES ADDRESS
031342  000240                          NOP                     ;SPACE AND PUSH ONTO KERNEL STACK
031344  001367                          BNE     4$              ;ERROR IF BRANCH TAKEN! SHOULD HAVE A ZERO ON THE STACK
```

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7286  031346  005116                          COM     (SP)            ;COMPLEMENT OPERAND
7287  031350  006636                          MTPI    @(SP)+          ;POP OPERAND OFF KERNEL STACK AND MOVE
7288                                                                  ;IT TO PREV MODE'S SPACE
7289  031352  000002                          RTI                     ;RETURN TO INST FOLLOWING IOT ABOVE
7290  031354  104000                  5$:     HLT                     ;ERROR! MEMORY MANG. ABORT
7291  031356  105037  177776                  CLRB    @#PSW           ;SET PRIORITY LEVEL BACK TO 0
7292  031362  012737  054662  000250  6$:     MOV     #KTABRT,@#MMVEC ;RESTORE VECTOR
7293  031370  012737  046720  000020          MOV     #$SCOPE,@#IOTVEC
7294  031376  012706  000700                  MOV     #USESTK,SP      ;RESTORE STACK POINTER
7295                                  ;;**********************************************************************
7296                                  ;*TEST 75        CHECK ILLEGAL HALT
7297                                  ;;**********************************************************************
7298  031402                          ^ST75:
7299  031402  000004                          SCOPE
7300  031404  112737  000075  001202          MOVB    #75,@#$TSTNM
7301  031412  010746                  HALT1:  MOV     PC,-(SP)        ;GET CURRENT PC
7302  031414  062716  000022                  ADD     #2$-.,(SP)
7303  031420  011637  000004                  MOV     (SP),@#ERRVEC   ;SET ERROR TRAP VECTOR TO 2$ BELOW
7304  031424  012637  000010                  MOV     (SP)+,@#RESVEC  ;LOAD RESERVED INST TRAP VECTOR
7305  031430  000000                          HALT                    ;SHOULD TRAP TO 4 IN USER MODE
7306  031432  104000                  1$:     HLT                     ;ERROR! HALT ABOVE FAILED IN USER MODE
7307  031434  000404                          BR      3$
7308  031436  010716                  2$:     MOV     PC,(SP)         ;REPLACE RETURN PC WITH
7309  031440  062716  000006                  ADD     #3$-.,(SP)      ;ADDRESS OF 3$ BELOW
7310  031444  000002                          RTI                     ;RETURN (TO 3$)
7311
7312  031446  012737  055064  000004  3$:     MOV     #ERPRT,@#ERRVEC ;RESTORE ERROR TRAP VECTOR
7313  031454  012737  054774  000010          MOV     #RESERR,@#RESVEC
7314  031462  105037  177776                  CLRB    @#PSW
7315                                  ;;**********************************************************************
7316                                  ;*TEST 76        CHECK RESET IN USER MODE
7317                                  ;;**********************************************************************
7318  031466                          ^ST76:
7319  031466  000004                          SCOPE
7320  031470  112737  000076  001202          MOVB    #76,@#$TSTNM
7321  031476  000277                  RESET1: SCC
7322  031500  013700  177776                  MOV     @#PSW,R0        ;GET CURRENT PSW
7323  031504  000277                          SCC
7324  031506  000005                          RESET
7325  031510  023700  177776                  CMP     @#PSW,R0        ;CHECK THAT PSW UNCHANGED BY RESET ABOVE
7326  031514  001401                          BEQ     .+4
7327  031516  104000                          HLT                     ;ERROR! RESET CLEARED MODE BITS IN PSW
7328  031520  010037  177776                  MOV     R0,@#PSW        ;RESTORE PSW (FOR ERROR)
7329  031524                          ENDCP:
7330  031524  000004                  RELE6:  SCOPE
7331  031526  010702                          MOV     PC,R2
7332  031530  062702  000012                  ADD     #12,R2
7333  031534  012707  036574                  MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
7334  031540  000000                  REL66:  .WORD   0
7335                                  ;6666666666666 LAST ADDRESS OF CODE TO BE RELOCATED 66666666666
7336
7337                                  ;;**********************************************************************
7338                                  ;*TEST 77        TEST STACK LIMIT REGISTER
7339                                  ;;**********************************************************************
7340  031542                          ^ST77:
7341  031542  012767  000001  147554          MOV     #1,$TIMES       ;;DO 1 ITERATION
```

```
7342  031550  000004                          SCOPE
7343  031552  112737  000077  001202          MOVB    #77,@#$TSTNM
7344
7345                                          .SBTTL  START OF SECTION 7
7346                                  ;777777777777 FIRST ADDRESS TO BE RELOCATED 777777777
7347  031560  112737  000077  001202  REL7:   MOVB    #$TN-1,@#$TSTNM
7348  031566  010700                          MOV     PC,R0           ;GET PC
7349  031570  005740                          TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL7
7350  031572  010037  001554                  MOV     R0,@#FRSTAD     ;SAVE
7351  031576  010700                          MOV     PC,R0           ;GET CURRENT PC
7352  031600  162700  031600                  SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
7353  031604  010037  001550                  MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
7354  031610  010737  001212                  MOV     PC,@#$LPERR     ;SET LOOP ADDRESS
7355  031614  062737  000026  001212          ADD     #26,@#$LPERR    ;ADJUST
7356  031622  013737  001212  001210          MOV     @#$LPERR,@#$LPADR
7357  031630  105737  001544                  TSTB    @#NEXEC         ;BR IF TEST CODE TO BE EXECUTED
7358  031634  001402                          BEQ     .+6
7359  031636  000167  000726                  JMP     REL7
7360                                  ;THIS TEST SHIFTS A '1' BIT THROUGH ALL BIT POSITIONS
7361  031642  012702  177774                  MOV     #STKLMT,R2                      ;GET ADDRESS OF STACK LIM REG
7362  031646  005022                          CLR     (R2)+                   ;CLEAR STACK LIMIT REG
7363  031650  032712  000020                  BIT     #20,(R2)                        ;EXIT TEST IF 'T' BIT IS SET
7364  031654  001111                          BNE     101$
7365  031656  052712  000340                  BIS     #340,(R2)               ;SET PRIORITY LEVEL 7 TO PREVENT
7366                                                                          ;ANY INTERRUPTS FROM OCCURRING
7367  031662  012700  000400                  MOV     #400,R0                 ;SET CHECK DATA
7368  031666  010042                  1$:     MOV     R0,-(R2)                ;MOVE TO STACK LIMIT REG
7369  031670  022200                          CMP     (R2)+,R0                ;AND CHECK RESULT
7370  031672  001401                          BEQ     2$
7371  031674  104000                          HLT                             ;ERROR! STACK LIMIT DID NOT
7372                                                                          ;LOAD CORRECTLY. CORRECT RESULT
7373                                                                          ;IS IN R0
7374  031676  006300                  2$:     ASL     R0                      ;SHIFT '1' BIT LEFT
7375  031700  103372                          BCC     1$                      ;LOOP UNTIL 1 BIT SHIFTS OUT
7376  031702  005042                          CLR     -(R2)                   ;CLEAR STACK LIMIT REG
7377
7378                                  ;THIS TEST CHECKS THAT A PROPER 'RED' ZONE VIOLATION OCCURS, NOTE THAT
7379                                  ;NO 'RED ZONE' VIOLATION WILL OCCUR IF IN USER MODES.
7380                                  ;A RED ZONE VIOLATION PUSHES THE CURRENT PSW,PC ON @ STACK AT 2 AND 0
7381                                  ;AND TAKES THE NEXT INSTRUCTION FROM THE PC IN LOC  '004. THE INST-
7382                                  ;RUCTION CAUSING THE RED ZONE VIOLATION IS 'ABORTE.
7383  031704  010746                          MOV     PC,-(SP)                ;GET CURRENT PC
7384  031706  062716  000060                  ADD     #4$-.,(SP)              ;FORM ADDRESS OF 4$ BELOW
7385  031712  012637  000004                  MOV     (SP)+,@#ERRVEC          ;SET ERROR TRAP VECTOR TO 4$ BELOW
7386  031716  013737  177776  000006          MOV     @#PSW,@#ERRVEC+2        ;RETAIN CURRENT STATUS ON TRAP
7387  031724  010712                          MOV     PC,(R2)                 ;SET STACK LIMIT TO CURRENT PC
7388                                                                          ;+400
7389  031726  011206                          MOV     (R2),SP                 ;AND STACK PTR = STACK LIMIT REG
7390  031730  010603                          MOV     SP,R3                   ;SAVE STACK PTR
7391  031732  016304  000336                  MOV     336(R3),R4              ;SAVE MEMORY LOC CONTENTS
7392                                                                          ;AT 'RED ZONE' BOUNDARY
7393  031736  032737  140000  177776          BIT     #UM,@#PSW               ;BRANCH IF IN KERNEL MODE
7394  031744  001403                          BEQ     20$
7395  031746  010466  000336                  MOV     R4,336(SP)              ;SHOULD NOT CAUSE TRAP
7396  031752  000432                          BR      100$
7397
```

```
7398  031754  005066  000336          20$:    CLR     336(SP)                 ;SHOULD CAUSE 'RED ZONE' TRAP
7399  031760  012706  000700          3$:     MOV     #USESTK,SP              ;RESTORE THE STACK
7400  031764  104000                          HLT                             ;ERROR! FAILED TO TRAP
7401
7402  031766  032737  140000  000002  4$:     BIT     #UM,@#2                 ;CHECK IF TRAPPED WHEN IN USER
7403                                                                          ;MODE (2 CONTAINS OLD PSW)
7404  031774  001013                          BNE     99$                     ;GO TO ERROR CALL
7405  031776  010600                          MOV     SP,R0                   ;STACK PTR SHOULD = 0
7406  032000  001011                          BNE     99$                     ;GO TO ERROR CALL IF NOT 0
7407  032002  026304  000336                  CMP     336(R3),R4              ;CHECK THAT INST WAS ABORTED
7408  032006  001006                          BNE     99$                     ;GO REPORT ERRPR
7409  032010  005012                  5$:     CLR     (R2)                    ;CLEAR STACK LIMIT REG
7410  032012  010705                          MOV     PC,R5                   ;GET CURRENT PC
7411  032014  062705  177744                  ADD     #3$-.,R5                ;FORM ADDRESS OF  3$ ABOVE
7412  032020  020516                          CMP     R5,(SP)                 ;CHECK THAT RETURN PC IS ON
7413                                                                          ;THE STACK (AT 0)
7414  032022  001406                          BEQ     100$                    ;EXIT TEST
7415
7416                                  ;ERROR
7417  032024  005012                  99$:    CLR     (R2)                    ;CLEAR STACK LIMIT REG
7418  032026  010463  000336                  MOV     R4,336(R3)              ;RESTORE MEM LOCATION
7419  032032  012706  000700                  MOV     #USESTK,SP              ;SET STACK PTR
7420  032036  104000                          HLT                             ;ERROR!
7421  032040  010463  000336          100$:   MOV     R4,336(R3)              ;RESTORE MEM LOCATION
7422  032044  005022                          CLR     (R2)+                   ;CLEAR STACK LIM REG
7423  032046  012706  000700                  MOV     #USESTK,SP              ;SET STACK PTR
7424  032052  042712  000340                  BIC     #340,(R2)               ;SET PRIORITY LEVEL BACK TO 0
7425  032056  012737  055064  000004          MOV     #ERPRT,@#ERRVEC         ;RESTORE ERROR TRAP VECTOR
7426  032064  013737  177776  000006          MOV     @#PSW,@#ERRVEC+2
7427  032072  112737  000340  000006          MOVB    #PR7,@#ERRVEC+2
7428  032100                          101$:
7429                                  ;;**************************************************************
7430                                  ;*TEST 100      MEMORY MANAGEMENT REGISTER TESTS
7431                                  ;*      PDR TEST - THIS TEST WRITES 64. RANDOM #'S INTO EACH PDR REGISTER
7432                                  ;*      NOTE:  IF MEM MGMT IS ENABLED ONLY PDR/PAR PAIRS 3-5 ARE TESTED.
7433                                  ;;**************************************************************
7434  032100                          TST100:
7435  032100  000004                          SCOPE
7436  032102  112737  000100  001202          MOVB    #100,@#$TSTNM
7437
7438  032110  012702  032340          KTPDR:  MOV     #PDRTBL,R2              ;SET TABLE ADDRESS OF PDR'S
7439  032114  012705  100361                  MOV     #100361,R5              ;SET BIT MASK
7440  032120  012200                  1$:     MOV     (R2)+,R0                ;GET PDR ADDRESS
7441  032122  001435                          BEQ     100$                    ;EXIT ON '0' TERMINATOR
7442  032124  012716  000010          2$:     MOV     #8.,(SP)                ;SET LOOP COUNT (FOR 8 REGS)
7443  032130  105737  001545                  TSTB    @#MMON                  ;BRANCH IF MEM MGMT DISABLED
7444  032134  001404                          BEQ     3$
7445  032136  062700  000006                  ADD     #6,R0                   ;SET R0 TO PDR3
7446  032142  012716  000003                  MOV     #3,(SP)                 ;AND LIMIT TO TEST 3 PDRS
7447  032146  012703  000040          3$:     MOV     #32.,R3                 ;SET DATA COUNT
7448  032152  005004                          CLR     R4                      ;INITIALIZE DATA TO BE WRITTEN
7449  032154  040504                  4$:     BIC     R5,R4                   ;CLEAR NON-SETTABLE BITS
7450  032156  010410                          MOV     R4,(R0)                 ;WRITE INTO PDR
7451  032160  021004                          CMP     (R0),R4                 ;AND CHECK DATA READ BACK
7452  032162  001013                          BNE     99$                     ;GO TO ERROR CALL
7453  032164  005104                          COM     R4                      ;COMPLEMENT DATA
```

```
7454  032166  040504                        BIC     R5,R4           ;CLEAR NON-SETTABLE BITS
7455  032170  010410                        MOV     R4,(R0)         ;WRITE COMPLEMENT DATA INTO PDR
7456  032172  021004                        CMP     (R0),R4         ;AND CHECK
7457  032174  001006                        BNE     99$             ;GO TO ERROR CALL
7458  032176  060104                        ADD     R1,R4           ;STEP DATA
7459  032200  077313                        SOB     R3,4$
7460  032202  005020                5$:     CLR     (R0)+           ;STEP TO NEXT REGISTER
7461  032204  005316                        DEC     (SP)            ;DECREMENT REGISTER COUNT
7462  032206  001357                        BNE     3$
7463  032210  000743                        BR      1$              ;GET NEXT SET OF 8 REGISTERS
7464
7465  032212  104000                99$:    HLT                     ;ERROR! INCORRECT DATA READ
7466                                                                ;BACK FROM PDR. ADDRESS OF
7467                                                                ;PDR IS IN R0, DATA IS IN R4
7468  032214  000772                        BR      5$              ;STEP TO NEXT REGISTER
7469  032216                        100$:
7470                                ;;*****************************************************************
7471                                ;*TEST 101      PAR TEST
7472                                ;*      PAR TEST - THIS TEST WRITES 64. COMPLEMENTING RANDOM #'S INTO EACH PAR.
7473                                ;;*****************************************************************
7474  032216                        TST101:
7475  032216  000004                        SCOPE
7476  032220  112737  000101  001202        MOVB    #101,@#$TSTNM
7477  032226  012702  032346        KTPAR:  MOV     #PARTBL,R2      ;GET TABLE ADDRESS OF PAR'S
7478  032232  005005                        CLR     R5
7479  032234  012705  170000                MOV     #170000,R5
7480  032240  012200                1$:     MOV     (R2)+,R0        ;GET PAR ADDRESS
7481  032242  001435                        BEQ     100$            ;EXIT ON '0' TERMINATOR
7482  032244  012716  000010        2$:     MOV     #8.,(SP)        ;SET LOOP COUNT (FOR 8 REGS.)
7483  032250  105737  001545                TSTB    @#MMON          ;BRANCH IF MEM MGMT DISABLED
7484  032254  001404                        BEQ     3$
7485  032256  062700  000006                ADD     #6,R0           ;SET R0 TO PAR3
7486  032262  012716  000003                MOV     #3,(SP)         ;AND LIMIT TEST TO 3 PARS
7487  032266  012703  000040        3$:     MOV     #32.,R3         ;SET DATA COUNT
7488  032272  005004                        CLR     R4              ;INITIALIZE DATA
7489  032274  040504                4$:     BIC     R5,R4           ;CLEAR NON-SETTABLE BITS
7490  032276  010410                        MOV     R4,(R0)         ;WRITE INTO PAR
7491  032300  021004                        CMP     (R0),R4         ;AND CHECK
7492  032302  001013                        BNE     99$             ;TAKE ERROR EXIT
7493  032304  005104                        COM     R4              ;COMPLEMENT DATA
7494  032306  040504                        BIC     R5,R4           ;CLEAR NON-SETTABLE BITS
7495  032310  010410                        MOV     R4,(R0)         ;WRITE COMPLEMENT DATA
7496  032312  021004                        CMP     (R0),R4         ;AND CHECK
7497  032314  001006                        BNE     99$             ;TAKE ERROR EXIT
7498  032316  060104                        ADD     R1,R4           ;STEP DATA
7499  032320  077313                        SOB     R3,4$           ;LOOP UNTIL FINISHED
7500
7501  032322  005020                5$:     CLR     (R0)+
7502  032324  005316                        DEC     (SP)            ;DECREMENT REGISTER COUNT
7503  032326  001357                        BNE     3$              ;BRANCH IF 8 REGS NOT DONE
7504  032330  000743                        BR      1$
7505
7506  032332  104000                99$:    HLT                     ;ERROR! INCORRECT DATA READ BACK
7507                                                                ;FROM PAR. ADDRESS OF PAR IS IN
7508                                                                ;R0, DATA IS IN R4
7509  032334  000772                        BR      5$              ;DO NEXT REGISTER
```

```
7510  032336                                  100$:
7511  032336  000406                                  BR      TST102          ;;GO TO NEXT TEST
7512                                          ;TABLES FOR PDR & PAR TESTS ABOVE
7513  032340  172300                          PDRTBL: .WORD   KIPDR0
7514  032342  177600                                  .WORD   UIPDR0
7515  032344  000000                                  .WORD   0               ;TERMINATOR
7516
7517  032346  172340                          PARTBL: .WORD   KIPAR0
7518  032350  177640                                  .WORD   UIPAR0
7519  032352  000000                                  .WORD   0               ;TERMINATOR
7520
7521                                          ;;*****************************************************************
7522                                          ;*TEST 102      CHECK KT ABORT LOGIC
7523                                          ;*      THIS TEST CHECKS KT ABORT LOGIC. TEST CREATES AN ABORT CONDITION
7524                                          ;*      AND INSURES THAT ABORT IS TAKEN PROPERLY. NOTE: TEST IS EXECUTED ONLY
7525                                          ;*      IF TEST IS ENTERED WITH MEM MGMT ENABLED.
7526                                          ;;*****************************************************************
7527  032354                                  TST102:
7528  032354  000004                                  SCOPE
7529  032356  112737  000102  001202                 MOVB    #102,@#$TSTNM
7530  032364  105737  001545                 KTABT:  TSTB    @#MMON          ;BRANCH IF MEM MGMT DISABLED
7531  032370  001477                                  BEQ     KTEX
7532  032372  005037  172350                          CLR     @#KIPAR4        ;SET UP MEM MGMT REGISTERS
7533  032376  005037  172310                          CLR     @#KIPDR4        ;TO ABORT IF A MEMORY
7534  032402  005037  177650                          CLR     @#UIPAR4        ;REFERENCE IS MADE TO
7535  032406  005037  177610                          CLR     @#UIPDR4        ;ADDRESSES (VIRTUAL) BETWEEN
7536  032412  013746  000250                  1$:     MOV     @#MMVEC,-(SP)   ;SAVE MEM MGMT VECTOR
7537  032416  013746  000252                          MOV     @#MMVEC+2,-(SP) ;AND PRIORITY
7538  032422  010746                                  MOV     PC,-(SP)        ;SET MEM MGMT
7539  032424  062716  000040                          ADD     #4$-.,(SP)      ;VECTOR TO 4$ BELOW
7540  032430  012637  000250                          MOV     (SP)+,@#MMVEC
7541  032434  013737  177776  000252                  MOV     @#PSW,@#MMVEC+2
7542  032442  005000                                  CLR     R0              ;CLEAR ABORT INDICATOR
7543  032444  010702                                  MOV     PC,R2           ;SET R2 AND R3 NOTE:
7544  032446  012703  100000                          MOV     #100000,R3      ;THE REF VIA R3 CAUSES THE
7545  032452  014223                          2$:     MOV     -(R2),(R3)+     ;ABORT
7546  032454  005700                          3$:     TST     R0              ;BRANCH IF THE ABORT OCCURRED
7547  032456  001001                                  BNE     .+4
7548  032460  104000                                  HLT                     ;REPORT ERROR
7549  032462  000433                                  BR      100$
7550                                          ;ABORT HERE
7551  032464  013700  177776                  4$:     MOV     @#PSW,R0        ;SR0 SHOULD CONTAIN
7552  032470  000300                                  SWAB    R0              ;CAUSE FOR ABORT AND
7553  032472  006200                                  ASR     R0              ;ALSO WHICH SEGMENT
7554  032474  042700  177637                          BIC     #177637,R0      ;WAS IN USE WHEN ABORT
7555  032500  062700  100011                          ADD     #100011,R0      ;OCCURRED.
7556  032504  020037  177572                          CMP     R0,@#SR0
7557  032510  001013                                  BNE     99$
7558  032512  012700  032452                          MOV     #2$,R0          ;GET ADDRESS OF INST THAT ABORTED
7559  032516  020037  177576                          CMP     R0,@#SR2        ;THAT ABORTED
7560  032522  001006                                  BNE     99$
7561  032524  012700  032452                          MOV     #2$,R0
7562  032530  005720                          5$:     TST     (R0)+           ;R0=ADDRESS OF INST FOLLOWING ABORT
7563  032532  020016                                  CMP     R0,(SP)         ;(3$)
7564  032534  001001                                  BNE     99$
7565  032536  000002                                  RTI                     ;RETURN
```

```
                                        ;ENTER HERE ON ERROR
032540  104000                  99$:   HLT                     ;REPORT ERROR
032542  010716                         MOV     PC,(SP)
032544  062716  177710                 ADD     #3$-.,(SP)
032550  000002                         RTI                     ;RETURN
032552  012637  000252          100$:  MOV     (SP)+,@#MMVEC+2 ;RESTORE ABORT VECTOR
032556  012637  000250                 MOV     (SP)+,@#MMVEC   ;& PRIORITY.
032562  012737  000001  177572         MOV     #1,@#SR0        ;CLEAR ERROR CONDITIONS
032570                          KTEX:
032570  000004                  RELE7: SCOPE
032572  010702                         MOV     PC,R2
032574  062702  000012                 ADD     #12,R2
032600  012707  036574                 MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
032604  000000                  REL77: .WORD   0
                                        ;7777777777777 LAST ADDRESS OF CODE TO BE RELOCATED 77777777777

                                        ;;*****************************************************************
                                        ;*TEST 103      FLOATING POINT TEST 1
                                        ;*
                                        ;*      THIS TEST TAKES TWO RANDOM NUMBERS (A AND B) AND
                                        ;*      COMPARES THE RESULTS OF TWO EQUAL CALCULATIONS.
                                        ;*      EACH SECTION EVALUATES A DIFFERENT EQUATION AS DESCRIBED BELOW:
                                        ;*      SECT1   (A+B)**2=A**2+2*A*B+B**2
                                        ;*      SECT2   (A+B)*(A-B)=A**2-B**2
                                        ;*      SECT3   A/B*B=A
                                        ;;*****************************************************************
032606                          ;ST103:
032606  012767  000001  146510         MOV     #1,$TIMES       ;;DO 1 ITERATION
032614  000004                         SCOPE
032616  112737  000103  001202         MOVB    #103,@#$TSTNM

                                        .SBTTL  START OF SECTION 8
                                        ;8888888888888 FIRST ADDRESS TO BE RELOCATED 888888888
032624  112737  000103  001202  REL8:  MOVB    #$TN-1,@#$TSTNM
032632  010700                         MOV     PC,R0           ;GET PC
032634  005740                         TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL8
032636  010037  001554                 MOV     R0,@#FRSTAD     ;SAVE
032642  010700                         MOV     PC,R0           ;GET CURRENT PC
032644  162700  032644                 SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
032650  010037  001550                 MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
032654  010737  001212                 MOV     PC,@#$LPERR     ;SET LOOP ADDRESS
032660  062737  000026  001212         ADD     #26,@#$LPERR    ;ADJUST
032666  013737  001212  001210         MOV     @#$LPERR,@#$LPADR
032674  105737  001544                 TSTB    @#NEXEC         ;BR IF TEST CODE TO BE EXECUTED
032700  001402                         BEQ     .+6
032702  000167  002400                 JMP     RELE8
032706  004737  053056          100$:  JSR     PC,@#FLTSGL     ;GET RANDOM OPERANDS
032712  170127  000000                 LDFPS   #0              ;INIT FPS
032716  172537  001424                 LDF     @#FTMP0,AC1     ;LOAD A OPERAND
032722  172437  001430                 LDF     @#FTMP2,AC0     ;LOAD B OPERAND
032726  013737  001444  001412         MOV     @#FREG0,@#$AC1  ;SETUP EXTENDED
032734  013737  001446  001410         MOV     @#FREG1,@#$AC0  ;EXPONENTS
032742  004767  002202                 JSR     PC,FLTADD       ;PERFORM THE ADD
032746  174100                         STF     AC1,AC0         ;SETUP AC0 TO
032750  013737  001412  001410         MOV     @#$AC1,@#$AC0   ;PERFORM THE SQUARE
032756  004767  002116                 JSR     PC,FLTMPY       ;DO THE MULTIPLY
```

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7622  032762  174137  001434                  STF     AC1,@#FTMP4     ;SAVE RESULT
7623  032766  013737  001412  001450          MOV     @#$AC1,@#FREG2  ;AND SOFTWARE EXP
7624                                  ;
7625                                  ;NOW DO THE RIGHT HAND SIDE OF THE EQUATION
7626                                  ;DO THE A*A FIRST
7627  032774  013737  001444  001410          MOV     @#FREG0,@#$AC0  ;GET EXT EXPONENT
7628  033002  172437  001424                  LDF     @#FTMP0,AC0     ;LOAD OPERAND A
7629  033006  013737  001410  001412          MOV     @#$AC0,@#$AC1   ;SET OPERAND B EXT EXPONENT
7630  033014  172500                          LDF     AC0,AC1         ;LOAD B OPERAND
7631  033016  004767  002056                  JSR     PC,FLTMPY       ;EXECUTE THE MULTIPLY
7632  033022  174102                          STF     AC1,AC2         ;SAVE RESULT
7633  033024  013737  001412  001414          MOV     @#$AC1,@#$AC2
7634                                  ;
7635                                  ;NOW DO THE B*B
7636  033032  172437  001430                  LDF     @#FTMP2,AC0     ;LOAD B OPERAND
7637  033036  172500                          LDF     AC0,AC1
7638  033040  013737  001446  001410          MOV     @#FREG1,@#$AC0  ;AND EXT EXPONENT
7639  033046  013737  001410  001412          MOV     @#$AC0,@#$AC1
7640  033054  004767  002020                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
7641  033060  174103                          STF     AC1,AC3         ;SAVE THE RESULT
7642  033062  013737  001412  001416          MOV     @#$AC1,@#$AC3
7643                                  ;
7644                                  ;NOW DO THE 2*B*A
7645  033070  012701  001430                  MOV     #FTMP2,R1
7646  033074  172411                          LDF     (R1),AC0        ;LOAD THE B OPERAND
7647  033076  172541                          LDF     -(R1),AC1       ;LOAD THE A OPERAND
7648  033100  013737  001446  001410          MOV     @#FREG1,@#$AC0  ;AND THE EXT EXPONENTS
7649  033106  013737  001444  001412          MOV     @#FREG0,@#$AC1
7650  033114  004767  001760                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
7651  033120  172427  040000                  LDF     #^O40000,AC0    ;SETUP TO MULTIPLY BY TWO
7652  033124  012737  000002  001410          MOV     #2,@#$AC0
7653  033132  004767  001742                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
7654                                  ;
7655                                  ;NOW SUM THE RESULTS
7656  033136  013737  001416  001410          MOV     @#$AC3,@#$AC0
7657  033144  172403                          LDF     AC3,AC0         ;GET RESULT OF B*B
7658  033146  004767  001776                  JSR     PC,FLTADD       ;ADD THE RESULT
7659  033152  172402                          LDF     AC2,AC0         ;GET RESULT OF A*A
7660  033154  013737  001414  001410          MOV     @#$AC2,@#$AC0
7661  033162  004767  001762                  JSR     PC,FLTADD       ;ADD THIS RESULT
7662  033166  174137  001440                  STF     AC1,@#FTMP6     ;SAVE FINAL RESULT
7663  033172  013737  001412  001452          MOV     @#$AC1,@#FREG3
7664                                  ;
7665                                  ;NOW CHECK BOTH SIDES OF THE EQUATION
7666                                  ;CALCULATE THE NUMBER OF CORRECT BITS
7667                                  ;PUT LARGEST EXPONENT OF A**2 OR B**2 IN $AC2
7668  033200  023737  001414  001416          CMP     @#$AC2,@#$AC3
7669  033206  002003                          BGE     1$              ;BRANCH IF $AC2 ALREADY HAS LARGEST
7670  033210  013737  001416  001414          MOV     @#$AC3,@#$AC2   ;$AC3 WAS LARGER
7671  033216  163737  001412  001414  1$:     SUB     @#$AC1,@#$AC2   ;NOW CALCULATE NUMBER
7672  033224  162737  000024  001414          SUB     #24.,@#$AC2     ;OF CORRECT BITS WITHIN 2
7673  033232  005437  001414                  NEG     @#$AC2          ;MAKE RESULT POSITIVE
7674  033236  172437  001434                  LDF     @#FTMP4,AC0     ;LOAD RESULT OF LEFT HAND SIDE
7675  033242  013737  001450  001410          MOV     @#FREG2,@#$AC0  ;AND EXTENDED EXPONENT
7676  033250  004767  001670                  JSR     PC,FLTSUB       ;SUBTRACT TO SEE HOW CLOSE THEY ARE
7677  033254  163737  001452  001412          SUB     @#FREG3,@#$AC1  ;GET DIFFERENCE IN EXT EXPONENTS
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7678                                                    ;ACTUAL EXP'S ARE EQUAL TO 200
7679  033262  100002                      BPL     3$    ;ENSURE RESULT IS POSITIVE
7680  033264  005437  001412              NEG     @#$AC1
7681  033270  023737  001414  001412  3$: CMP     @#$AC2,@#$AC1   ;ANSWERS WITHIN ALLOWABLE NUMBER
7682  033276  003401                      BLE     SECT2           ;BRANCH IF YES
7683  033300  104014                  4$: ERROR   14              ;RESULTS ARE WRONG
7684                                    ;;*****************************************************************
7685  033302  170127  000000          SECT2:  LDFPS   #0
7686                                    ;DO A+B
7687  033306  172537  001424                  LDF     @#FTMP0,AC1     ;LOAD A OPERAND
7688  033312  172437  001430                  LDF     @#FTMP2,AC0     ;LOAD B OPERAND
7689  033316  013737  001444  001412         MOV     @#FREG0,@#$AC1
7690  033324  013737  001446  001410         MOV     @#FREG1,@#$AC0
7691  033332  004767  001612                 JSR     PC,FLTADD       ;ADD THEM
7692  033336  174102                         STF     AC1,AC2         ;SAVE IN AC2
7693  033340  013737  001412  001414         MOV     @#$AC1,@#$AC2   ;AND EXT EXPONENT
7694                                    ;NOW DO THE A-B
7695  033346  172537  001424                  LDF     @#FTMP0,AC1     ;LOAD OPERAND A
7696  033352  013737  001444  001412         MOV     @#FREG0,@#$AC1  ;AND EXT EXPONENT
7697  033360  172437  001430                  LDF     @#FTMP2,AC0     ;LOAD OPERAND B
7698  033364  013737  001446  001410         MOV     @#FREG1,@#$AC0
7699  033372  004767  001546                 JSR     PC,FLTSUB       ;SUBTRACT THEM
7700                                    ;NOW DO (A+B)*(A-B)
7701  033376  172402                         LDF     AC2,AC0         ;GET RESULT OF (A+B)
7702  033400  013737  001414  001410         MOV     @#$AC2,@#$AC0
7703  033406  004767  001466                 JSR     PC,FLTMPY       ;FORM THE PRODUCT
7704  033412  174137  001434                 STF     AC1,@#FTMP4     ;SAVE RESULT
7705  033416  013737  001412  001450         MOV     @#$AC1,@#FREG2  ;AND EXT EXPONENT
7706                                    ;NOW DO THE B*B
7707  033424  172437  001430                  LDF     @#FTMP2,AC0     ;LOAD OPERAND B
7708  033430  013737  001446  001410         MOV     @#FREG1,@#$AC0
7709  033436  172500                         LDF     AC0,AC1         ;B OPERAND IS IN AC0
7710  033440  013737  001410  001412         MOV     @#$AC0,@#$AC1   ;AND EXT EXPONENT
7711  033446  004767  001426                 JSR     PC,FLTMPY       ;
7712  033452  174102                         STF     AC1,AC2         ;SAVE RESULT IN AC2
7713  033454  013737  001412  001414         MOV     @#$AC1,@#$AC2
7714                                    ;NOW DO THE A*A
7715  033462  172437  001424                  LDF     @#FTMP0,AC0     ;LOAD OPERAND A
7716  033466  013737  001444  001410         MOV     @#FREG0,@#$AC0
7717  033474  172500                         LDF     AC0,AC1
7718  033476  013737  001410  001412         MOV     @#$AC0,@#$AC1
7719  033504  004767  001370                 JSR     PC,FLTMPY       ;EXECUTE THE MULTIPLY
7720  033510  013737  001412  001416         MOV     @#$AC1,@#$AC3   ;SAVE EXT EXPO OF A*A
7721                                    ;NOW DO A**2-B**2
7722  033516  172402                         LDF     AC2,AC0         ;GET B*B
7723  033520  013737  001414  001410         MOV     @#$AC2,@#$AC0   ;A*A IN AC1
7724  033526  004767  001412                 JSR     PC,FLTSUB
7725  033532  174137  001440                 STF     AC1,@#FTMP6     ;SAVE IN MEMORY
7726  033536  013737  001412  001452         MOV     @#$AC1,@#FREG3
7727                                    ;NOW COMPUTE THE RESULTS
7728                                    ;CALCULATE THE NUMBER OF CORRECT BITS
7729  033544  023737  001414  001416         CMP     @#$AC2,@#$AC3   ;DETERMINE WHICH EXP IS LARGER
7730  033552  002003                         BGE     2$              ;BRANCH IF AC2 LARGER
7731  033554  013737  001416  001414         MOV     @#$AC3,@#$AC2   ;PUT LARGEST IN AC2
7732  033562  163737  001412  001414  2$:    SUB     @#$AC1,@#$AC2
7733  033570  162737  000025  001414         SUB     #21.,@#$AC2
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7734  033576  005437  001414                    NEG     @#$AC2
7735  033602  172437  001434                    LDF     @#FTMP4,AC0     ;GET LEFT HAND SIDE
7736  033606  013737  001450  001410            MOV     @#FREG2,@#$AC0
7737  033614  004767  001324                    JSR     PC,FLTSUB       ;SUBTRACT TO SEE HOW CLOSE THEY ARE
7738  033620  163737  001452  001412            SUB     @#FREG3,@#$AC1  ;SUB EXT EXPONENTS
7739                                                                    ;ACTUAL EXPONENTS ARE EQUAL
7740  033626  100002                            BPL     1$              ;MAKE SURE RESULT IS POSITIVE
7741  033630  005437  001412                    NEG     @#$AC1
7742  033634  023737  001414  001412  1$:       CMP     @#$AC2,@#$AC1   ;RESULTS WITHIN RANGE ALLOWED?
7743  033642  003401                            BLE     SECT3           ;BRANCH IF YES
7744  033644  104014                            ERROR   14              ;RESULTS WRONG
7745
7746                                    ;;*****************************************************************
7747  033646  172537  001424            SECT3:  LDF     @#FTMP0,AC1     ;LOAD OPERAND A
7748  033652  172437  001430                    LDF     @#FTMP2,AC0     ;AND OPERAND B
7749  033656  013737  001444  001412            MOV     @#FREG0,@#$AC1
7750  033664  013737  001446  001410            MOV     @#FREG1,@#$AC0
7751  033672  004767  001224                    JSR     PC,FLTDIV       ;GO DIVIDE THEM
7752  033676  004767  001176                    JSR     PC,FLTMPY       ;MULTIPLY RESULT BY B
7753  033702  174137  001434                    STF     AC1,@#FTMP4     ;SAVE RESULT
7754  033706  013737  001412  001450            MOV     @#$AC1,@#FREG2
7755  033714  172437  001424                    LDF     @#FTMP0,AC0     ;LOAD OPERAND A
7756  033720  174037  001440                    STF     AC0,@#FTMP6     ;SAVE INCASE TYPE OUT
7757  033724  013737  001444  001410            MOV     @#FREG0,@#$AC0
7758  033732  013737  001444  001452            MOV     @#FREG0,@#FREG3
7759  033740  004767  001200                    JSR     PC,FLTSUB       ;SUBTRACT RIGHT AND LEFT HAND SIDES
7760  033744  163737  001444  001412            SUB     @#FREG0,@#$AC1  ;SEE IF RESULT OK
7761  033752  100002                            BPL     1$              ;ENSURE DIFFERANCE IS POSITIVE
7762  033754  005437  001412                    NEG     @#$AC1
7763  033760  022737  000027  001412  1$:       CMP     #23.,@#$AC1     ;RESULTS WITHIN 2 BITS?
7764  033766  003001                            BGT     2$              ;BRANCH IF NO
7765  033770  000401                            BR      TST104          ;;GO TO NEXT TEST
7766  033772  104014                    2$:     ERROR   14              ;RESULTS WRONG
7767
7768                                    ;;*****************************************************************
7769                                    ;*TEST 104      FLOATING POINT TEST 2
7770                                    ;*
7771                                    ;*      THIS TEST TAKES TWO RANDOM NUMBERS (A AND B) AND
7772                                    ;*      COMPARES THE RESULTS OF TWO EQUAL CALCULATIONS.
7773                                    ;*      EACH SECTION EVALUATES A DIFFERENT EQUATION AS DESCRIBED BELOW:
7774                                    ;*      SECT1   (A+B)**2=A**2+2*A*B+B**2
7775                                    ;*      SECT2   (A+B)*(A-B)=A**2-B**2
7776                                    ;*      SECT3   A/B*B=A
7777                                    ;*****************************************************************
7778  033774                            TST104:
7779  033774  000004                            SCOPE
7780  033776  112737  000104  001202            MOVB    #104,@#$TSTNM
7781  034004  012737  000001  001324            MOV     #1,@#$TIMES
7782  034012  004737  053050                    JSR     PC,@#FLTDBL     ;GET RANDOM OPERANDS
7783  034016  170127  000200            100$:   LDFPS   #200            ;INIT FPS
7784  034022  172537  001424                    LDF     @#FTMP0,AC1     ;LOAD A OPERAND
7785  034026  172437  001434                    LDF     @#FTMP4,AC0     ;LOAD B OPERAND
7786  034032  013737  001444  001412            MOV     @#FREG0,@#$AC1  ;SETUP EXTENDED
7787  034040  013737  001446  001410            MOV     @#FREG1,@#$AC0  ;EXPONENTS
7788  034046  004767  001076                    JSR     PC,FLTADD       ;PERFORM THE ADD
7789  034052  174100                            STF     AC1,AC0         ;SETUP AC0 TO
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 7790  034054  013737  001412  001410          MOV     @#SAC1,@#SAC0   ;PERFORM THE SQUARE
 7791  034062  004767  001012                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
 7792  034066  174137  001464                  STF     AC1,@#FLTMP0    ;SAVE RESULT
 7793  034072  013737  001412  001450          MOV     @#SAC1,@#FREG2  ;AND SOFTWARE EXP
 7794                                  ;
 7795                                  ;NOW DO THE RIGHT HAND SIDE OF THE EQUATION
 7796                                  ;DO THE A*A FIRST
 7797  034100  013737  001444  001410          MOV     @#FREG0,@#SAC0  ;GET EXT EXPONENT
 7798  034106  172437  001424                  LDF     @#FTMP0,AC0     ;LOAD OPERAND A
 7799  034112  013737  001410  001412          MOV     @#SAC0,@#SAC1   ;SET OPERAND B EXT EXPONENT
 7800  034120  172500                          LDF     AC0,AC1         ;LOAD B OPERAND
 7801  034122  004767  000752                  JSR     PC,FLTMPY       ;EXECUTE THE MULTIPLY
 7802  034126  174102                          STF     AC1,AC2         ;SAVE RESULT
 7803  034130  013737  001412  001414          MOV     @#SAC1,@#SAC2
 7804                                  ;
 7805                                  ;NOW DO THE B*B
 7806  034136  172437  001434                  LDF     @#FTMP4,AC0     ;LOAD B OPERAND
 7807  034142  172500                          LDF     AC0,AC1
 7808  034144  013737  001446  001410          MOV     @#FREG1,@#SAC0  ;AND EXT EXPONENT
 7809  034152  013737  001410  001412          MOV     @#SAC0,@#SAC1
 7810  034160  004767  000714                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
 7811  034164  174103                          STF     AC1,AC3         ;SAVE THE RESULT
 7812  034166  013737  001412  001416          MOV     @#SAC1,@#SAC3
 7813                                  ;
 7814                                  ;NOW DO THE 2*B*A
 7815  034174  012701  001434                  MOV     #FTMP4,R1
 7816  034200  172411                          LDF     (R1),AC0        ;LOAD THE B OPERAND
 7817  034202  172541                          LDF     -(R1),AC1       ;LOAD THE A OPERAND
 7818  034204  013737  001446  001410          MOV     @#FREG1,@#SAC0  ;AND THE EXT EXPONENTS
 7819  034212  013737  001444  001412          MOV     @#FREG0,@#SAC1
 7820  034220  004767  000654                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
 7821  034224  172427  040000                  LDF     #^O040000,AC0   ;SETUP TO MULTIPLY BY TWO
 7822  034230  012737  000002  001410          MOV     #2,@#SAC0
 7823  034236  004767  000636                  JSR     PC,FLTMPY       ;DO THE MULTIPLY
 7824                                  ;
 7825                                  ;NOW SUM THE RESULTS
 7826  034242  013737  001416  001410          MOV     @#SAC3,@#SAC0
 7827  034250  172403                          LDF     AC3,AC0         ;GET RESULT OF B*B
 7828  034252  004767  000672                  JSR     PC,FLTADD       ;ADD THE RESULT
 7829  034256  172402                          LDF     AC2,AC0         ;GET RESULT OF A*A
 7830  034260  013737  001414  001410          MOV     @#SAC2,@#SAC0
 7831  034266  004767  000656                  JSR     PC,FLTADD       ;ADD THIS RESULT
 7832  034272  174137  001474                  STF     AC1,@#FLTMP1    ;SAVE FINAL RESULT
 7833  034276  013737  001412  001452          MOV     @#SAC1,@#FREG3
 7834                                  ;
 7835                                  ;NOW CHECK BOTH SIDES OF THE EQUATION
 7836                                  ;CALCULATE THE NUMBER OF CORRECT BITS
 7837                                  ;PUT LARGEST EXPONENT OF A**2 OR B**2 IN $AC2
 7838  034304  023737  001414  001416          CMP     @#SAC2,@#SAC3
 7839  034312  002003                          BGE     1$              ;BRANCH IF $AC2 ALREADY HAS LARGEST
 7840  034314  013737  001416  001414          MOV     @#SAC3,@#SAC2   ;$AC3 WAS LARGER
 7841  034322  163737  001412  001414  1$:     SUB     @#SAC1,@#SAC2   ;NOW CALCULATE NUMBER
 7842  034330  163737  000065  001414          SUB     #53.,@#SAC2     ;OF CORRECT BITS WITHIN 2
 7843  034336  005437  001414                  NEG     @#SAC2          ;MAKE RESULT POSITIVE
 7844  034342  172437  001464                  LDF     @#FLTMP0,AC0    ;LOAD RESULT OF LEFT HAND SIDE
 7845  034346  013737  001450  001410          MOV     @#FREG2,@#SAC0  ;AND EXTENDED EXPONENT
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7846  034354  004767  000564                  JSR     PC,FLTSUB       ;SUBTRACT TO SEE HOW CLOSE THEY ARE
7847  034360  163737  001452  001412          SUB     @#FREG3,@#SAC1  ;GET DIFFERENCE IN EXT EXPONENTS
7848                                                                  ;ACTUAL EXP'S ARE EQUAL TO 200
7849  034366  100002                          BPL     3$              ;ENSURE RESULT IS POSITIVE
7850  034370  005437  001412                  NEG     @#SAC1
7851  034374  023737  001414  001412  3$:     CMP     @#SAC2,@#SAC1   ;ANSWERS WITHIN ALLOWABLE NUMBER?
7852  034402  003401                          BLE     SECT2D          ;BRANCH IF YES
7853  034404  104011                  4$:     ERROR   11              ;RESULTS ARE WRONG
7854                                  ;;**********************************************************************
7855  034406  170127  000200          SECT2D: LDFPS   #200
7856                                  ;DO A+B
7857  034412  172537  001424                  LDF     @#FTMP0,AC1     ;LOAD A OPERAND
7858  034416  172437  001434                  LDF     @#FTMP4,AC0     ;LOAD B OPERAND
7859  034422  013737  001444  001412          MOV     @#FREG0,@#SAC1
7860  034430  013737  001446  001410          MOV     @#FREG1,@#SAC0
7861  034436  004767  000506                  JSR     PC,FLTADD       ;ADD THEM
7862  034442  174102                          STF     AC1,AC2         ;SAVE IN AC2
7863  034444  013737  001412  001414          MOV     @#SAC1,@#SAC2   ;AND EXT EXPONENT
7864                                  ;NOW DO THE A-B
7865  034452  172537  001424                  LDF     @#FTMP0,AC1     ;LOAD OPERAND A
7866  034456  013737  001444  001412          MOV     @#FREG0,@#SAC1  ;AND EXT EXPONENT
7867  034464  172437  001434                  LDF     @#FTMP4,AC0     ;LOAD OPERAND B
7868  034470  013737  001446  001410          MOV     @#FREG1,@#SAC0
7869  034476  004767  000442                  JSR     PC,FLTSUB       ;SUBTRACT THEM
7870                                  ;NOW DO (A+B)*(A-B)
7871  034502  172402                          LDF     AC2,AC0         ;GET RESULT OF (A+B)
7872  034504  013737  001414  001410          MOV     @#SAC2,@#SAC0
7873  034512  004767  000362                  JSR     PC,FLTMPY       ;FORM THE PRODUCT
7874  034516  174137  001464                  STF     AC1,@#FLTMP0    ;SAVE RESULT
7875  034522  013737  001412  001450          MOV     @#SAC1,@#FREG2  ;AND EXT EXPONENT
7876                                  ;NOW DO THE B*B
7877  034530  172437  001434                  LDF     @#FTMP4,AC0     ;LOAD OPERAND B
7878  034534  013737  001446  001410          MOV     @#FREG1,@#SAC0
7879  034542  172500                          LDF     AC0,AC1         ;B OPERAND IS IN AC0
7880  034544  013737  001410  001412          MOV     @#SAC0,@#SAC1   ;AND EXT EXPONENT
7881  034552  004767  000322                  JSR     PC,FLTMPY       ;
7882  034556  174102                          STF     AC1,AC2         ;SAVE RESULT IN AC2
7883  034560  013737  001412  001414          MOV     @#SAC1,@#SAC2
7884                                  ;NOW DO THE A*A
7885  034566  172437  001424                  LDF     @#FTMP0,AC0     ;LOAD OPERAND A
7886  034572  013737  001444  001410          MOV     @#FREG0,@#SAC0
7887  034600  172500                          LDF     AC0,AC1
7888  034602  013737  001410  001412          MOV     @#SAC0,@#SAC1
7889  034610  004767  000264                  JSR     PC,FLTMPY       ;EXECUTE THE MULTIPLY
7890  034614  013737  001412  001416          MOV     @#SAC1,@#SAC3   ;SAVE EXT EXPO OF A*A
7891                                  ;NOW DO A**2-B**2
7892  034622  172402                          LDF     AC2,AC0         ;GET B*B
7893  034624  013737  001414  001410          MOV     @#SAC2,@#SAC0   ;A*A IN AC1
7894  034632  004767  000306                  JSR     PC,FLTSUB
7895  034636  174137  001474                  STF     AC1,@#FLTMP1    ;SAVE IN MEMORY
7896  034642  013737  001412  001452          MOV     @#SAC1,@#FREG3
7897                                  ;NOW COMPUTE THE RESULTS
7898                                  ;CALCULATE THE NUMBER OF CORRECT BITS
7899  034650  023737  001414  001416          CMP     @#SAC2,@#SAC3   ;DETERMINE WHICH EXP IS LARGER
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  7900  034656  002003                        BGE     2$              ;BRANCH IF AC2 LARGER
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7901  034660  013737  001416  001414          MOV     @#$AC3,@#$AC2   ;PUT LARGEST IN AC2
7902  034666  163737  001412  001414  2$:     SUB     @#$AC1,@#$AC2
7903  034674  162737  000066  001414          SUB     #54.,@#$AC2
7904  034702  005437  001414                  NEG     @#$AC2
7905  034706  172437  001464                  LDF     @#FLTMP0,AC0    ;GET LEFT HAND SIDE
7906  034712  013737  001450  001410          MOV     @#FREG2,@#$AC0
7907  034720  004767  000220                  JSR     PC,FLTSUB       ;SUBTRACT TO SEE HOW CLOSE THEY ARE
7908  034724  163737  001452  001412          SUB     @#FREG3,@#$AC1  ;SUB EXT EXPONENTS
7909                                                                  ;ACTUAL EXPONENTS ARE EQUAL
7910  034732  100002                          BPL     1$              ;MAKE SURE RESULT IS POSITIVE
7911  034734  005437  001412                  NEG     @#$AC1
7912  034740  023737  001414  001412  1$:     CMP     @#$AC2,@#$AC1   ;RESULTS WITHIN RANGE ALLOWED?
7913  034746  003401                          BLE     SECT3D          ;BRANCH IF YES
7914  034750  104011                          ERROR   11              ;RESULTS WRONG
7915
7916                                  ;;*****************************************************************
7917  034752  172537  001424          SECT3D: LDF     @#FTMP0,AC1     ;LOAD OPERAND A
7918  034756  172437  001434                  LDF     @#FTMP4,AC0     ;AND OPERAND B
7919  034762  013737  001444  001412          MOV     @#FREG0,@#$AC1
7920  034770  013737  001446  001410          MOV     @#FREG1,@#$AC0
7921  034776  004767  000120                  JSR     PC,FLTDIV       ;GO DIVIDE THEM
7922  035002  004767  000072                  JSR     PC,FLTMPY       ;MULTIPLY RESULT BY B
7923  035006  174137  001464                  STF     AC1,@#FLTMP0    ;SAVE RESULT
7924  035012  013737  001412  001450          MOV     @#$AC1,@#FREG2
7925  035020  172437  001424                  LDF     @#FTMP0,AC0     ;LOAD OPERAND A
7926  035024  174037  001474                  STF     AC0,@#FLTMP1    ;SAVE INCASE TYPE OUT
7927  035030  013737  001444  001410          MOV     @#FREG0,@#$AC0
7928  035036  013737  001444  001452          MOV     @#FREG0,@#FREG3
7929  035044  004767  000074                  JSR     PC,FLTSUB       ;SUBTRACT RIGHT AND LEFT HAND SIDES
7930  035050  163737  001444  001412          SUB     @#FREG0,@#$AC1  ;SEE IF RESULT OK
7931  035056  100002                          BPL     1$              ;ENSURE DIFFERANCE IS POSITIVE
7932  035060  005437  001412                  NEG     @#$AC1
7933  035064  022737  000067  001412  1$:     CMP     #55.,@#$AC1     ;RESULTS WITHIN 2 BITS?
7934  035072  003505                          BLE     RELE8           ;BRANCH IF YES
7935  035074  104011                          ERROR   11              ;RESULTS WRONG
7936  035076  000503                          BR      RELE8
7937
7938                                  ;;*****************************************************************
7939                                  .SBTTL  FLOATING POINT MULTIPLY ROUTINE
7940                                  ;*      THIS ROUTINE MULTIPLIES THE CONTENTS OF AC0 AND AC1
7941                                  ;*      AND LEAVES THE RESULT IN AC1. IT ALSO TAKES CARE OF
7942                                  ;*      THE SOFTWARE EXPONENTS THAT ARE KEPT IN $AC0 AND $AC1.
7943                                  ;;*****************************************************************
7944  035100  063737  001410  001412  FLTMPY: ADD     @#$AC0,@#$AC1   ;ADD SOFTWARE EXPONENTS
7945  035106  171100                          MULF    AC0,AC1         ;DO THE MULTIPLY
7946  035110  012746  100400                  MOV     #100400,-(SP)   ;PUT CONTROL WORD ON STACK
7947  035114  004737  053210                  JSR     PC,@#EXPEXT     ;CALCULATE EXT EXPONENT
7948  035120  000207                  1$:     RTS     PC              ;RETURN
7949
7950                                  ;;*****************************************************************
7951                                  .SBTTL  FLOATING POINT DIVIDE ROUTINE
7952                                  ;*      THIS ROUTINE DIVIDES THE CONTENTS OF AC1 BY AC0
7953                                  ;*      AND LEAVES THE RESULT IN AC1.
7954                                  ;;*****************************************************************
7955  035122  163737  001410  001412  FLTDIV: SUB     @#$AC0,@#$AC1   ;ADJUST SOFTWARE EXPONENTS
7956  035130  174500                          DIVF    AC0,AC1         ;EXECUTE THE DIVIDE
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7957  035132  012746  100400            MOV     #100400,-(SP)   ;PUT CONTROL WORD ON STACK
7958  035136  004737  053210            JSR     PC,@#EXPEXT     ;CALCULATE EXT EXPONENT
7959  035142  000207            1$:     RTS     PC              ;RETURN
7960
7961                                ;;*****************************************************************
7962                                .SBTTL  FLOATING POINT ADD ROUTINE
7963                                ;*      THIS ROUTINE ADDS THE CONTENTS OF AC0 TO AC1.
7964                                ;*      THIS CAN ONLY BE DONE IF THE SOFTWARE EXPONENTS
7965                                ;*      ARE CLOSE ENOUGH TOGETHER SUCH THAT AN ADJUSTMENT
7966                                ;*      OF THE REAL EXPONENT LEAVES A NON-ZERO NUMBER.
7967                                ;;*****************************************************************
7968  035144  010667  000134       FLTSUB: MOV     SP,SUBFLG       ;SET SUBTRACT FLAG
7969  035150  023737  001410  001412 FLTADD: CMP     @#$AC0,@#$AC1   ;CHECK SOFTWARE EXPONENTS
7970  035156  003016                    BGT     1$
7971  035160  001434                    BEQ     2$
7972                                ;ACCUMULATOR 1 IS LARGER THAN ACCUMULATOR 0
7973  035162  013702  001412            MOV     @#$AC1,R2       ;GET OPERAND B SOFTWARE EXP
7974  035166  163702  001410            SUB     @#$AC0,R2       ;GET DIFFERENCE IN SOFTWARE EXP'S
7975  035172  020227  000071            CMP     R2,#57.         ;EXP WITHIN DBL PREC RANGE?
7976  035176  002003                    BGE     7$              ;BRANCH IF ADD NOT REQUIRED
7977                                                            ;RESULT IS OPERAND B
7978  035200  005402                    NEG     R2
7979  035202  176402                    LDEXP   R2,AC0          ;RELOAD THE EXPONENT
7980  035204  000422                    BR      2$
7981  035206  176427  177703    7$:     LDEXP   #-75,AC0        ;FAKE EXPONENT SO HARDWARE
7982  035212  000417                    BR      2$              ;WILL DETECT OUT OF RANGE
7983                                ;
7984                                ;ACCUMULATOR 0 IS LARGER THAN ACCUMULATOR 1
7985  035214  013702  001410    1$:     MOV     @#$AC0,R2       ;GET SOFTWARE EXP OF OPERAND A
7986  035220  163702  001412            SUB     @#$AC1,R2       ;GET DIFFERENCE IN EXP'S
7987  035224  013737  001410  001412    MOV     @#$AC0,@#$AC1   ;MAKE SOFTWARE EXP'S EQUAL
7988  035232  020227  000071            CMP     R2,#57. ;EXP WITHIN DBL PREC RANGE?
7989  035236  002003                    BGE     4$              ;BRANCH IF NO
7990  035240  005402                    NEG     R2
7991  035242  176502                    LDEXP   R2,AC1          ;RELOAD THE EXPONENT
7992  035244  000402                    BR      2$
7993                                ;
7994                                ;ACCUMULATOR 0 IS MUCH LARGER THAN ACCUMULATOR 1 SO RESULT IS 0
7995  035246  176527  177703    4$:     LDEXP   #-75,AC1        ;FAKE EXPONENT SO HARDWARE
7996                                                            ;WILL DETECT OUT OF RANGE
7997  035252  005767  000026    2$:     TST     SUBFLG          ;ADD OR SUBTRACT?
7998  035256  001402                    BEQ     5$              ;BRANCH IF ADD
7999  035260  173100                    SUBF    AC0,AC1
8000  035262  000401                    BR      6$
8001  035264  172100            5$:     ADDF    AC0,AC1         ;EXECUTE THE ADD
8002  035266  012746  100400    6$:     MOV     #100400,-(SP)   ;PUT CONTROL WORD ON STACK
8003  035272  004737  053210            JSR     PC,@#EXPEXT     ;CALCULATE EXT EXPONENT
8004  035276  005067  000002    3$:     CLR     SUBFLG          ;INIT SUBTRACT FLAG
8005  035302  000207                    RTS     PC              ;RETURN
8006  035304  000000            SUBFLG: .WORD
8007  035306  000004            RELEB:  SCOPE
8008  035310  010702                    MOV     PC,R2
8009  035312  062702  000012            ADD     #12,R2
8010  035316  012707  036574            MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
8011  035322  000000            RELBB:  .WORD   0
8012                                ;888888888888 LAST ADDRESS OF CODE TO BE RELOCATED 888888888
```

```
                                        ;;*****************************************************************
                                        ;*TEST 105       TELETYPE AND CLOCK TESTS
                                        ;;*****************************************************************
035324                                  TST105:
035324  000240                                    NOP
035326  112737  000105  001202                    MOVB    #105,@#$TSTNM
035334  113777  001202  143700                    MOVB    @#$TSTNM,@SWR
035342  005037  001550            TTYCHK: CLR     @#FACTOR
035346  012704  000100                    MOV     #100,R4                 ;SET R4 = CONSTANT 100
035352  032737  000400  001532            BIT     #TTOPT,@#OPT.CP         ;BRANCH IF TTY
035360  001002                            BNE     1$                      ;ON SYSTEM
035362  000167  000206                    JMP     ARBFIN                  ;JUMP IF NOT
035366  122777  000200  143656    1$:     CMPB    #200,@$TPS              ;CHECK IF TTY IS READY
035374  001374                            BNE     1$
035376  012737  001567  001276            MOV     #NULLS-1,@#$REGS;SET ADDRESS OF ASCII STRING TO TYPE
035404  106277  143642                    ASRB    @$TPS                   ;SET IE BIT. SEE TPISR FOR INT SERVICE.
035410  000001                            WAIT                            ;WAIT FOR INTERRUPT

035412                                  DUMMY:
                                        ;ROUTINE TO CHECK PRIORITY ARBITRATION LOGIC
                                        ;THE BELOW TEST WILL INHIBIT INTERRUPTS ON LEVEL 6 AND BELOW (LOCKING
                                        ;OUT THE LINE CLOCK) AND THEN SET UP THE TTY TO INTERRUPT. NEXT THE
                                        ;PRIORITY LEVEL WILL BE SET TO 0 ALLOWING INTERRUPTS IN WHICH CASE
                                        ;THE LINE CLOCK (AT LEVEL 6) SHOULD INTERRUPT BEFORE THE TTY (AT LEVEL 4).
```

```
 8039  035412  132737  000020  177776  1$:     BITB    #20,@#PSW
 8040  035420  001072                          BNE     ARBEX                   ;EXIT TEST IF 'T' BIT SET
 8041  035422  030477  143624          2$:     BIT     R4,@$TPS                ;WAIT FOR TTY TO BE NOT
 8042  035426  001375                          BNE     2$                      ;BUSY
 8043  035430  112737  000300  177776          MOVB    #300,@#PSW              ;SET PRIORITY LEVEL 6
 8044  035436  150477  143610          3$:     BISB    R4,@$TPS                ;SET IE BIT
 8045  035442  100375                          BPL     3$                      ;AND WAIT FOR READY
 8046  035444  032737  001000  001532          BIT     #LKOPT,@#OPT.CP         ;LINE CLOCK AVAILABLE?
 8047  035452  001450                          BEQ     ARBFIN                  ;BRANCH IF NO
 8048  035454  012737  035546  000064          MOV     #7$,@#TPVEC             ;SET TTY VECTOR
 8049  035462  012737  035560  000100          MOV     #8$,@#LKVEC             ;SET CLOCK VECTORS
 8050  035470  012737  000340  000102          MOV     #PR7,@#LKVEC+2
 8051  035476  005027                          CLR     (PC)+                   ;CLEAR CHECK WORD
 8052  035500  000000                  4$:     .WORD   0
 8053  035502  000240                          NOP
 8054  035504  000240                          NOP
 8055  035506  000240                          NOP
 8056  035510  010437  177546                  MOV     R4,@#LKS
 8057  035514  113700                  5$:     MOVB    @(PC)+,R0               ;GET CLOCK STATUS & BRANCH IF READY
 8058  035516  177546                  6$:     .WORD   LKS                     ;CONTAINS ADDRESS OF L CLOCK STAT
 8059  035520  100375                          BPL     5$
 8060  035522  000240                          NOP                             ;AT THIS TIME BOTH THE CLOCK
 8061                                                                          ;ARE READY TO INTERRUPT
 8062  035524  105037  177776                  CLRB    @#PSW                   ;SET PRIORITY LEVEL 0
 8063                          ;A CLOCK INTERRUPT WILL OCCUR (8$) AND LOC 4$ WILL BE INCREMENTED
 8064                          ;AFTER THE CLOCK SERVICE A TTY INTERRUPT WILL OCCUR. THE TTY INT SERV
 8065                          ;ICE WILL SHIFT LEFT 4$.
 8066
 8067  035530  000240                          NOP                             ;LEAVE TIME FOR INTERRUPTS
 8068  035532  022767  000002  177740          CMP     #2,4$                   ;CHECK THAT THE CLOCK
 8069  035540  001415                          BEQ     ARBFIN                  ;& TTY INTERRUPTED IN
 8070  035542  104000                          HLT                             ;THE PROPER SEQUENCE
 8071  035544  000413                          BR      ARBFIN
 8072
 8073  035546  005077  143500          7$:     CLR     @$TPS                   ;CLEAR IE BIT
 8074  035552  006367  177722                  ASL     4$                      ;SHIFT INDICATOR
 8075  035556  000002                          RTI                             ;RETURN
 8076
 8077  035560  005267  177714          8$:     INC     4$
 8078  035564  012737  046630  000100          MOV     #LKSRV,@#LKVEC          ;SET CLOCK VECTORS
 8079  035572  000002                          RTI
 8080
 8081
 8082  035574  012737  054364  000064  ARBFIN: MOV     #TPISR,@#TPVEC          ;RESTORE TTY VECTOR
 8083  035602  005077  143444                  CLR     @$TPS                   ;CLEAR IE BIT
 8084  035606                          ARBEX:
 8085                          ;;*****************************************************************
 8086                          ;*TEST 106      TURN ON UBE AND MBT
 8087                          ;*      TURN ON THE MASS BUS TESTER AND UNIBUS EXERCISER IF PRESENT
 8088                          ;;*****************************************************************
 8089  035606                  TST106:
 8090  035606  000240                          NOP
 8091  035610  112737  000106  001202          MOVB    #106,@#$TSTNM
 8092  035616  113777  001202  143416          MOVB    @#$TSTNM,@SWR
 8093
 8094                          ;FIRST SETUP SOME MEM. MGMT. REGISTERS
```

```
8095  035624  012700  077406              MOV     #77406,R0       ;SET CONSTANT=R/W UP 4K WORDS
8096  035630  010037  172300              MOV     R0,@#KIPDR0     ;SET KIPDR0,1,2,3,& 7 R/W UP 4K WORDS
8097  035634  010037  172302              MOV     R0,@#KIPDR1
8098  035640  010037  172304              MOV     R0,@#KIPDR2
8099  035644  010037  172306              MOV     R0,@#KIPDR3
8100  035650  010037  172310              MOV     R0,@#KIPDR4
8101  035654  010037  172312              MOV     R0,@#KIPDR5
8102  035660  010037  172316              MOV     R0,@#KIPDR7
8103  035664  005037  172340              CLR     @#KIPAR0
8104  035670  012737  000200  172342      MOV     #200,@#KIPAR1
8105  035676  012737  000400  172344      MOV     #400,@#KIPAR2
8106  035704  012737  007600  172356      MOV     #7600,@#KIPAR7
8107  035712  005737  177776              TST     @#PSW           ;ARE WE IN USER MODE?
8108  035716  100464                      BMI     11$             ;BRANCH IF YES
8109  035720  005737  001624              TST     @#MXMMLO        ;HAS MXMMLO BEEN FOUND YET?
8110  035724  001061                      BNE     11$             ;BRANCH IF YES
8111  035726  012737  000001  177572      MOV     #1,@#SR0
8112                          ;GET ADDRESS OF LAST MEMORY LOCATION ON THE SYSTEM
8113  035734  012737  000600  172346      MOV     #600,@#KIPAR3   ;INITIALLY MAP PAR3 TO 12K
8114  035742  012737  036006  000004      MOV     #10$,@#ERRVEC   ;EXIT TO 10$ ON FIRST TIMEOUT
8115  035750  005037  000006              CLR     @#ERRVEC+2      ;BE SURE IN KERNEL MODE
8116  035754  012700  060000              MOV     #60000,R0       ;SETUP STARTING VIRTUAL ADDR.
8117  035760  012701  100000              MOV     #100000,R1      ;SETUP VIRT. ADDR. THAT SELECTS PAR4
8118  035764  005720              5$:     TST     (R0)+           ;TEST MEMORY LOCATION
8119  035766  020001                      CMP     R0,R1           ;DOES VIRT. ADDR. STILL SELECT PAR3
8120  035770  103775                      BLO     5$              ;BRANCH IF IT DOES
8121  035772  062737  000200  172346      ADD     #200,@#KIPAR3   ;MAP PAR3 UP TO THE NEXT 4K
8122  036000  012700  060000              MOV     #60000,R0       ;RESET R0
8123  036004  000767                      BR      5$              ;CONTINUE TESTING EACH VIRT. ADDR.
8124                                                              ;UNTIL A TIMEOUT OCCURS
8125  036006  062706  000004      10$:    ADD     #4,SP           ;CLEANUP THE STACK
8126  036012  162700  000002              SUB     #2,R0           ;GET VIRT. ADDR. OF "TIMEOUT" LOC.
8127  036016  010003                      MOV     R0,R3           ;MOVE VIRT. ADDR. INTO R3
8128  036020  072327  177772              ASH     #-6,R3          ;SHIFT VIRT. ADDR. RIGHT SIX BITS
8129  036024  042703  177600              BIC     #177600,R3      ;CLEAR OFF THE TOP 9 BITS
8130  036030  063703  172346              ADD     @#KIPAR3,R3     ;ADD THE PAF TO THE BLOCK NO.
8131  036034  005002                      CLR     R2              ;CLEAR R2
8132  036036  073227  000006              ASHC    #6,R2           ;FORM TOP 12 BITS OF PHYSICAL ADDR.
8133  036042  042702  177774              BIC     #177774,R2      ;CLEAR ALL BUT BITS 0 & 1 IN R2
8134  036046  042700  177700              BIC     #177700,R0      ;CLEAR BITS <15:06> IN VIRT. ADDR.
8135  036052  050003                      BIS     R0,R3           ;SET BITS <05:00> IN PHYSICAL ADDR.
8136  036054  010237  001622              MOV     R2,@#MXMMHI     ;SAVE BITS 16 & 17 OF TIMEOUT ADDR.
8137  036060  010337  001624              MOV     R3,@#MXMMLO     ;SAVE BITS 15-0 OF TIMEOUT ADDR.
8138  036064  005037  177572              CLR     @#SR0           ;TURN MEM. MGMT. OFF AGAIN
8139
8140  036070  032737  001000  001532  11$:    BIT     #LKOPT,@#OPT.CP         ;BRANCH IF NOT AVAIL
8141  036076  001411                      BEQ     UBESET
8142  036100  012737  046630  000100      MOV     #LKSRV,@#LKVEC
8143  036106  012737  000340  000102      MOV     #PR7,@#LKVEC+2
8144  036114  052737  000100  177546      BIS     #100,@#LKS              ;SET IE BIT
8145
8146                          ;;**************************************************************
8147                          ;TURN ON THE UNIBUS EXERCISER IF PRESENT
8148  036122  105737  001532  UBESET: TSTB    @#OPT.CP        ;IS UBE OPTION AVAILABLE?
8149  036126  100023                      BPL     MBTSET          ;BRANCH IF NO
8150  036130  032777  010000  143104      BIT     #SW12,@SWR      ;INHIBIT UBE?
```

```
8151  036136  001017                          BNE     MBTSET          ;BRANCH IF YES
8152  036140  122737  000060  001574          CMPB    #60,@#SUBPASS   ;FIRST SUB-PASS?
8153  036146  001056                          BNE     STMM            ;BRANCH IF NO
8154  036150  105737  001200                  TSTB    @#$PASS         ;FIRST PASS?
8155  036154  001053                          BNE     STMM            ;BRANCH IF NO
8156  036156  105737  001545                  TSTB    @#MMON          ;MEM MGMT ON?
8157  036162  001050                          BNE     STMM            ;BRANCH IF YES
8158  036164  004737  053646                  JSR     PC,@#UBEINIT    ;INITIALIZE UBE
8159  036170  012772  064545  000000          MOV     #64545,@(R2)    ;START UBE
8160
8161                                  ;;**************************************************************
8162                                  ;TURN ON THE MASS BUS TESTER IF PRESENT
8163  036176  032737  002000  001532  MBTSET: BIT     #MBTOPT,@#OPT.CP        ;IS MBT AVAILABLE?
8164  036204  001437                          BEQ     STMM            ;BRANCH IF NO
8165  036206  032777  000010  143026          BIT     #SW3,@SWR       ;INHIBIT MBT?
8166  036214  001033                          BNE     STMM            ;BRANCH IF YES
8167  036216  122737  000060  001574          CMPB    r60,@#SUBPASS   ;FIRST SUB-PASS?
8168  036224  001027                          BNE     STMM            ;BRANCH IF NO
8169  036226  105737  001200                  TSTB    @#$PASS         ;FIRST PASS?
8170  036232  001024                          BNE     STMM            ;BRANCH IF NO
8171  036234  105737  001545                  TSTB    @#MMON          ;MEM MGMT ON?
8172  036240  001021                          BNE     STMM            ;BRANCH IF YES
8173  036242  052777  000047  144064  MBT1:   BIS     #47,@MBTTBL+12                  ;CLEAR THE MBT
8174  036250  012777  000007  144056          MOV     #7,@MBTTBL+12                   ;SELECT UNIT 7
8175  036256  005077  144042                  CLR     @MBTTBL+2                       ;CLEAR THE WORD COUNT
8176  036262  012777  046304  144054          MOV     #MBTSRV,@MBTTBL+22              ;SETUP INTERRUPT VECTOR
8177  036270  012777  000240  144050          MOV     #PR5,@MBTTBL+24                 ;SET VECTOR PSW
8178  036276  112777  000161  144016          MOVB    #161,@MBTTBL                    ;START MBT
8179
8180                                  ;;**************************************************************
8181                                  ;SBTTL  STMM ROUTINE
8182                                  ;ROUTINE TO SET UP MEMORY MANAGEMENT TO RELOCATE PROGRAM CODE ABOVE 16K
8183                                  ;CHECK IF PROGRAM IS TO BE RELOCATED.
8184                                  ;SW6=1=NO RELOCATION
8185                                  ;;**************************************************************
8186  036304  032777  000100  142730  STMM:   BIT     #SW6,@SWR       ;RELOCATION DISABLED?
8187  036312  001402                          BEQ     3$              ;BRANCH IF NO
8188  036314  000167  002266                  JMP     ENDM
8189
8190                                  ;THE PROGRAM IS GOING TO RELOCATE.
8191                                  ;RELOCATION WILL BE PERFORMED IN KERNEL MODE WITH PSW SET AT PRIORITY
8192                                  ;LEVEL 4 (TO PREVENT TTY INTERRUPT-WHICH CHANGES DATA IN PROGRAM)
8193                                  ;THE 'T' BIT IS CLEARED (IF SET). AFTER THE DATA HAS BEEN WRITTEN IT IS
8194                                  ;VERIFIED BEFORE EXECUTION.
8195  036320  013727  177776          3$:     MOV     @#PSW,(PC)+     ;SAVE CURRENT PSW
8196  036324  000000                  OLDPSW: .WORD   0
8197  036326  012737  000200  177776          MOV     #PR4,@#PSW
8198  036334  004767  015552                  JSR     PC,CLRTBIT      ;GO CLEAR 'T' BIT IF SET
8199
8200                                  ;NOW SETUP MEMORY MANAGEMENT REGISTERS.
8201
8202  036340  005037  172340                  CLR     @#KIPAR0        ;NOTE: THESE 2 INSTRUCIONS EFFECTIVELY
8203  036344  012737  000200  172342          MOV     #200,@#KIPAR1   ;RELOCATE PROGRAM EXECUTION
8204  036352  012737  000400  172344          MOV     #400,@#KIPAR2
8205  036360  013737  001562  172346          MOV     @#NEXPAR,@#KIPAR3       ;SET UP KIPAR3 & KIPAR4 & 5
8206  036366  013737  172346  172350          MOV     @#KIPAR3,@#KIPAR4
```

```
8207  036374  062737  000200  172350          ADD     #200,@#KIPAR4
8208  036402  013737  172346  172352          MOV     @#KIPAR3,@#KIPAR5
8209  036410  062737  000400  172352          ADD     #400,@#KIPAR5
8210  036416  012737  007600  172356          MOV     #7600,@#KIPAR7;AND OF COUSE THE I/O PAGE
8211                                  ;NOW SETUP USER MEM MGMT REGISTERS
8212  036424  012700  077406          1$:     MOV     #77406,R0       ;LOAD R0 WITH VALUE FOR PDRS
8213  036430  010037  177600                  MOV     R0,@#UIPDR0     ;SET UP USER MEM MGMT REGS
8214  036434  010037  177602                  MOV     R0,@#UIPDR1
8215  036440  010037  177604                  MOV     R0,@#UIPDR2
8216  036444  010037  177616                  MOV     R0,@#UIPDR7
8217  036450  016737  143106  177640          MOV     NEXPAR,@#UIPAR0
8218  036456  013737  177640  177642          MOV     @#UIPAR0,@#UIPAR1
8219  036464  062737  000200  177642          ADD     #200,@#UIPAR1
8220  036472  013737  177640  177644          MOV     @#UIPAR0,@#UIPAR2
8221  036500  062737  000400  177644          ADD     #400,@#UIPAR2
8222  036506  013737  172356  177656          MOV     @#KIPAR7,@#UIPAR7
8223
8224  036514  012737  000001  177572          MOV     #1,@#SR0        ;ENABLE MEM MGMT
8225  036522  110637  001545                  MOVB    SP,@#MMON       ;SET MEM MGMT ON IND = ON
8226  036526  013767  001202  021202          MOV     @#$TSTNM,ENDTAG ;LOAD LAST WORD XFERED
8227  036534  012737  040604  000004  RETRY:  MOV     #ENDMEM,@#ERRVEC;SET TIME OUT TRAP VECTOR
8228  036542  005037  000006                  CLR     @#ERRVEC+2
8229  036546  012702  060000                  MOV     #60000,R2       ;SETUP GENERAL REGISTERS
8230  036552  005000                          CLR     R0              ;DATA WILL BE RELOCATED FROM
8231                                                                  ;ADDRESS IN R0 TO ADDRESS IN R2
8232  036554  012703  137776                  MOV     #137776,R3      ;GET 12K WORDS TO RELOCATE
8233  036560  010013                          MOV     R0,(R3)         ;TRAP TO ENDMEM IF INSUFFICIENT MEMORY
8234  036562  012737  055064  000004          MOV     #ERPRT,@#ERRVEC ;RESTORE ERROR TRAP VECTOR
8235  036570  000137  036770                  JMP     @#IOMON
8236                                  ;;******************************************************************
8237                                  .SBTTL  RELOCATION ROUTINE
8238                                  ;*      THIS ROUTINE IS USED TO RELOCATE THE 9 SUBTESTS UP TO 28K.
8239                                  ;*      IF RELOCATION BY AN I/O DEVICE IS SELECTED, CONTROL IS PASSED
8240                                  ;*      TO THE I/O MONITOR.
8241                                  ;*      ENTER WITH:
8242                                  ;*              FRSTAD=PHYSICAL ADDRESS OF FIRST CODE
8243                                  ;*              FACTOR=NUMBER OF BYTES ABOVE BASE CODE
8244                                  ;*              R2    =LAST PHYSICAL ADDRESS OF THE SECTION
8245                                  ;*      EXIT TO I/O MONITOR WITH:
8246                                  ;*              OLDBASE=FIRST PHYSICAL ADDRESS TO BE RELOCATED
8247                                  ;*              NWBASL =FIRST PHYSICAL ADDRESS TO RELOCATE TO
8248                                  ;*              IOWC   =TWO'S COMPLIMENT WORD COUNT
8249                                  ;;******************************************************************
8250  036574  032777  000100  142440  RELOC:  BIT     #SW6,@SWR               ;IS RELOCATION DISABLED?
8251  036602  001067                          BNE     EXITRE                  ;BRANCH IF YES
8252  036604  105737  001545                  TSTB    @#MMON                  ;IS MEMORY MGMT ON?
8253  036610  001064                          BNE     EXITRE                  ;BRANCH IF YES
8254  036612  013700  001554                  MOV     @#FRSTAD,R0             ;GET FIRST ADDRESS TO BE RELOCATED
8255  036616  010005                          MOV     R0,R5
8256                                  ;LAST ADDRESS IS IN R2
8257  036620  010203                          MOV     R2,R3                   ;SAVE LAST ADDRESS
8258  036622  010204                          MOV     R2,R4
8259  036624  160004                          SUB     R0,R4                   ;R4 NOW HAS BYTE COUNT
8260  036626  010437  001552                  MOV     R4,@#$FACTOR            ;SAVE BYTE COUNT
8261  036632  005737  001550                  TST     @#FACTOR                ;FIRST RELOC IS TO ENDTAG+2
8262  036636  001004                          BNE     1$                      ;BRANCH IF NOT EXECUTING BASE CODE
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 8263  036640  010237  036766                 MOV     R2,@#RETPC              ;SAVE RETURN PC TO NEXT SECTION
 8264  036644  013702  001556                 MOV     @#FRSTMEM,R2            ;GET FIRST ADDRESS TO RELOCATE TO
 8265  036650  060204                 1$:     ADD     R2,R4                   ;R4 NOW CONTAINS LAST MEM ADDRESS
 8266  036652  020437  001560                 CMP     R4,@#LSTMEM             ;ENOUGH MEMORY?
 8267  036656  101042                         BHI     NOMEM                   ;BRANCH IF NO
 8268  036660  160204                         SUB     R2,R4                   ;R4 NOW HAS BYTE COUNT
 8269  036662  005037  001550                 CLR     @#FACTOR
 8270  036666  032777  000400  142346         BIT     #SW8,@SWR               ;INHIBIT RELOC BY I/O DEVICE?
 8271  036674  001014                         BNE     RELNIO                  ;BRANCH IF YES
 8272  036676  010037  001602                 MOV     R0,@#OLDBASE            ;SAVE START ADDRESS
 8273  036702  010237  001604                 MOV     R2,@#NWBASL             ;SAVE NEW BASE ADDRESS
 8274  036706  005037  001606                 CLR     @#NWBASH                ;
 8275  036712  006204                         ASR     R4                      ;MAKE IT A WORD COUNT
 8276  036714  005404                         NEG     R4                      ;GET TWO'S COMPLIMENT
 8277  036716  010437  001610                 MOV     R4,@#IOWC               ;SAVE R4 AS WORDCOUNT
 8278  036722  000167  000120                 JMP     ENTER2                  ;GO TO I/O MONITOR
 8279                          ;RELOCATE BY CPU-MEMORY MANAGEMENT OFF
 8280  036726  012022                 RELNIO: MOV     (R0)+,(R2)+             ;RELOCATE CODE
 8281  036730  020003                         CMP     R0,R3                   ;DONE YET?
 8282  036732  001375                         BNE     RELNIO                  ;BRANCH IF NO
 8283  036734  004737  054026                 JSR     PC,@#CHKDAT             ;GO CHECK DATA
 8284  036740  102010                         BVC     EXITRE
 8285  036742  010037  001304                 MOV     R0,@#$TMP0              ;SAVE R0 FOR TYPEOUT
 8286  036746  010237  001536                 MOV     R2,@#VADR               ;SAVE R2
 8287  036752  004737  053724                 JSR     PC,@#CNVADR             ;CONVERT R2 TO A PHYSICAL ADR
 8288  036756  104006                         ERROR   6
 8289  036760  000401                         BR      NOMEM
 8290  036762  010207                 EXITRE: MOV     R2,PC                   ;GO EXECUTE RELOCATED CODE
 8291  036764  011707                 NOMEM:  MOV     (PC),PC                 ;GO TO NEXT SECTION
 8292  036766  000000                 RETPC:  .WORD   0                       ;CONTAINS PC OF NEXT SECTION
 8293                          ;;*****************************************************************
 8294                          .SBTTL  I/O RELOCATION MONITOR
 8295                          ;*      THIS ROUTINE IS USED TO SCHEDULE I/O DEVICES FOR SUBTEST
 8296                          ;*      RELOCATION AND PROGRAM RELOCATION. THE I/O DEVICE UNIT
 8297                          ;*      NUMBER IS DETERMINED, THE BUS ADDRESS CALCULATED, THE WORD
 8298                          ;*      COUNT CALCULATED AND PASSED TO THE DEVICE HANDLER.
 8299                          ;;*****************************************************************
 8300  036770  012737  036776  001212 IOMON:  MOV     #1$,@#$LPERR    ;SETUP ERROR LOOP
 8301  036776  005037  001602         1$:     CLR     @#OLDBASE
 8302  037002  013705  172346                 MOV     @#KIPAR3,R5             ;SETUP R4 AND R5
 8303  037006  005004                         CLR     R4                      ;TO FORM 18 BIT ADDRESS
 8304  037010  073427  000006                 ASHC    #6,R4                   ;FORM 18 BIT ADDRESS
 8305  037014  010537  001604                 MOV     R5,@#NWBASL             ;SAVE LOWER 16 BITS
 8306  037020  010437  001606                 MOV     R4,@#NWBASH             ;SAVE UPPER 2 BITS
 8307  037024  032777  000400  142210         BIT     #SW8,@SWR               ;RELOCATE VIA I/O?
 8308  037032  001402                         BEQ     2$                      ;BRANCH IF YES
 8309  037034  000167  001374                 JMP     RELOCP                  ;GO RELOCATE VIA CP
 8310  037040  012737  174000  001610 2$:     MOV     #174000,@#IOWC          ;SET WORD COUNT TO 2K
 8311  037046  005037  001310         ENTER2: CLR     @#$TMP2
 8312  037052  012737  177776  001620         MOV     #-2,@#RNTBINX           ;SETUP RUN TABLE INDEX
 8313  037060  005037  001304                 CLR     @#$TMP0
 8314  037064  005002                         CLR     R2                      ;CLEAR LEGAL DEV FLAG
 8315  037066  032777  000040  142146 41$:    BIT     #SW5,@SWR               ;INHIBIT ROUND ROBIN?
 8316  037074  001416                         BEQ     50$                     ;BRANCH IF NO
 8317  037076  005737  001304                 TST     @#$TMP0                 ;FLAG SET?
 8318  037102  001027                         BNE     43$                     ;BRANCH IF YES
```

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8319  037104  117737  142132  001614          MOVB    @SWR,@#DEVINDX          ;GET DEVICE FROM SWITCHES
8320  037112  042737  177770  001614          BIC     #177770,@#DEVINDX       ;MASK LOWER 3 BITS
8321  037120  006337  001614                  ASL     @#DEVINDX               ;ADJUST FOR WORD INDEX
8322  037124  005237  001304                  INC     @#$TMPO                 ;SET FLAG
8323  037130  000414                          BR      43$                     ;CONTINUE
8324  037132  012705  000010          50$:    MOV     #10,R5                  ;SET SOB COUNT
8325  037136  022737  000016  001614  40$:    CMP     #16,@#DEVINDX           ;LAST DEVICE YET?
8326  037144  001003                          BNE     42$                     ;BRANCH IF NO
8327  037146  012737  177776  001614  48$:    MOV     #-2,@#DEVINDX           ;INIT DEVICE INDEX
8328  037154  062737  000002  001614  42$:    ADD     #2,@#DEVINDX            ;INCREMENT INDEX
8329  037162  013703  001614          43$:    MOV     @#DEVINDX,R3            ;GET INDEX
8330  037166  012737  000401  001306          MOV     #401,@#$TMP1            ;INIT UNIT MASK
8331  037174  012704  000010                  MOV     #10,R4          ;SET SOB COUNT
8332  037200  133763  001306  001646  44$:    BITB    @#$TMP1,SYSSIZE(R3)     ;IS THIS UNIT EXISTENT?
8333  037206  001405                          BEQ     52$                     ;BRANCH IF NO
8334  037210  005202                          INC     R2                      ;SET LEGAL DEVICE FLAG
8335  037212  133763  001307  001647          BITB    @#$TMP1+1,SYSSIZE+1(R3) ;HAS IT BEEN USED?
8336  037220  001520                          BEQ     11$                     ;BRANCH IF NO
8337  037222  006337  001306          52$:    ASL     @#$TMP1                 ;SELECT NEXT UNIT
8338  037226  077414                          SOB     R4,44$                  ;CONTINUE
8339  037230  005737  001304                  TST     @#$TMPO                 ;INHIBIT ROUND ROBIN?
8340  037234  001013                          BNE     45$                     ;BRANCH IF YES
8341  037236  077541                          SOB     R5,40$                  ;CONTINUE
8342  037240  005702                          TST     R2                      ;ANY DEVICES AT ALL?
8343  037242  001442                          BEQ     46$                     ;BRANCH IF NO
8344  037244  012704  000010                  MOV     #10,R4                  ;SET SOB COUNT
8345  037250  012701  001647                  MOV     #SYSSIZE+1,R1           ;GET ADR OF SIZE TABLE
8346  037254  105021          47$:    CLRB    (R1)+                   ;CLEAR ALL USED BITS
8347  037256  005201                  INC     R1                      ;IN ALL DEVICES
8348  037260  077403                  SOB     R4,47$                  ;CONTINUE
8349  037262  000701                  BR      41$
8350  037264  005702          45$:    TST     R2                      ;WAS IT A LEGAL DEVICE?
8351  037266  001403                  BEQ     49$                     ;BRANCH IF NO
8352  037270  105063  001647          CLRB    SYSSIZE+1(R3)           ;CLEAR ALL USED BITS THIS DEV
8353  037274  000732                  BR      43$
8354  037276  010367  000016          MOV     R3,60$                  ;
8355  037302  062767  055236  000010  ADD     #MSGINX,60$             ;GEN MESSAGE ADR
8356  037310  017767  000004  000002  MOV     @60$,60$
8357  037316  104401                  TYPE
8358  037320  000000          60$:    .WORD
8359  037322  104401  037330          TYPE    ,65$                    ;;TYPE ASCIZ STRING
8360  037326  000407                  BR      64$                     ;;GET OVER THE ASCIZ
8361                          ;;65$:  .ASCIZ  /UNAVAILABLE/<CRLF>
8362  037346                  64$:
8363  037346  000637                  BR      ENTER2
8364  037350  105737  001546  46$:    TSTB    @#QV                    ;ACT11?
8365  037354  001016                  BNE     51$                     ;BRANCH IF YES
8366  037356  005227  177777          INC     #-1
8367  037362  001013                  BNE     51$
8368  037364  104401  037372          TYPE    ,67$                    ;;TYPE ASCIZ STRING
8369  037370  000410                  BR      66$                     ;;GET OVER THE ASCIZ
8370                          ;;67$:  .ASCIZ  ?NO I/O DEVICES?<CRLF>
8371  037412                  66$:
8372  037412  105737  001545  51$:    TSTB    @#MMON                  ;MGMT ON?
8373  037416  001012                  BNE     61$                     ;BRANCH IF YES
8374  037420  013700  001602          MOV     @#OLDBASE,R0            ;RESTORE R0
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8375  037424  013702  001604                    MOV     @#NWBASL,R2             ;RESTORE R2
8376  037430  013703  001552                    MOV     @#$FACTOR,R3            ;GET RELOCATION FACTOR
8377  037434  060003                            ADD     R0,R3                   ;FORM LAST ADDRESS
8378  037436  010005                            MOV     R0,R5                   ;SETUP R5
8379  037440  000167  177262                    JMP     RELNIO                  ;GO RELOCATE WITH CP
8380  037444  012702  060000          61$:      MOV     #60000,R2               ;SETUP REGISTERS
8381  037450  012703  137776                    MOV     #137776,R3              ;WITH FROM
8382  037454  005000                            CLR     R0                      ;AND TO ADDRESS
8383  037456  000137  040434                    JMP     @#RELOCP                ;RELOCATE VIA CP
8384  037462  105763  001752          11$:      TSTB    RP3HSTAT(R3)            ;IS HANDLER BUSY?
8385  037466  100405                            BMI     8$                      ;BRANCH IF NO
8386  037470  005737  001304                    TST     @#$TMP0                 ;ROUND ROBIN?
8387  037474  001372                            BNE     11$                     ;BRANCH IF NO
8388  037476  000167  177364                    JMP     41$
8389  037502  005763  001752          8$:       TST     RP3HSTAT(R3)            ;DID HANDLER FAIL?
8390  037506  100005                            BPL     62$                     ;BRANCH IF NO
8391  037510  005737  001304                    TST     @#$TMP0                 ;ROUND ROBIN
8392  037514  001402                            BEQ     62$                     ;BRANCH IF YES
8393  037516  000137  040414                    JMP     @#15$
8394  037522  153763  001307  001647  62$:      BISB    @#$TMP1+1,SYSSIZE+1(R3) ;SET UNIT USED BIT
8395  037530  005002                            CLR     R2
8396  037532  006037  001306          30$:      ROR     @#$TMP1                 ;ENCODE THE BIT POSITION
8397  037536  005202                            INC     R2                      ;INTO A UNIT NUMBER
8398  037540  103374                            BCC     30$
8399  037542  005302                            DEC     R2
8400  037544  010237  001616                    MOV     R2,@#UNITNO             ;SAVE UNIT NUMBER
8401  037550  013763  001610  001772  10$:      MOV     @#IOWC,RP3WC(R3)        ;GIVE WORD COUNT TO HANDLER
8402  037556  010304                            MOV     R3,R4
8403  037560  072427  000003                    ASH     #3,R4                   ;ENCODE DEVICE FOR RUNTABLE
8404  037564  053704  001616                    BIS     @#UNITNO,R4             ;ENCODE UNIT NUMBER
8405  037570  006304                            ASL     R4
8406  037572  062737  000002  001620            ADD     #2,@#RNTBINX            ;INCREMENT RUN TABLE INDEX
8407  037600  013702  001620                    MOV     @#RNTBINX,R2            ;GET RUN TABLE INDEX
8408  037604  110462  001667                    MOVB    R4,RUNTBL+1(R2)         ;ENTER DEV & UNIT IN TABLE
8409  037610  013763  001616  002066            MOV     @#UNITNO,RP3UNIT(R3)    ;GIVE HANDLER UNIT NUMBER
8410  037616  012737  000240  000012            MOV     #PR5,@#RESVEC+2         ;SETUP RESERVED VECTOR PSW
8411  037624  016337  002102  000010            MOV     RP3HANA(R3),@#RESVEC    ;SETUP RESERVED VECTOR
8412  037632  006303                            ASL     R3                      ;ADJUST INDEX
8413  037634  013763  001602  002006            MOV     @#OLDBASE,RP3OLD(R3)    ;GIVE HANDLER OLD BASE ADDRESS
8414  037642  013763  001604  002036            MOV     @#NWBASL,RP3NWL(R3)     ;GIVE HANDLER
8415  037650  013763  001606  002040            MOV     @#NWBASH,RP3NWH(R3)     ;NEW BASE ADDRESS
8416  037656  005063  002010                    CLR     RP3OLD+2(R3)            ;ENSURE OLD BASE HIGH IS CLR
8417  037662  000010                            CALLHANDLER
8418  037664  105737  001545                    TSTB    @#MMON                  ;IS MEMORY MANAGEMENT ON?
8419  037670  001416                            BEQ     13$                     ;BRANCH IF NO
8420  037672  022737  000012  001620            CMP     #12,@#RNTBINX           ;TRANSFERED 12K YET?
8421  037700  001412                            BEQ     13$                     ;BRANCH IF YES
8422  037702  062737  010000  001602            ADD     #10000,@#OLDBASE        ;ADD 2K
8423  037710  062737  010000  001604            ADD     #10000,@#NWBASL         ;TO BASE
8424  037716  005537  001606                    ADC     @#NWBASH                ;ADDRESSES
8425  037722  000137  037066                    JMP     @#41$
8426  037726  113705  001645          13$:      MOVB    @#LTICKS+1,R5           ;GET SECOND COUNT
8427  037732  062705  000002                    ADD     #2,R5                   ;INCREMENT BY TWO
8428  037736  162705  000074                    SUB     #60.,R5                 ;ENSURE RESULT IS 59 OR LESS
8429  037742  100002                            BPL     31$
8430  037744  062705  000074                    ADD     #60.,R5                 ;COUNT WAS LESS THAN 58-RESTORE
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8431  037750  012700  000010          31$:    MOV     #10,R0                  ;SET SOB COUNT
8432  037754  005002                          CLR     R2
8433  037756  005003                          CLR     R3
8434  037760  005004                          CLR     R4
8435  037762  066203  001752          14$:    ADD     RP3HSTAT(R2),R3         ;ADD ALL THE HANDLER
8436  037766  005504                          ADC     R4                      ;STATUS WORDS. WHEN ALL
8437  037770  062702  000002                  ADD     #2,R2                   ;TRANSFERS ARE FINISHED
8438  037774  077006                          SOB     R0,14$                  ;RESULT WILL BE 2000
8439  037776  006103                          ROL     R3                      ;(WITHOUT ROTATE)
8440  040000  005504                          ADC     R4
8441  040002  022703  004000                  CMP     #4000,R3                ;ALL DONE?
8442  040006  001406                          BEQ     32$                     ;BRANCH IF YES
8443  040010  123709  001645                  CMPB    @#LTICKS+1,R5           ;TWO SECONDS ELAPSED YET?
8444  040014  001355                          BNE     31$                     ;BRANCH IF NO
8445  040016  104015                          ERROR   15                      ;DEVICE HUNG
8446  040020  000177  141166                  JMP     @$LPERR                 ;RESTART RELOCATION
8447  040024  005704          32$:    TST     R4                      ;ANY DEVICE ERRORS?
8448  040026  001172                          BNE     15$                     ;BRANCH IF YES
8449  040030  105737  001545                  TSTB    @#MMON                  ;MEM MGMT ON?
8450  040034  001012                          BNE     25$                     ;BRANCH IF YES
8451  040036  013705  001602                  MOV     @#OLDBASE,R5            ;SETUP R5 FOR DATA CHECK
8452  040042  010500                          MOV     R5,R0
8453  040044  063700  001552                  ADD     @#$FACTOR,R0            ;GET LAST ADDRESS
8454                                                                          ;OF GOOD DATA
8455  040050  013702  001604                  MOV     @#NWBASL,R2
8456  040054  063702  001552                  ADD     @#$FACTOR,R2            ;GET LAST ADDRESS
8457                                                                          ;OF DATA TO BE CHECKED
8458  040060  000406                          BR      22$                     ;CONTINUE
8459  040062  012700  057776          25$:    MOV     #57776,R0               ;GET LAST ADR OF GOOD DATA
8460  040066  012702  137776                  MOV     #137776,R2              ;GET LAST ADR OF DATA TO BE CHECKED
8461  040072  012705  002500                  MOV     #2500,R5                ;DON'T CHECK FIRST 2000 LOCATIONS
8462  040076  004737  054026          22$:    JSR     PC,@#CHKDAT             ;GO CHECK DATA
8463  040102  102173                          BVC     EXIT                    ;EXIT IF NO ERRORS
8464  040104  005001                          CLR     R1
8465  040106  010037  001304                  MOV     R0,@#$TMP0
8466  040112  010237  001536                  MOV     R2,@#VADR
8467  040116  010203                          MOV     R2,R3                   ;SAVE ERROR ADDRESS
8468  040120  005004                          CLR     R4
8469  040122  105737  001545                  TSTB    @#MMON                  ;IS MEM MGMT ON?
8470  040126  001406                          BEQ     16$                     ;BRANCH IF NO
8471  040130  162703  010000          17$:    SUB     #10000,R3               ;SUBTRACT 2K FROM ERROR ADDRESS
8472  040134  100403                          BMI     16$                     ;BRANCH IF BLOCK IS FOUND
8473  040136  062704  000002                  ADD     #2,R4                   ;COUNT ONE MORE BLOCK
8474  040142  000772                          BR      17$                     ;CONTINUE
8475                          ;R4 NOW CONTAINS INDEX OF ERROR FOR RUN TIME TABLE
8476  040144  116404  001667          16$:    MOVB    RUNTBL+1(R4),R4         ;GET DEVICE THAT FAILED
8477  040150  042704  177400                  BIC     #177400,R4              ;ENSURE HIGH BYTE CLEAR
8478  040154  006004                          ROR     R4                      ;THROW AWAY LSB
8479  040156  005005                          CLR     R5                      ;ENSURE R5 CLEAR
8480  040160  073427  177775                  ASHC    #-3,R4                  ;GET UNIT NUMBER IN R5
8481  040164  010500                          MOV     R5,R0
8482  040166  072027  177764                  ASH     #-14,R0
8483  040172  042700  177770                  BIC     #177770,R0
8484  040176  010037  001312                  MOV     R0,@#$TMP3
8485  040202  010403                          MOV     R4,R3                   ;AND DEVICE INDEX IN R4 & R3
8486  040204  010337  001310                  MOV     R3,@#$TMP2
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8487  040210  012737  000001  001306          MOV     #1,@#$TMP1              ;ENCODE 3 BIT UNIT NO INTO
8488  040216  162705  020000          19$:    SUB     #20000,R5               ;ONE BIT IN THE LOW BYTE OF $TMP1
8489  040222  103403                          BCS     18$                     ;BRANCH IF DONE
8490  040224  006137  001306                  ROL     @#$TMP1                 ;SELECT NEXT UNIT
8491  040230  000772                          BR      19$                     ;CONTINUE
8492  040232  012737  040350  001212  18$:    MOV     #20$,@#$LPERR           ;SETUP LOOP RETURN
8493  040240  005701                          TST     R1                      ;DEVICE ERROR?
8494  040242  001010                          BNE     100$                    ;BRANCH IF YES
8495  040244  104010                          ERROR   10                      ;DATA CHECK ERROR
8496  040246  105737  001545                  TSTB    @#MMON                  ;MGMT ON?
8497  040252  001002                          BNE     70$                     ;BRANCH IF YES
8498  040254  000137  037046          71$:    JMP     @#ENTER2
8499  040260  000137  036770          70$:    JMP     @#IOMON
8500  040264  104007          100$:   ERROR   7
8501  040266  042763  100000  001752          BIC     #BIT15,RP3HSTAT(R3)     ;CLEAR THE ERROR
8502  040274  022703  000002                  CMP     #2,R3                   ;RK?
8503  040300  002405                          BLT     90$                     ;BRANCH IF RH
8504  040302  003016                          BGT     92$                     ;BRANCH IF RP03
8505  040304  112777  000001  141670          MOVB    #1,@RKCS                ;CLEAR RK
8506  040312  000412                          BR      92$
8507
8508  040314  022703  000012          90$:    CMP     #12,R3                  ;RS?
8509  040320  001004                          BNE     91$                     ;BRANCH IF NO
8510  040322  052777  000040  141740          BIS     #BIT5,@RSCS2            ;CLEAR RS
8511  040330  000403                          BR      92$
8512
8513  040332  052777  000040  141670  91$:    BIS     #BIT5,@RP4CS2           ;CLEAR RP
8514
8515  040340                          92$:
8516  040340  105737  001545                  TSTB    @#MMON                  ;MGMT ON?
8517  040344  001345                          BNE     70$                     ;BRANCH IF YES
8518  040346  000742                          BR      71$
8519  040350  052763  000400  001752  20$:    BIS     #BIT8,RP3HSTAT(R3)      ;SET REPEAT FLAG IN HANDLER
8520  040356  016337  002102  000010          MOV     RP3HANA(R3),@#RESVEC    ;SETUP RESERVED INSTRUCTION VECTOR
8521  040364  000010                          CALLHANDLER
8522  040366  105763  001752          21$:    TSTB    RP3HSTAT(R3)            ;HANDLER FINISHED?
8523  040372  100375                          BPL     21$                     ;BRANCH IF NO
8524  040374  005763  001752                  TST     RP3HSTAT(R3)            ;ANY ERROR?
8525  040400  100714                          BMI     18$                     ;BRANCH IF YES
8526  040402  032777  001000  140632          BIT     #BIT9,@SWR              ;STILL LOOPING?
8527  040410  001357                          BNE     20$                     ;BRANCH IF YES
8528  040412  000725                          BR      100$+2                  ;CONTINUE TEST
8529                                  ;THE FOLLOWING CODE HANDLES DEVICE ERROR ON RELOCATION
8530  040414  005004          15$:    CLR     R4                              ;SET INDEX
8531  040416  010601                          MOV     SP,R1
8532  040420  005764  001702          24$:    TST     RUNTRAK(R4)             ;SEARCH FOR DEVICE ERROR
8533  040424  100647                          BMI     16$                     ;BRANCH IF ERROR
8534  040426  062704  000002                  ADD     #2,R4                   ;INCREMENT INDEX
8535  040432  000772                          BR      24$                     ;CONTINUE SEARCH
8536                                  ;RELOCATE BY CPU-MEMORY MANAGEMENT ON
8537  040434  012022          RELOCP: MOV     (R0)+,(R2)+             ;RELOCATE CODE
8538  040436  020302                          CMP     R3,R2                   ;DONE YET?
8539  040440  001375                          BNE     RELOCP                  ;BRANCH IF NO
8540  040442  012705  002500                  MOV     #2500,R5
8541  040446  004737  054026                  JSR     PC,@#CHKDAT             ;CHECK DATA
8542  040452  102007                          BVC     EXIT
```

```
8543  040454  010037  001304          MOV     R0,@#$TMP0
8544  040460  010237  001536          MOV     R2,@#VADR
8545  040464  104006                  ERROR   6
8546  040466  000167  176042          JMP     RETRY
8547  040472  105737  001545  EXIT:   TSTB    @#MMON                  ;MEM MGMT ON?
8548  040476  001002                  BNE     .+6                     ;BRANCH IF YES
8549  040500  000137  036762          JMP     @#EXITRE
8550  040504  062737  000077  001562  ADD     #77,@#NEXPAR            ;SET VALUE FOR NEXT RELOCATION
8551  040512  013737  172346  172340  MOV     @#KIPAR3,@#KIPAR0
8552  040520  013737  172350  172342  MOV     @#KIPAR4,@#KIPAR1
8553  040526  013737  172352  172344  MOV     @#KIPAR5,@#KIPAR2
8554                                  ;*************************************************************************
8555                                  ;PROGRAM IS NOW EXECUTING IN KERNEL MODE RELOCATED TO ADDRESS AS SPEC-
8556                                  ;IFIED IN KIPAR0. FOR EX. IF KIPAR0=1600 THEN PROGRAM EXECUTING AT
8557                                  ;ADDRESS 160000+(PC)
8558  040534  013700  172340          MOV     @#KIPAR0,R0     ;GET PAR0
8559  040540  072027  177774          ASH     #-4,R0          ;GET BITS <11:4> IN LOW BYTE
8560  040544  110037  001203          MOVB    R0,@#$TSTNM+1   ;PUT IN DSPLAY REG HIGH BYTE
8561  040550  005037  177776          CLR     @#PSW
8562  040554  012706  001200          MOV     #KERSTK,SP      ;SET KERNEL STACK PTR
8563  040560  016746  175540          MOV     OLDPSW,-(SP)    ;RESTORE OLD PSW
8564  040564  012746  005530          MOV     #LOOP,-(SP)
8565  040570  105737  001544          TSTB    @#NEXEC         ;BRANCH IF TEST CODE TO
8566  040574  001402                  BEQ     1$              ;BE EXECUTED
8567  040576  012716  036304          MOV     #STMM,(SP)
8568  040602  000002          1$:     RTI                     ;RESTART PROGRAM AT LOOP
8569
8570                                  ;WHEN RELOCATION ABOVE 28K IS COMPLETE PROGRAM TRAPS TO ENDMEM.
8571  040604  022626          ENDMEM: CMP     (SP)+,(SP)+     ;POP STACK TWICE
8572  040606  005037  177572  ENDM:   CLR     @#SR0           ;DISABLE MEM MGMT
8573
8574                                  ;*************************************************************************
8575                                  ;AT THIS TIME A 'SUB-PASS' HAS BEEN COMPLETED.
8576                                  ;PROGRAM NOW EXECUTING IN KERNEL MODE AT PC AS SHOWN (NO RELOCATION)
8577  040612  012737  000600  001562          MOV     #600,@#NEXPAR   ;RESET NEXT VALUE FOR PAR REGISTERS
8578  040620  005737  003330                  TST     @#PROT
8579  040624  001403                          BEQ     2$
8580  040626  012737  001600  001562          MOV     #1600,@#NEXPAR
8581  040634  105037  001545          2$:     CLRB    @#MMON          ;SET MEM MGMT ON IND = OFF
8582                                  ;;*********************************************************************
8583                                  .SBTTL  END OF SUB-PASS ROUTINE
8584                                  ;*      THIS ROUTINE SETS UP THE PSW FROM THE PSW TABLE
8585                                  ;*      FOR THE NEXT SUB-PASS. IT THEN STARTS THE PRINTER
8586                                  ;*      (IF NOT ON ACT11) FOR TYPING THE END OF SUB-PASS MESSAGE.
8587                                  ;;*****************************************************************
8588  040640                  END:
8589  040640  012737  055064  000004  END1:   MOV     #ERPRT,@#ERRVEC
8590  040646  005037  177776          CLR     @#PSW           ;CLEAR MODE BITS IN PSW
8591  040652  004767  013234          JSR     PC,CLRTBIT      ;GO CLEAR 'T' BIT IF SET
8592  040656  012706  001200          MOV     #KERSTK,SP      ;SET KERNEL STACK PTR
8593  040662  032737  000400  001532  BIT     #BIT8,@#OPT.CP  ;TTY AVAILABLE?
8594  040670  001404                  BEQ     1$              ;BRANCH IF NO
8595  040672  032777  000100  140352  BIT     #100,@$TPS      ;CHECK IF OUTPUT DEVICE IS BUSY
8596  040700  001374                  BNE     .-6             ;IS AVAILABLE
8597  040702  105237  001574  1$:     INCB    @#SUBPASS
8598  040706  113702  001574          MOVB    @#SUBPASS,R2
```

```
                        SUB     #60,R2
                        CMP     #4,R2                   ;END OF TEST?
                        BNE     2$              ;BRANCH IF NOT AT END
                        MOV     #60,@#SUBPASS           ;INIT SUBPASS COUNT TO ASCII 0
                        CLR     -(SP)
                        MOV     #$EOP,-(SP)
                        RTI
                2$:     ASL     R2
                        MOV     #$RTRN,@#TBITVEC        ;SET 'T' TRAP VECTOR
                        MOV     #SUBPASS-1,@#$REGS
                        ASRB    @$TPS
                        MOV     PSWTAB(2),-(SP) ;PUSH NEXT PASS PSW ON STACK
                        MOV     #LOOP,-(SP)     ;RESTART PROGRAM AT LOOP
                3$:     TSTB    @#QV            ;QV PASS?
                        BNE     RTI1            ;BRANCH IF YES
                        BIT     #BIT8,@#OPT.CP  ;TTY AVAILABLE?
                        BEQ     RTI1            ;BRANCH IF NO
                        CMPB    #200,@$TPS      ;IS PRINTER READY?
                        BNE     3$              ;BRANCH IF NO
                        MOV     #MSG20-1,@#$REGS
                        ASRB    @$TPS           ;TYPE END SUBPASS MESSAGE
                RTI1:   RTI                     ;RESTART PROGRAM AT LOOP WITH NEW PSW
                                                ;(FROM TABLE NEAR END OF PROGRAM)

                .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 LOOP

        041036  $EOP:
        041036  004737  051010          JSR     PC,@#TYPTIME
        041042  005067  140134          CLR     $TSTNM          ;;ZERO THE TEST NUMBER
        041046  005067  140252          CLR     $TIMES          ;;ZERO THE NUMBER OF ITERATIONS
        041052  005267  140122          INC     $PASS           ;;INCREMENT THE PASS NUMBER
        041056  042767  100000  140114  BIC     #100000,$PASS   ;;DON'T ALLOW A NEG. NUMBER
        041064  005327                  DEC     (PC)+           ;;LOOP?
        041066  000001          $EOPCT: .WORD   1
        041070  003063                  BGT     $DOAGN          ;;YES
        041072  012737                  MOV     (PC)+,@(PC)+    ;;RESTORE COUNTER
        041074  000001          $ENDCT: .WORD   1
        041076  041066                  $EOPCT
        041100  104401  041106          TYPE    ,65$            ;;TYPE ASCIZ STRING
        041104  000407                  BR      64$             ;;GET OVER THE ASCIZ
                        ;;65$:  .ASCIZ  <12><15>/END PASS #/
        041124  64$:
        041124  016746  140050          MOV     $PASS,-(SP)     ;;SAVE $PASS FOR TYPEOUT
                                                                ;;TYPE PASS NUMBER
        041130  104405                  TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
        041132  104401  041140          TYPE    ,67$            ;;TYPE ASCIZ STRING
        041136  000421                  BR      66$             ;;GET OVER THE ASCIZ
                        ;;67$:  .ASCIZ  /  TOTAL ERRORS SINCE LAST REPORT /
        041202  66$:
```

```
 8655  041202  016746  140006                MOV     $ERTTL,-(SP)    ;;SAVE $ERTTL FOR TYPEOUT
 8656                                                                  ;;TOTAL NUMBER OF ERRORS
 8657  041206  104405                        TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
 8658  041210  104401  001335                TYPE    ,$CRLF          ;;TYPE CARRIAGE RETURN, LINE FEED
 8659  041214  005067  137774                CLR     $ERTTL          ;;CLEAR ERROR TOTAL
 8660  041220  013700  000042        $GET42: MOV     @#42,R0         ;;GET MONITOR ADDRESS
 8661  041224  001405                        BEQ     $DOAGN          ;;BRANCH IF NO MONITOR
 8662  041226  000005                        RESET                   ;;CLEAR THE WORLD
 8663  041230  004710                $ENDAD: JSR     PC,(R0)         ;;GO TO MONITOR
 8664  041232  000240                        NOP                     ;;SAVE ROOM
 8665  041234  000240                        NOP                     ;;FOR
 8666  041236  000240                        NOP                     ;;ACT11
 8667  041240                        $DOAGN:
 8668  041240  000137                        JMP     @(PC)+          ;;RETURN
 8669  041242  005530                $RTNAD: .WORD   LOOP
 8670  041244     377     377     000  $ENULL: .BYTE   -1,-1,0         ;;NULL CHARACTER STRING
 8671          041250                        .EVEN
 8672                                ;;*****************************************************************
 8673                                .SBTTL  RP11/RP03 HANDLER
 8674                                ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF HANDLER
 8675                                ;;*****************************************************************
 8676  041250  104406                RP3DRV: SAVREG
 8677  041252  105037  001752                CLRB    @#RP3HSTA               ;CLEAR DONE FLAG
 8678  041256  032737  000400  001752        BIT     #BIT8,@#RP3HSTA         ;REPEAT FLAG SET?
 8679  041264  001403                        BEQ     8$                      ;BRANCH IF NO
 8680  041266  104407                        RESREG
 8681  041270  000137  043130                JMP     @#RP3RPT
 8682  041274  013737  001620  001630  8$:   MOV     @#RNTBINX,@#RP311       ;SAVE RUN TABLE INDEX
 8683  041302  032777  000020  137732        BIT     #SW4,@SWR               ;INHIBIT RND DSK ADR?
 8684  041310  001403                        BEQ     1$                      ;BRANCH IF NO
 8685  041312  005000                        CLR     R0
 8686  041314  005001                        CLR     R1
 8687  041316  000410                        BR      4$
 8688  041320  004737  052752          1$:   JSR     PC,@#$RAND              ;GO GET RANDOM NUMBER
 8689  041324  013700  001566                MOV     @#$HINUM,R0             ;GET HI NUMBER
 8690  041330  013701  001564                MOV     @#$LONUM,R1             ;GET LO NUMBER
 8691  041334  073027  177771                ASHC    #-7,R0                  ;ADJUST TO FORM CYL ADR
 8692  041340  042700  177000          4$:   BIC     #177000,R0              ;GET RID OF UNUSED BITS
 8693  041344  022700  000624                CMP     #624,R0                 ;LEGAL CYL?
 8694  041350  100003                        BPL     5$                      ;BRANCH IF YES
 8695  041352  062700  000624                ADD     #624,R0                 ;MAKE IT LEGAL
 8696  041356  000770                        BR      4$
 8697  041360  013702  001630          5$:   MOV     @#RP311,R2              ;GET RUN TABLE INDEX
 8698  041364  016203  001666                MOV     RUNTBL(R2),R3           ;GET DEVICE ID
 8699  041370  042703  000777                BIC     #777,R3                 ;ID ONLY
 8700  041374  050300                        BIS     R3,R0                   ;COMBINE WITH CYL ADR
 8701  041376  010062  001666                MOV     R0,RUNTBL(R2)           ;PUT BACK IN TABLE
 8702  041402  072127  177775                ASH     #-3,R1                  ;GEN TRK-SECT ADR
 8703  041406  010103                        MOV     R1,R3                   ;SAVE
 8704  041410  042701  160377          6$:   BIC     #160377,R1              ;GET RID OF ALL BUT TRK
 8705  041414  022701  011400                CMP     #11400,R1               ;LEGAL TRAK?
 8706  041420  100003                        BPL     2$                      ;BRANCH IF YES
 8707  041422  062701  011400                ADD     #11400,R1               ;MAKE IT LEGAL
 8708  041426  000770                        BR      6$
 8709  041430  042703  177760          2$:   BIC     #177760,R3              ;GET SECTOR ADR
 8710  041434  022703  000011                CMP     #11,R3                  ;IS IT LEGAL?
```

```
8711  041440  100003                          BPL     3$                      ;BRANCH IF YES
8712  041442  062703  000011                  ADD     #11,R3                  ;MAKE IT LEGAL
8713  041446  000770                          BR      2$
8714  041450  050301                  3$:     BIS     R3,R1                   ;COMBINE TRK-SECT
8715  041452  010162  001702                  MOV     R1,RUNTRAK(R2)          ;PUT IN TABLE
8716  041456  010037  002120                  MOV     R0,@#RP3HDC             ;SAVE DESIRED CYL
8717  041462  010137  002166                  MOV     R1,@#RP3DA              ;SAVE DSK ADR
8718  041466  112737  177775  002146          MOVB    #-3,@#RP3TRY            ;INIT TRY COUNT
8719  041474  012737  000103  001626  7$:     MOV     #103,@#RP310            ;GET FUNCTION
8720  041502  013700  002010                  MOV     @#RP3OLD+2,R0           ;GET BAE BITS
8721  041506  072027  000004                  ASH     #4,R0                   ;SHIFT TO BITS 4 & 5
8722  041512  050037  001626                  BIS     R0,@#RP310              ;COMBINE WITH FUNCTION
8723  041516  010037  002010                  MOV     R0,@#RP3OLD+2
8724  041522  013700  002066                  MOV     @#RP3UNIT,R0
8725  041526  072027  000010                  ASH     #10,R0                  ;SHIFT UNIT NO TO RIGHT BITS
8726  041532  050037  001626                  BIS     R0,@#RP310              ;COMBINE WITH FUNC & BAE
8727  041536  010037  002066                  MOV     R0,@#RP3UNIT
8728  041542  104407                          RESREG
8729  041544  053777  002066  140406  RP3WTRY:BIS     @#RP3UNIT,@RP3CS                ;SET UNIT BITS
8730  041552  004737  041612                  JSR     PC,@#LDRP3              ;LOAD RP3 REGISTERS
8731  041556  012777  043160  140406          MOV     #RP3SRV,@RP3VEC         ;SET VECTOR
8732  041564  005077  140404                  CLR     @RP3PSW
8733  041570  005037  002134                  CLR     @#RP3FUN                ;SET FUNCTION TO WRITE
8734  041574  005777  140354          1$:     TST     @RP3DS                  ;IS DRIVE READY?
8735  041600  100375                          BPL     1$                      ;BRANCH IF NO
8736  041602  013777  001626  140350          MOV     @#RP310,@RP3CS          ;LOAD FUNCT AND GO
8737  041610  000002                          RTI                             ;RETURN
8738  041612  013777  002116  140346  LDRP3:  MOV     @#RP3HDA,@RP3DA         ;LOAD DSK ADR
8739  041620  013777  002120  140342          MOV     @#RP3HDC,@RP3DC         ;LOAD CYL ADR
8740  041626  013777  001772  140326          MOV     @#RP3HWC,@RP3WC         ;LOAD WORD COUNT
8741  041634  013777  002006  140322          MOV     @#RP3OLD,@RP3BA         ;LOAD BUS ADR
8742  041642  000207                          RTS     PC                      ;RETURN
8743
8744                                  ;;*****************************************************************
8745                                  .SBTTL  RK11/RK05 HANDLER
8746                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF HANDLER
8747                                  ;;*****************************************************************
8748  041644  104406                  RKDRV:  SAVREG
8749  041646  105037  001754                  CLRB    @#RKHSTAT               ;CLEAR DONE FLAG IN HANDLER STAT
8750  041652  032737  000400  001754          BIT     #BIT8,@#RKHSTAT         ;REPEAT FLAG SET?
8751  041660  001403                          BEQ     5$                      ;BRANCH IF NO
8752  041662  104407                          RESREG
8753  041664  000137  043700                  JMP     @#RKRPT
8754  041670  013737  001620  001634  5$:     MOV     @#RNTBINX,@#RK11        ;SAVE RUN TABLE INDEX
8755  041676  105037  001754                  CLRB    @#RKHSTAT               ;CLEAR DONE FLAG IN HANDLER STAT
8756  041702  032777  000020  137332          BIT     #SW4,@SWR               ;RANDOM DSK ADDRESS?
8757  041710  001403                          BEQ     6$                      ;BRANCH IF YES
8758  041712  005000                          CLR     R0                      ;CLEAR REGISTERS
8759  041714  005001                          CLR     R1
8760  041716  000406                          BR      7$                      ;FOR ADDRESS CHECKING
8761  041720  004737  052752          6$:     JSR     PC,@#$RAND              ;GET RANDOM NUMBER
8762  041724  013700  001566                  MOV     @#$HINUM,R0             ;GET HIGH NUMBER
8763  041730  013701  001564                  MOV     @#$LONUM,R1             ;GET LO NUMBER
8764  041734  072027  177775          7$:     ASH     #-3,R0                  ;ADJUST TO FORM
8765                                                                          ;CYLINDER ADDRESS
8766  041740  010001                          MOV     R0,R1                   ;SAVE IN R1
```

```
8767  041742  042701  160037          4$:     BIC     #160037,R1              ;GET RID OF SURF-SECT BITS
8768  041746  022701  014300                  CMP     #14300,R1               ;IS IT A LEGAL TRAK?
8769  041752  100003                          BPL     3$                      ;BRANCH IF YES
8770  041754  062701  014340                  ADD     #14340,R1               ;ADD MAXIMUM TRAK
8771  041760  000770                          BR      4$                      ;TRY AGAIN
8772
8773  041762  072127  177773          3$:     ASH     #-5,R1                  ;ADJUST CYLINDER ADDRESS
8774  041766  013702  001634                  MOV     @#RK11,R2               ;GET RUN TABLE INDEX
8775  041772  016203  001666          DWORRY: MOV     RUNTBL(R2),R3
8776  041776  042703  000777                  BIC     #777,R3
8777  042002  050103                          BIS     R1,R3
8778  042004  010362  001666                  MOV     R3,RUNTBL(R2)           ;ENTER CYLINDER ADR IN RUN TABLE
8779  042010  072027  177770                  ASH     #-10,R0                 ;GENER SECTOR-SURF ADDRESS
8780  042014  042700  177740                  BIC     #177740,R0              ;GET RID OF EXTRA BITS
8781  042020  010003                          MOV     R0,R3                   ;SAVE
8782  042022  042700  000020                  BIC     #BIT4,R0                ;GET RID OF SURFACE BIT
8783  042026  022700  000012                  CMP     #12,R0                  ;IS SECTOR ADDRESS LEGAL?
8784  042032  100004                          BPL     1$                      ;BRANCH IF YES
8785  042034  062700  000012                  ADD     #12,R0                  ;MAKE IT LEGAL
8786  042040  042700  000020                  BIC     #BIT4,R0                ;GET RID OF CARRY FROM ADD
8787  042044  042703  000017          1$:     BIC     #17,R3                  ;GET SURFACE ADDRESS
8788  042050  050300                          BIS     R3,R0                   ;GENER COMP SECT-SURF ADDRESS
8789  042052  010062  001702                  MOV     R0,RUNTRAK(R2)          ;SAVE IN RUN TRAK TABLE
8790  042056  072127  000005                  ASH     #5,R1                   ;ADJUST CYLINDER ADDRESS
8791  042062  050100                          BIS     R1,R0                   ;CONCATINATE TRK & SECT ADDR
8792  042064  013701  002070                  MOV     @#KUNIT,R1              ;GET UNIT NUMBER
8793  042070  072127  000015                  ASH     #15,R1          ;ADJUST
8794  042074  050100                          BIS     R1,R0                   ;CONCATINATE UNIT,TRK,SURF,SECT
8795  042076  010037  002122                  MOV     R0,@#RKHDA              ;SAVE
8796  042102  112737  177775  002147          MOVB    #-3,@#RKTRY             ;SET RETRY COUNT
8797  042110  012767  000103  137514  2$:     MOV     #103,RK10               ;SET FUNCTION
8798  042116  013700  002014                  MOV     @#RKOLD+2,R0            ;GET BA EXTENDED
8799  042122  072027  000004                  ASH     #4,R0                   ;ADJUST
8800  042126  050037  001632                  BIS     R0,@#RK10               ;PUT IN WITH FUNCTION
8801  042132  010037  002014                  MOV     R0,@#RKOLD+2            ;SAVE IN MEMORY
8802  042136  104407                          RESREG
8803  042140  013777  002122  140042  RKWTRY: MOV     @#RKHDA,@RKDA           ;LOAD DISK ADDRESS
8804  042146  013777  001774  140030          MOV     @#RKWC,@RKWC            ;LOAD WORD COUNT
8805  042154  013777  002012  140024          MOV     @#RKOLD,@RKBA           ;LOAD BUS ADDRESS
8806  042162  012777  043730  140022          MOV     #RKSRV,@RKVEC           ;LOAD INTERRUPT VECTOR
8807  042170  005077  140020                  CLR     @RKPSW
8808  042174  005037  002136                  CLR     @#RKFUN                 ;SET FUNCTION TO WRITE
8809  042200  032777  000100  137770          BIT     #BIT6,@RKDS             ;UNIT READY?
8810  042206  001774                          BEQ     .-6
8811  042210  013777  001632  137764          MOV     @#RK10,@RKCS            ;LOAD FUNCTION AND GO
8812  042216  000006                          RTT                             ;RETURN
8813
8814                                  ;;*****************************************************************
8815                                  .SBTTL  RH11/RP04 HANDLER
8816                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF HANDLER
8817                                  ;;*****************************************************************
8818  042220  104406                  RP4DRV: SAVREG
8819  042222  105037  001762                  CLRB    @#RP4HSTA               ;CLEAR DONE FLAG
8820  042226  032737  000400  001762          BIT     #BIT8,@#RP4HST          ;REPEAT FLAG SET?
8821  042234  001403                          BEQ     6$                      ;BRANCH IF NO
8822  042236  104407                          RESREG
```

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8823  042240  000137  044504                  JMP     @#RP4RPT
8824  042244  013737  001620  001636  6$:     MOV     @#RNTBINX,@#RP411       ;SAVE RUN TABLE INDEX
8825  042252  105037  001762                  CLRB    @#RP4HSTA               ;CLEAR DONE FLAG
8826  042256  032777  000020  136756          BIT     #SW4,@SWR               ;RANDOM DSK ADDRESS?
8827  042264  001403                          BEQ     1$                      ;BRANCH IF YES
8828  042266  005000                          CLR     R0
8829  042270  005001                          CLR     R1
8830  042272  000410                          BR      4$
8831  042274  004737  052752          1$:     JSR     PC,@#$RAND              ;GET RANDOM NUMBER
8832  042300  013700  001566                  MOV     @#$HINUM,R0             ;GET HI NUMBER
8833  042304  013701  001564                  MOV     @#$LONUM,R1             ;GET LO NUMBER
8834  042310  073027  177771                  ASHC    #-7,R0                  ;ADJUST TO FORM CYL. ADR.
8835  042314  042700  177000          4$:     BIC     #177000,R0              ;GET RID OF UNUSED BITS
8836  042320  022700  000631                  CMP     #631,R0                 ;LEGAL CYLINDER
8837  042324  100003                          BPL     5$                      ;BRANCH IF YES
8838  042326  062700  000631                  ADD     #631,R0                 ;MAKE IT LEGAL
8839  042332  000770                          BR      4$
8840
8841  042334  013702  001636          5$:     MOV     @#RP411,R2              ;GET RUN TABLE INDEX
8842  042340  016203  001666                  MOV     RUNTBL(R2),R3           ;GET DEVICE ID
8843  042344  042703  000777                  BIC     #777,R3                 ;SAVE ID ONLY
8844  042350  050003                          BIS     R0,R3                   ;COMBINE WITH CYL ADR
8845  042352  010362  001666                  MOV     R3,RUNTBL(R2)           ;PUT IN RUN TABLE
8846  042356  072127  177775                  ASH     #-3,R1                  ;GEN TRAK-SECT ADR
8847  042362  042701  160340                  BIC     #160340,R1              ;GET RID OF UNUSED BITS
8848  042366  010103                          MOV     R1,R3                   ;SAVE
8849  042370  042701  000037                  BIC     #37,R1                  ;GET RID OF SECT BITS
8850  042374  022701  011000                  CMP     #11000,R1               ;LEGAL TRAK?
8851  042400  100004                          BPL     2$                      ;BRANCH IF YES
8852  042402  062701  011000                  ADD     #11000,R1               ;MAKE IT LEGAL
8853  042406  042701  020000                  BIC     #BIT13,R1               ;GET RID OF ADD CARRY
8854  042412  042703  177740          2$:     BIC     #177740,R3              ;GET SECTOR ADR
8855  042416  022703  000025                  CMP     #25,R3                  ;LEGAL SECTOR
8856  042422  100004                          BPL     3$                      ;BRANCH IF YES
8857  042424  062703  000025                  ADD     #25,R3                  ;MAKE IT LEGAL
8858  042430  042703  000040                  BIC     #BIT5,R3                ;GET RID OF ADD CARRY
8859  042434  050301                  3$:     BIS     R3,R1                   ;COMBINE TRACK-SECTOR
8860  042436  010162  001702                  MOV     R1,RUNTRAK(R2)          ;PUT TRAK-SECT IN TABLE
8861  042442  010037  002130                  MOV     R0,@#RP4HDC             ;SAVE CYLINDER ADR
8862  042446  010137  002126                  MOV     R1,@#RP4HDA             ;SAVE TRAK-SECTOR ADR
8863  042452  112737  177775  002151          MOVB    #-3,@#RP4TRY            ;SET TRY COUNT
8864  042460  104407                          RESREG
8865  042462                          RP4WTRY:
8866  042462  004767  000026                  JSR     PC,LDRP4                ;LOAD RP4 REGISTERS
8867  042466  012777  044530  137556          MOV     #RP4SRV,@RP4VEC ;LOAD INTERRUPT VECTOR
8868  042474  005077  137554                  CLR     @RP4PSW                 ;
8869  042500  005037  002142                  CLR     @#RP4FUN                ;SET FUNCTION TO WRITE
8870  042504  112777  000161  137504          MOVB    #161,@RP4CS1            ;LOAD FUNCTION AND GO
8871  042512  000002                          RTI                             ;RETURN
8872
8873  042514  013777  002076  137506  LDRP4:  MOV     @#RP4UNIT,@RP4CS2       ;LOAD UNIT NUMBER
8874  042522  012777  010000  137520          MOV     #BIT12,@RP40F           ;SET FORMAT TO 16 BIT
8875  042530  013777  002130  137502          MOV     @#RP4HDC,@RP4DC         ;LOAD CYLINDER ADR
8876  042536  013777  002126  137462          MOV     @#RP4HDA,@RP4DA         ;LOAD TRAK-SECTOR
8877  042544  013777  002002  137446          MOV     @#RP4HWC,@RP4WC         ;LOAD WORD COUNT
8878  042552  010546                          MOV     R5,-(SP)                ;SAVE R5
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```
8879  042554  013705  002030                  MOV     @#RP4OLD+2,R5
8880  042560  072527  000010                  ASH     #10,R5                  ;SHIFT EXTENDED ADDR. BITS
8881  042564  042705  176377                  BIC     #176377,R5              ;       AND
8882  042570  042777  001400  137420          BIC     #1400,@RP4CS1
8883  042576  050577  137414                  BIS     R5,@RP4CS1              ;LOAD INTO RP4CS1
8884  042602  012605                          MOV     (SP)+,R5                ;RESTORE R5
8885  042604  013777  002026  137410          MOV     @#RP4OLD,@RP4BA         ;LOAD BUS ADR
8886  042612  000207                          RTS     PC                      ;RETURN
8887
8888                                  ;;*****************************************************************
8889                                  .SBTTL  RH11/RS04 HANDLER
8890                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF HANDLER
8891                                  ;;*****************************************************************
8892  042614  104406                  RSDRV:  SAVREG
8893  042616  105037  001764                  CLRB    @#RSHSTAT               ;CLEAR DONE FLAG
8894  042622  032737  000400  001764          BIT     #BIT8,@#RSHSTAT         ;REPEAT FLAG SET?
8895  042630  001403                          BEQ     3$                      ;BRANCH IF NO
8896  042632  104407                          RESREG
8897  042634  000137  045234                  JMP     @#RSRPT
8898  042640  013737  001620  001640  3$:     MOV     @#RNTBINX,@#RS11        ;SAVE RUN TABLE INDEX
8899  042646  032777  000020  136366          BIT     #SW4,@SWR               ;RANDOM DSK ADR?
8900  042654  001403                          BEQ     1$                      ;BRANCH IF YES
8901  042656  005000                          CLR     R0
8902  042660  005001                          CLR     R1
8903  042662  000407                          BR      4$
8904  042664  004737  052752          1$:     JSR     PC,@#$RAND              ;GET RANDOM NUMBER
8905  042670  013700  001566                  MOV     @#$HINUM,R0
8906  042674  072027  177774                  ASH     #-4,R0
8907  042700  010001                          MOV     R0,R1                   ;SAVE RANDOM NUMBER
8908  042702  042700  170077          4$:     BIC     #170077,R0              ;GET TRACK ADR
8909  042706  022700  007600                  CMP     #7600,R0                ;IS IT LEGAL?
8910  042712  100003                          BPL     5$                      ;BRANCH IF YES
8911  042714  062700  007600                  ADD     #7600,R0                ;MAKE IT LEGAL
8912  042720  000770                          BR      4$
8913  042722  013702  001640          5$:     MOV     @#RS11,R2               ;GET RUN TABLE INDEX
8914  042726  072027  177772                  ASH     #-6,R0                  ;ADJUST TRACK ADR
8915  042732  110062  001666                  MOVB    R0,RUNTBL(R2)           ;SAVE TRAK ADR IN RUN TBL
8916  042736  042701  177700          6$:     BIC     #177700,R1              ;GET SECTOR ADR
8917  042742  022701  000077                  CMP     #77,R1                  ;IS IT LEGAL?
8918  042746  100003                          BPL     2$                      ;BRANCH IF YES
8919  042750  062701  000077                  ADD     #77,R1                  ;MAKE IT LEGAL
8920  042754  000770                          BR      6$
8921  042756  010162  001702          2$:     MOV     R1,RUNTRAK(R2)          ;SAVE IN RUN TRAK TABLE
8922  042762  072027  000006                  ASH     #6,R0
8923  042766  050100                          BIS     R1,R0                   ;COMBINE SECTOR TRAK
8924  042770  010037  002132                  MOV     R0,@#RSHDA              ;SAVE AS DSK ADR
8925  042774  112737  177775  002152          MOVB    #-3,@#RSTRY             ;SET TRY COUNT
8926  043002  104407                          RESREG
8927  043004  004737  043044  RSWTRY: JSR     PC,@#LDRS               ;GO LOAD REGISTERS
8928  043010  012777  045260  137262          MOV     #RSSRV,@RSVEC           ;SET INTERRUPT VECTOR
8929  043016  005077  137260                  CLR     @RSPSW
8930  043022  005037  002144                  CLR     @#RSFUN                 ;SET FUNCTION TO WRITE
8931  043026  105777  137242          1$:     TSTB    @RSDS                   ;IS DRIVE READY?
8932  043032  001775                          BEQ     1$                      ;BRANCH IF NO
8933  043034  112777  000161  137214          MOVB    #161,@RSCS1             ;LOAD FUNCTION AND GO
8934  043042  000002                          RTI
```

```
8935
8936  043044  013777  002100  137216  LDRS:   MOV     @#RSUNIT,@RSCS2         ;LOAD UNIT NUMBER
8937  043052  013777  002132  137206          MOV     @#RSHDA,@RSDA           ;LOAD DSK ADR
8938  043060  013777  002004  137172          MOV     @#RSHWC,@RSWC           ;LOAD WORD COUNT
8939  043066  010546                          MOV     R5,-(SP)                ;SAVE R5
8940  043070  013705  002034                  MOV     @#RSOLD+2,R5            ;SHIFT EXTENDED ADDR. BITS
8941  043074  072527  000010                  ASH     #10,R5                  ;       AND
8942  043100  042705  176377                  BIC     #176377,R5              ;       LOAD
8943  043104  042777  001400  137144          BIC     #1400,@RSCS1
8944  043112  050577  137140                  BIS     R5,@RSCS1               ;INTO RSCS1
8945  043116  012605                          MOV     (SP)+,R5                ;RESTORE R5
8946  043120  013777  002032  137134          MOV     @#RSOLD,@RSBA           ;LOAD BUS ADDRESS
8947  043126  000207                          RTS     PC                      ;RETURN
8948
8949                                  ;;**********************************************************************
8950                                  .SBTTL  RP11/RP03 SERVICE ROUTINE
8951                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF ROUTINE
8952                                  ;;**********************************************************************
8953  043130  000005                  RP3RPT: RESET
8954  043132  005337  002134                  DEC     @#RP3FUN                ;RESTORE FUNCTION
8955  043136  022737  000001  002134          CMP     #1,@#RP3FUN             ;WHAT IS IT?
8956  043144  001472                          BEQ     RP31                    ;BRANCH IF WC
8957  043146  002402                          BLT     1$                      ;BRANCH IF WRITE
8958  043150  000137  041544                  JMP     @#RP3WTRY               ;BRANCH TO READ
8959  043154  000167  000366          1$:     JMP     RP33
8960  043160  005237  002134          RP3SRV: INC     @#RP3FUN                ;INCREMENT FUNCTION
8961  043164  022737  000002  002134          CMP     #2,@#RP3FUN             ;WHAT IS IT?
8962  043172  001501                          BEQ     RP3WCK                  ;BRANCH TO WRITE CHECK
8963  043174  100002                          BPL     .+6
8964  043176  000137  043606                  JMP     @#RP3READ
8965
8966                                  ;FUNCTION JUST EXECUTED WAS A WRITE
8967  043202  032737  000400  001752          BIT     #BIT8,@#RP3HSTAT        ;REPEAT FLAG SET?
8968  043210  001036                          BNE     RP3LOOP                 ;BRANCH IF YES
8969  043212  005777  136742                  TST     @RP3CS                  ;ANY ERRORS?
8970  043216  100045                          BPL     RP31                    ;BRANCH IF NO
8971  043220  105737  002146                  TSTB    @#RP3TRY                ;TRIED 3 TIMES?
8972  043224  001415                          BEQ     RP3ERR                  ;BRANCH IF YES
8973  043226  112777  000001  136724          MOVB    #BIT0,@RP3CS            ;CLEAR THE DRIVE
8974  043234  105777  136720                  TSTB    @RP3CS                  ;CONTROLLER READY?
8975  043240  100375                          BPL     .-4                     ;BRANCH IF NO
8976  043242  105237  002146                  INCB    @#RP3TRY                ;INCREMENT TRY COUNT
8977  043246  013746  177776                  MOV     @#PSW,-(SP)             ;MAINTAIN SAME PSW
8978  043252  012746  041544                  MOV     #RP3WTRY,-(SP)          ;SET RETRY ADDRESS
8979  043256  000002                          RTI                             ;RETURN
8980  043260  012737  100200  001752  RP3ERR: MOV     #100200,@#RP3HSTA       ;SET ERROR BIT IN HAND. STA
8981  043266  010046                          MOV     R0,-(SP)                ;SAVE R0
8982  043270  013700  001630                  MOV     @#RP3II,R0              ;GET RUNTABLE INDEX
8983  043274  052760  100000  001702          BIS     #BIT15,RUNTRAK(R0)      ;SET ERROR BIT
8984  043302  012600                          MOV     (SP)+,R0                ;RESTORE R0
8985  043304  000002                          RTI                             ;RETURN
8986
8987  043306  012737  100200  001752  RP3LOOP:MOV     #100200,@#RP3HSTAT      ;SET DONE AND ERROR
8988  043314  005777  136640                  TST     @RP3CS                  ;ANY ERRORS?
8989  043320  100403                          BMI     1$                      ;BRANCH IF YES
8990  043322  042737  100000  001752          BIC     #BIT15,@#RP3HSTAT       ;CLEAR ERROR BIT
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8991  043330  000002                  1$:     RTI                             ;RETURN
8992                                  ;WRITE WAS OK- NOW DO A WRITE CHECK
8993  043332  112737  177775  002146  RP31:   MOVB    #-3,@#RP3TRY            ;INIT TRY COUNT
8994  043340  012737  000107  001626          MOV     #107,@#RP310            ;SET FUNCTION
8995  043346  053737  002010  001626          BIS     @#RP3OLD+2,@#RP310      ;SET BAE BITS
8996  043354  053737  002066  001626          BIS     @#RP3UNIT,@#RP310       ;SET UNIT BITS
8997  043362  004737  041612          RP32:   JSR     PC,@#LDRP3              ;LOAD RP3 REGISTERS
8998  043366  013777  001626  136564          MOV     @#RP310,@RP3CS          ;LOAD FUNCTION AND GO
8999  043374  000002                          RTI                             ;RETURN
9000
9001                                  ;FUNCTION JUST EXECUTED WAS A WRITE CHECK
9002  043376  032737  000400  001752  RP3WCK: BIT     #BIT8,@#RP3HSTAT                ;REPEAT FLAG SET?
9003  043404  001340                          BNE     RP3LOOP                 ;BRANCH IF YES
9004  043406  005777  136546                  TST     @RP3CS                  ;ANY ERRORS?
9005  043412  100031                          BPL     1$                      ;BRANCH IF NO
9006  043414  005737  001630                  TST     @#RP311                 ;FIRST 2K?
9007  043420  001422                          BEQ     4$                      ;BRANCH IF YES
9008  043422  105737  002146          5$:     TSTB    @#RP3TRY                ;TRIED 3 TIMES?
9009  043426  001714                          BEQ     RP3ERR                  ;BRANCH IF YES
9010  043430  005337  002134                  DEC     @#RP3FUN                ;RESTORE FUNCTION
9011  043434  112777  000001  136516          MOVB    #BIT0,@RP3CS            ;CLEAR THE DRIVE
9012  043442  105777  136512                  TSTB    @RP3CS                  ;CONTROLLER READY?
9013  043446  100375                          BPL     .-4                     ;BRANCH IF NO
9014  043450  105237  002146                  INCB    @#RP3TRY                ;INCREMENT TRY COUNT
9015  043454  013746  177776                  MOV     @#PSW,-(SP)
9016  043460  012746  043362                  MOV     #RP32,-(SP)
9017  043464  000002                          RTI                             ;GO TRY AGAIN
9018  043466  032777  000010  136462  4$:     BIT     #BIT3,@RP3ER            ;WRITE CHECK ERROR?
9019  043474  001752                          BEQ     5$                      ;BRANCH IF NO
9020
9021                                  ;WRITE CHECK OK- NOW DO A READ
9022  043476  112737  177775  002146  1$:     MOVB    #-3,@#RP3TRY            ;RESTORE TRY COUNT
9023  043504  010046                  2$:     MOV     R0,-(SP)                ;SAVE R0
9024  043506  013700  002040                  MOV     @#RP3NWH,R0             ;GET BAE BITS
9025  043512  072027  000004                  ASH     #4,R0                   ;ADJUST
9026  043516  010037  002040                  MOV     R0,@#RP3NWH             ;SAVE
9027  043522  012600                          MOV     (SP)+,R0                ;RESTORE R0
9028  043524  012737  000105  001626          MOV     #105,@#RP310            ;SET FUNCTION
9029  043532  053737  002040  001626          BIS     @#RP3NWH,@#RP310        ;SET BAE BITS
9030  043540  053737  002066  001626          BIS     @#RP3UNIT,@#RP310       ;SET UNIT NUMBER
9031  043546  013777  002116  136412  RP33:   MOV     @#RP3HDA,@RP3DA         ;LOAD DSK ADR
9032  043554  013777  002120  136406          MOV     @#RP3HDC,@RP3DC         ;LOAD CYL
9033  043562  013777  001772  136372          MOV     @#RP3HWC,@RP3WC         ;LOAD WORD COUNT
9034  043570  013777  002036  136366          MOV     @#RP3NWL,@RP3BA         ;LOAD BUS ADR
9035  043576  013777  001626  136354          MOV     @#RP310,@RP3CS          ;LOAD FUNCTION AND GO
9036  043604  000002                          RTI                             ;RETURN
9037
9038                                  ;FUNCTION JUST EXECUTED WAS A READ
9039  043606  032737  000400  001752  RP3READ:BIT     #BIT8,@#RP3HSTAT                ;REPEAT FLAG SET?
9040  043614  001234                          BNE     RP3LOOP                 ;BRANCH IF YES
9041  043616  005777  136336                  TST     @RP3CS                  ;ANY ERRORS?
9042  043622  100022                          BPL     1$                      ;BRANCH IF NO
9043  043624  105737  002146                  TSTB    @#RP3TRY                ;TRIED 3 TIMES?
9044  043630  001613                          BEQ     RP3ERR                  ;BRANCH IF YES
9045  043632  005337  002134                  DEC     @#RP3FUN                ;RESTORE FUNCTION
9046  043636  112777  000001  136314          MOVB    #BIT0,@RP3CS            ;CLEAR THE DRIVE
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9047  043644  105777  136310                  TSTB    @RP3CS                  ;CONTROLLER READY?
9048  043650  100375                          BPL     .-4                     ;BRANCH OF NO
9049  043652  105237  002146                  INCB    @#RP3TRY                ;INCREMENT TRY COUNT
9050  043656  013746  177776                  MOV     @#PSW,-(SP)
9051  043662  012746  043546                  MOV     #RP33,-(SP)
9052  043666  000002                          RTI                             ;GO TRY AGAIN
9053  043670  112737  000200  001752  1$:     MOVB    #200,@#RP3HSTA          ;SET DONE FLAG
9054  043676  000002                          RTI                             ;RETURN
9055                                  ;;**************************************************************
9056                                  .SBTTL  RK11/RK05 SERVICE ROUTINE
9057                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF ROUTINE
9058                                  ;;**************************************************************
9059  043700  000005                  RKRPT:  RESET
9060  043702  005337  002136                  DEC     @#RKFUN                 ;RESTORE FUNCTION
9061  043706  022737  000001  002136          CMP     #1,@#RKFUN              ;WHAT IS IT?
9062  043714  001475                          BEQ     RK1                     ;BRANCH IF WC
9063  043716  002402                          BLT     1$                      ;BRANCH IF WRITE
9064  043720  000137  042140                  JMP     @#RKWTRY                ;IT WAS A WRITE
9065  043724  000137  044332          1$:     JMP     @#RK3
9066  043730  062737  000001  002136  RKSRV:  ADD     #1,@#RKFUN              ;FIND OUT WHAT FUNCTION
9067                                                                          ;WAS EXECUTED
9068  043736  022737  000002  002136          CMP     #2,@#RKFUN              ;WAS IT A WRITE CHECK?
9069  043744  001507                          BEQ     RKWRCK                  ;BRANCH IF YES
9070  043746  100002                          BPL     .+6                     ;BRANCH IF IT WAS A WRITE
9071  043750  000137  044364                  JMP     @#RKREAD
9072
9073                                  ;FUNCTION JUST EXECUTED WAS A WRITE. ANY ERRORS?
9074  043754  032737  000400  001754          BIT     #BIT8,@#RKHSTAT         ;REPEAT FLAG SET?
9075  043762  001040                          BNE     RKLOOP                  ;BRANCH IF YES
9076  043764  005777  136212                  TST     @RKCS                   ;ANY ERRORS?
9077  043770  100047                          BPL     RK1                     ;BRANCH IF NO
9078  043772  105737  002147                  TSTB    @#RKTRY                 ;TRYED 3 TIMES?
9079  043776  001417                          BEQ     RKERR                   ;BRANCH IF YES
9080  044000  012777  000001  136174          MOV     #1,@RKCS                ;CLEAR THE ERROR
9081  044006  004737  044466                  JSR     PC,@#TIMER              ;WAIT A LITTLE
9082  044012  105777  136164                  TSTB    @RKCS                   ;WAIT FOR CONT CLR TO FINISH
9083  044016  100375                          BPL     .-4
9084  044020  105237  002147                  INCB    @#RKTRY                 ;INCREMENT TRY COUNT
9085  044024  013746  177776                  MOV     @#PSW,-(SP)
9086  044030  012746  042140                  MOV     #RKWTRY,-(SP)
9087  044034  000002                          RTI
9088  044036  012737  100200  001754  RKERR:  MOV     #100200,@#RKHSTAT       ;SET ERROR & DONE FLAG
9089  044044  010046                          MOV     R0,-(SP)                ;SAVE R0
9090  044046  013700  001634                  MOV     @#RK11,R0               ;GET SAVED RUN TABLE INDEX
9091  044052  052760  100000  001702          BIS     #BIT15,RUNTRAK(R0)      ;SET ERROR BIT IN RUN TABLE
9092  044060  012600                          MOV     (SP)+,R0                ;RESTORE R0
9093  044062  000002                          RTI                             ;RETURN
9094
9095  044064  012737  100200  001754  RKLOOP: MOV     #100200,@#RKHSTAT       ;SET DONE AND ERROR BITS
9096  044072  005777  136104                  TST     @RKCS                   ;ANY ERRORS?
9097  044076  100403                          BMI     1$                      ;BRANCH IF YES
9098  044100  042737  100000  001754          BIC     #BIT15,@#RKHSTAT        ;CLEAR ERROR BIT
9099  044106  000002                  1$:     RTI                             ;RETURN
9100                                  ;WRITE WAS OK, NOW DO A WRITE CHECK
9101  044110  112737  177775  002147  RK1:    MOVB    #-3,@#RKTRY             ;RESTORE TRY COUNT
9102  044116  012767  000507  135506          MOV     #507,RK10               ;SET FUNCTION TO WRITE
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 9103  044124  053767  002014  135500          BIS     @#RKOLD+2,RK10          ;SET BA EXT BITS
 9104  044132  013777  002122  136050  RK2:    MOV     @#RKHDA,@RKDA           ;LOAD DISK ADDRESS
 9105  044140  013777  001774  136036          MOV     @#RKHWC,@RKWC           ;LOAD WORD COUNT
 9106  044146  013777  002012  136032          MOV     @#RKOLD,@RKBA           ;LOAD BUS ADDRESS
 9107  044154  016777  135452  136020          MOV     RK10,@RKCS              ;START FUNCTION
 9108  044162  000002                          RTI                             ;RETURN
 9109
 9110                                  ;FUNCTION JUST EXECUTED WAS A WRITE CHECK. ANY ERRORS?
```

```
 9111  044164  032737  000400  001754  RKWRCK:BIT     #BIT8,@#RKHSTAT              ;REPEAT FLAG SET?
 9112  044172  001334                      BNE     RKLOOP                       ;BRANCH IF YES
 9113  044174  005777  136002              TST     @RKCS                        ;ANY ERRORS?
 9114  044200  100033                      BPL     1$                           ;BRANCH IF NO
 9115  044202  005737  001634              TST     @#R'11                       ;FIRST 2K?
 9116  044206  001424                      BEQ     4$                           ;BRANCH IF YES
 9117  044210  105737  002147          5$: TSTB    @#RKTRY                      ;TRYED 3 TIMES?
 9118  044214  001710                      BEQ     RKERR                        ;BRANCH IF YES
 9119  044216  005337  002136              DEC     @#RKFUN                      ;SET FUNCTION BACK TO WC
 9120  044222  012777  000001  135752      MOV     #1,@RKCS                     ;CLEAR THE ERROR
 9121  044230  004737  044466              JSR     PC,@#TIMER                   ;WAIT A LITTLE
```

```
 9122  044234  105777  135742                  TSTB    @RKCS                   ;WAIT FOR CLR TO FINISH
 9123  044240  100375                          BPL     .-4
 9124  044242  105237  002147                  INCB    @#RKTRY                 ;INCREMENT TRY COUNT
 9125  044246  013746  177776                  MOV     @#PSW,-(SP)
 9126  044252  012746  044132                  MOV     #RK2,-(SP)
 9127  044256  000002                          RTI
 9128  044260  032777  040000  135714  4$:     BIT     #BIT14,@RKCS            ;HARD ERROR?
 9129  044266  001350                          BNE     5$                      ;BRANCH IF YES
 9130
 9131                                  ;WRITE CHECK WAS OK, NOW DO A READ.
 9132  044270  112737  177775  002147  1$:     MOVB    #-3,@#RKTRY             ;RESTORE TRY COUNT
 9133  044276  010046                  2$:     MOV     R0,-(SP)                ;SAVE R0
 9134  044300  013700  002044                  MOV     @#RKNEWH,R0             ;GET BA EXT
 9135  044304  072027  000004                  ASH     #4,R0                   ;ADJUST
```

```
 9136  044310  010037  002044                  MOV     R0,@#RKNEWH             ;SAVE
 9137  044314  012600                          MOV     (SP)+,R0                ;RESTORE R0
 9138  044316  012767  000105  135306          MOV     #105,RK10               ;SET FUNCTION
 9139  044324  053767  002044  135300          BIS     @#RKNEWH,RK10           ;SET BA EXT BITS IN FUNCTION
 9140  044332  013777  002122  135650  RK3:    MOV     @#RKHDA,@RKDA           ;LOAD DISK ADDRESS
 9141  044340  013777  001774  135636          MOV     @#RKHWC,@RKWC           ;LOAD WORD COUNT
 9142  044346  013777  002042  135632          MOV     @#RKNEWL,@RKBA          ;LOAD BUS ADDRESS
 9143  044354  016777  135252  135620          MOV     RK10,@RKCS              ;LOAD FUNCTION AND GO
 9144  044362  000002                          RTI                             ;RETURN
 9145
 9146                                  ;FUNCTION JUST EXECUTED WAS A READ. ANY ERRORS?
 9147  044364  032737  000400  001754  RKREAD: BIT     #BIT8,@#RKHSTAT                 ;REPEAT FLAG SET?
 9148  044372  001234                          BNE     RKLOOP                  ;BRANCH IF YES
 9149  044374  005777  135602                  TST     @RKCS                   ;ANY ERRORS?
 9150  044400  100026                          BPL     1$                      ;BRANCH IF NO
 9151  044402  105737  002147                  TSTB    @#RKTRY                 ;TRYED 3 TIMES?
 9152  044406  001002                          BNE     3$                      ;BRANCH IF NO
 9153  044410  000167  177422                  JMP     RKERR
 9154  044414  005337  002136          3$:     DEC     @#RKFUN                 ;SET FUNCTION BACK TO READ
 9155  044420  012777  000001  135554          MOV     #1,@RKCS                ;CLEAR THE ERROR
 9156  044426  004737  044466                  JSR     PC,@#TIMER              ;WAIT A LITTLE
 9157  044432  105777  135544                  TSTB    @RKCS                   ;WAIT FOR CLR TO FINISH
 9158  044436  100375                          BPL     .-4
 9159  044440  105237  002147                  INCB    @#RKTRY                 ;INCREMENT TRY COUNT
 9160  044444  013746  177776                  MOV     @#PC,-(SP)
 9161  044450  012746  044332                  MOV     #RK3,-(SP)
 9162  044454  000002                          RTI
 9163  044456  112737  000200  001754  1$:     MOVB    #200,@#RKHSTAT          ;SET DON E FLAG
 9164  044464  000002                          RTI                             ;RETURN
 9165  044466  005067  000010          TIMER:  CLR     1$
 9166  044472  105267  000004          2$:     INCB    1$
 9167  044476  001375                          BNE     2$
 9168  044500  000207                          RTS     PC
 9169  044502  000000                  1$:     .WORD
 9170
 9171                                  ;;*****************************************************************
 9172                                  .SBTTL  RH11/RP04 SERVICE ROUTINE
 9173                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF ROUTINE
 9174                                  ;;*****************************************************************
 9175  044504  000005                  RP4RPT: RESET
 9176  044506  005337  002142                  DEC     @#RP4FUN                ;RESTORE FUNCTION
 9177  044512  022737  000001  002142          CMP     #1,@#RP4FUN             ;WHAT IS IT?
 9178  044520  001501                          BEQ     RP41                    ;BRANCH IF WC
 9179  044522  002560                          BLT     RP43                    ;BRANCH IF READ
 9180  044524  000137  042462                  JMP     @#RP4WTRY               ;GO TO WRITE
 9181  044530  005237  002142          RP4SRV: INC     @#RP4FUN                ;FIND OUT WHAT FUNCTION
 9182  044534  022737  000002  002142          CMP     #2,@#RP4FUN             ;WAS JUST EXECUTED
 9183  044542  001504                          BEQ     RP4WCK
 9184  044544  100576                          BMI     RP4READ
 9185
 9186                                  ;WRITE FUNCTION WAS JUST EXECUTED.
 9187  044546  032737  000400  001762          BIT     #BIT8,@#RP4HSTAT        ;REPEAT FLAG SET?
 9188  044554  001050                          BNE     RP4LOOP                 ;BRANCH IF YES
 9189  044556  032777  040000  135450          BIT     #BIT14,@RP4DS           ;ANY ERRORS
 9190  044564  001457                          BEQ     RP41                    ;BRANCH IF NO
 9191  044566  105737  002151                  TSTB    @#RP4TRY                ;TRIED 3 TIMES?
```

```
 9192  044572  001426                          BEQ     RP4ERR                  ;BRANCH IF YES
 9193  044574  052777  000040  135426          BIS     #BIT5,@RP4CS2           ;CLEAR ALL ERRORS
 9194  044602  004737  042514                  JSR     PC,@#LDRP4              ;RELOAD THE UNIT NO
 9195  044606  105237  002151                  INCB    @#RP4TRY                ;INCREMENT TRY COUNT
 9196  044612  013746  177776                  MOV     @#PSW,-(SP)             ;SETUP THE STACK TO
 9197  044616  012746  042462                  MOV     #RP4WTRY,-(SP)          ;TRY WRITE AGAIN
 9198  044622  032737  000400  001762          BIT     #BIT8,@#RP4HSTAT        ;REPEAT FLAG SET?
 9199  044630  001006                          BNE     2$                      ;BRANCH IF YES
 9200  044632  012777  000007  135356          MOV     #7,@RP4CS1              ;RECALIBRATE
 9201  044640  105777  135352          1$:     TSTB    @RP4CS1                 ;DRIVE READY?
 9202  044644  100375                          BPL     1$                      ;BRANCH IF NO
 9203  044646  000002                  2$:     RTI
 9204  044650  012737  100200  001762  RP4ERR: MOV     #100200,@#RP4HSTA       ;SET ERROR & DONE BIT
 9205  044656  010046                          MOV     R0,-(SP)                ;SAVE R0
 9206  044660  013700  001636                  MOV     @#RP411,R0              ;GET RUN TABLE INDEX
 9207  044664  052760  100000  001702          BIS     #BIT15,RUNTRAK(R0)      ;SET ERROR BIT
 9208  044672  012600                          MOV     (SP)+,R0                ;RESTORE R0
 9209  044674  000002                          RTI                             ;RETURN
 9210
 9211  044676  012737  100200  001762  RP4LOOP:MOV     #100200,@#RP4HSTAT      ;SET DONE AND ERROR BITS
 9212  044704  032777  040000  135322          BIT     #BIT14,@RP4DS           ;ANY ERRORS?
 9213  044712  001003                          BNE     1$                              ;BRANCH IF YES
 9214  044714  042737  100000  001762          BIC     #BIT15,@#RP4HSTAT       ;CLEAR ERROR BIT
 9215  044722  000002                  1$:     RTI                             ;RETURN
 9216                                  ;WRITE OK...NOW DO A WRITE CHECK.
 9217  044724  112737  177773  002151  RP41:   MOVB    #-3,@#RP4TRY            ;INITIALIZE TRY COUNT
 9218  044732  105777  135276          RP42:   TSTB    @RP4DS                  ;IS DRIVE READY?
 9219  044736  001775                          BEQ     RP42                    ;BRANCH IF NO
 9220  044740  004737  042514                  JSR     PC,@#LDRP4
 9221  044744  112777  000151  135244          MOVB    #151,@RP4CS1            ;LOAD FUNCTION AND GO
 9222  044752  000002                          RTI
 9223
 9224                                  ;FUNCTION JUST EXECUTED WAS A WRITE CHECK
 9225  044754  032737  000400  001762  RP4WCK: BIT     #BIT8,@#RP4HSTAT                ;REPEAT FLAG SET?
 9226  044762  001345                          BNE     RP4LOOP                 ;BRANCH IF YES
 9227  044764  032777  040000  135242          BIT     #BIT14,@RP4DS           ;ANY ERRORS?
 9228  044772  001421                          BEQ     1$                      ;BRANCH IF NO
 9229  044774  105737  002151          3$:     TSTB    @#RP4TRY                ;TRIED 3 TIMES?
 9230  045000  001723                          BEQ     RP4ERR                  ;BRANCH IF YES
 9231  045002  005337  002136                  DEC     @#RKFUN                 ;SET FUNCTION TO WC
 9232  045006  052777  000040  135214          BIS     #BIT5,@RP4CS2           ;CLEAR ALL ERRORS
 9233  045014  004737  042514                  JSR     PC,@#LDRP4              ;RELOAD THE UNIT NO
 9234  045020  105237  002151                  INCB    @#RP4TRY                ;INCREMENT TRY COUNT
 9235  045024  013746  177776                  MOV     @#PSW,-(SP)
 9236  045030  012746  044732                  MOV     #RP42,-(SP)
 9237  045034  000002                          RTI                             ;TRY AGAIN
 9238  045036  032777  040000  135164  1$:     BIT     #BIT14,@RP4CS2          ;WRITE CHECK ERROR?
 9239  045044  001404                          BEQ     2$                      ;BRANCH IF NO
 9240  045046  005737  001636                  TST     @#RP411                 ;FIRST 2K?
 9241  045052  001401                          BEQ     2$
 9242  045054  000747                          BR      3$
 9243
 9244                                  ;WRITE CHECK WAS OK...NOW DO A READ.
 9245  045056  112737  177775  002151  2$:     MOVB    #-3,@#RP4TRY            ;INITIALIZE TRY COUNT
 9246  045064  105777  135144          RP43:   TSTB    @RP4DS                  ;IS DRIVE READY?
 9247  045070  001775                          BEQ     RP43                    ;BRANCH IF NO
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9248  045072  004737  042514                  JSR     PC,@#LDRP4              ;LOAD REGISTERS
9249  045076  010546                          MOV     R5,-(SP)                ;SAVE R5
9250  045100  013705  002060                  MOV     @#RP4NXM,R5             ;SHIFT EXTENDED
9251  045104  072527  000010                  ASH     #10,R5                  ;ADDRESS BITS
9252  045110  042777  001400  135100          BIC     #1400,@RP4CS1           ;       AND
9253  045116  050577  135074                  BIS     R5,@RP4CS1              ;LOAD INTO RP4CS1
9254  045122  012605                          MOV     (SP)+,R5                ;RESTORE R5
9255  045124  013777  002056  135070          MOV     @#RP4XML,@RP4BA         ;LOAD BUS ADR
9256  045132  112777  000171  135056          MOVB    #171,@RP4CS1            ;LOAD FUNCTION AND GO
9257  045140  000002                          RTI                             ;RETURN
9258
9259                                  ;FUNCTION JUST EXECUTED WAS A READ.
9260  045142  032737  000400  001762  RP4READ:BIT     #BIT8,@#RP4HSTAT        ;REPEAT FLAG SET?
9261  045150  001252                          BNE     RP4LOOP                 ;BRANCH IF YES
9262  045152  032777  040000  135054          BIT     #BIT14,@RP4DS           ;ANY ERRORS?
9263  045160  001421                          BEQ     1$                      ;BRANCH IF NO
9264  045162  105737  002151                  TSTB    @#RP4TRY                ;TRIED 3 TIMES?
9265  045166  001630                          BEQ     RP4ERR                  ;BRANCH IF YES
9266  045170  005337  002142                  DEC     @#RP4FUN                ;SET FUNCTION TO A READ
9267  045174  052777  000040  135026          BIS     #BIT5,@RP4CS2           ;CLEAR ALL ERRORS
9268  045202  004737  042514                  JSR     PC,@#LDRP4              ;RELOAD THE UNIT NO
9269  045206  105237  002151                  INCB    @#RP4TRY                ;INCREMENT TRY COUNT
9270  045212  013746  177776                  MOV     @#PSW,-(SP)
9271  045216  012746  045064                  MOV     #RP43,-(SP)
9272  045222  000002                          RTI                             ;TRY AGAIN
9273  045224  112737  000200  001762  1$:     MOVB    #200,@#RP4HSTA          ;SET DONE FLAG
9274  045232  000002                          RTI                             ;RETURN
9275                                  ;;*****************************************************************
9276                                  .SBTTL  RH11/RS04 SERVICE ROUTINE
9277                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF ROUTINE
9278                                  ;;*****************************************************************
9279  045234  000005                  RSRPT:  RESET
9280  045236  005337  002144                  DEC     @#RSFUN                 ;RESTORE FUNCTION
9281  045242  022737  000001  002144          CMP     #1,@#RSFUN              ;WHAT IS IT?
9282  045250  001465                          BEQ     RS41                    ;BRANCH IF WC
9283  045252  002542                          BLT     RS43                    ;BRANCH IF WRITE
9284  045254  000137  043004                  JMP     @#RSWTRY
9285  045260  005237  002144          RSSRV:  INC     @#RSFUN                 ;FIND OUT WHAT FUNCTION
9286  045264  022737  000002  002144          CMP     #2,@#RSFUN              ;WAS JUST EXECUTED
9287  045272  001470                          BEQ     RSWCK
9288  045274  100562                          BMI     RSREAD
9289
9290                                  ;WRITE FUNCTION WAS JUST EXECUTED
9291  045276  032737  000400  001754          BIT     #BIT8,@#RSHSTAT ;REPEAT FLAG SET?
9292  045304  001034                          BNE     RSLOOP                  ;BRANCH IF YES
9293  045306  032777  040000  134760          BIT     #BIT14,@RSDS            ;ANY ERRORS?
9294  045314  001443                          BEQ     RS41                    ;BRANCH IF NO
9295  045316  105737  002152                  TSTB    @#RSTRY                 ;TRIED 3 TIMES?
9296  045322  001412                          BEQ     RSERR                   ;BRANCH IF YES
9297  045324  052777  000040  134736          BIS     #BIT5,@RSCS2            ;CLEAR ALL ERRORS
9298  045332  105237  002152                  INCB    @#RSTRY                 ;INCREMENT TRY COUNT
9299  045336  013746  177776                  MOV     @#PSW,-(SP)             ;SETUP THE STACK TO
9300  045342  012746  043004                  MOV     #RSWTRY,-(SP)           ;TRY THE WRITE AGAIN
9301  045346  000002                          RTI
9302  045350  012737  100200  001764  RSERR:  MOV     #100200,@#RSHSTAT       ;SET ERROR AND DONE BIT
9303  045356  010046                          MOV     R0,-(SP)                ;SAVE R0
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9304  045360  013700  001640                  MOV     @#RS11,R0               ;GET RUN TBL INDEX
9305  045364  052760  100000  001702          BIS     #BIT15,RUNTRAK(R0)      ;SET ERROR BIT
9306  045372  012600                          MOV     (SP)+,R0                ;RESTORE R0
9307  045374  000002                          RTI
9308
9309  045376  012737  100200  001764  RSLOOP: MOV     #100200,@#RSHSTAT       ;SET DONE AND ERROR BITS
9310  045404  032777  040000  134662          BIT     #BIT14,@RSDS            ;ANY ERRORS?
9311  045412  001003                          BNE     1$                      ;BRANCH IF YES
9312  045414  042737  100000  001764          BIC     #BIT15,@#RSHSTAT        ;CLEAR ERROR BIT
9313  045422  000002                  1$:     RTI                             ;RETURN
9314                                  ;WRITE OK...NOW DO A WRITE CHECK
9315  045424  112737  177775  002152  RS41:   MOVB    #-3,@#RSTRY             ;INIT TRY COUNT
9316  045432  105777  134636          RS42:   TSTB    @RSDS                   ;IS DRIVE READY?
9317  045436  001775                          BEQ     RS42                    ;BRANCH IF NO
9318  045440  004737  043044                  JSR     PC,@#LDRS               ;LOAD RS REGISTERS
9319  045444  112777  000151  134604          MOVB    #151,@RSCS1             ;LOAD FUNCTION AND GO
9320  045452  000002                          RTI                             ;RETURN
9321
9322                                  ;FUNCTION JUST EXECUTED WAS A WRITE CHECK
9323  045454  032737  000400  001764  RSWCK:  BIT     #BIT8,@#RSHSTAT         ;REPEAT FLAG SET?
9324  045462  001345                          BNE     RSLOOP                  ;BRANCH IF YES
9325  045464  032777  040000  134602          BIT     #BIT14,@RSDS            ;ANY ERRORS?
9326  045472  001417                          BEQ     1$                      ;BRANCH IF NO
9327  045474  105737  002152          3$:     TSTB    @#RSTRY                 ;TRIED 3 TIMES?
9328  045500  001723                          BEQ     RSERR                   ;BRANCH IF YES
9329  045502  005337  002144                  DEC     @#RSFUN                 ;SET FUNCTION BACK TO WC
9330  045506  052777  000040  134554          BIS     #BIT5,@RSCS2            ;CLEAR THE ERROR
9331  045514  105237  002152                  INCB    @#RSTRY                 ;INCREMENT THE TRY COUNT
9332  045520  013746  177776                  MOV     @#PSW,-(SP)
9333  045524  016746  177702                  MOV     RS42,-(SP)
9334  045530  000002                          RTI                             ;TRY AGAIN
9335
9336  045532  032777  040000  134530  1$:     BIT     #BIT14,@RSCS2           ;WRITE CHECK ERROR?
9337  045540  001404                          BEQ     2$                      ;BRANCH IF NO
9338  045542  005737  001640                  TST     @#RS11                  ;FIRST 2K?
9339  045546  001401                          BEQ     2$                      ;BRANCH IF YES
9340  045550  000751                          BR      3$
9341
9342                                  ;WRITE CHECK WAS OK...NOW DO A READ.
9343  045552  112737  177775  002152  2$:     MOVB    #-3,@#RSTRY             ;INIT TRY COUNT
9344  045560  105777  134510          RS43:   TSTB    @RSDS                   ;IS DRIVE READY?
9345  045564  001775                          BEQ     RS43                    ;BRANCH IF NO
9346  045566  004737  043044                  JSR     PC,@#LDRS               ;LOAD RS REGISTERS
9347  045572  010546                          MOV     R5,-(SP)                ;SAVE R5
9348  045574  013705  002064                  MOV     @#RSMEMH,R5             ;SHIFT EXTENDED
9349  045600  072527  000010                  ASH     #10,R5                  ;ADDRESS BITS
9350  045604  042705  176377                  BIC     #176377,R5              ;       AND
9351  045610  042777  001400  134440          BIC     #1400,@RSCS1
9352  045616  050577  134434                  BIS     R5,@RSCS1               ;LOAD INTO RSCS1
9353  045622  012605                          MOV     (SP)+,R5                ;RESTORE R5
9354  045624  013777  002062  134430          MOV     @#RSMEML,@RSBA          ;LOAD BUS ADR
9355  045632  112777  000171  134416          MOVB    #171,@RSCS1             ;LOAD FUNCTION AND GO
9356  045640  000002                          RTI                             ;RETURN
9357
9358                                  ;FUNCTION JUST EXECUTED WAS A READ.
9359  045642  032737  000400  001764  RSREAD: BIT     #BIT8,@#RSHSTAT         ;REPEAT FLAG SET?
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9360  045650  001252                          BNE     RSLOOP                  ;BRANCH IF YES
9361  045652  032777  040000  134414          BIT     #BIT14,@RSDS            ;ANY ERRORS?
9362  045660  001417                          BEQ     1$                      ;BRANCH IF NO
9363  045662  105737  002152                  TSTB    @#RSTRY                 ;TRIED 3 TIMES?
9364  045666  001630                          BEQ     RSERR                   ;BRANCH IF YES
9365  045670  005337  002144                  DEC     @#RSFUN                 ;RESTORE FUN TO READ
9366  045674  052777  000040  134366          BIS     #BIT5,@RSCS2            ;CLEAR ALL ERRORS
9367  045702  105237  002152                  INCB    @#RSTRY                 ;INCREMENT TRY COUNT
9368  045706  013746  177776                  MOV     @#PSW,-(SP)
9369  045712  012746  045560                  MOV     #RS43,-(SP)
9370  045716  000002                          RTI                             ;TRY AGAIN
9371  045720  112737  000200  001764  1$:     MOVB    #200,@#RSHSTAT          ;SET DONE FLAG
9372  045726  000002                          RTI                             ;RETURN
9373                                  ;;**************************************************************
9374                                  .SBTTL  UNIBUS EXERCISER SERVICE ROUTINE
9375                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF ROUTINE
9376                                  ;;**************************************************************
9377  045730  104406                  UBESRV: SAVREG
9378  045732  004737  054516                  JSR     PC,@#LDKT               ;GO TO LOW CORE
9379  045736  012704  002312                  MOV     #UBETBL+6,R4            ;GET ADDRESS OF UBECR1
9380  045742  005774  000000                  TST     @(R4)                   ;WAS THERE AN ERROR?
9381  045746  100430                          BMI     UBE2                    ;BRANCH IF YES
9382  045750  062737  000776  001716          ADD     #776,@#UBESAV           ;INCREMENT UBE BUS ADR
9383  045756  005537  001720                  ADC     @#UBESAV+2
9384  045762  013737  001716  001722          MOV     @#UBESAV,@#UBEADR
9385  045770  013737  001720  001724          MOV     @#UBESAV+2,@#UBEADR+2
9386  045776  013754  001724                  MOV     @#UBEADR+2,@-(R4)       ;LOAD UBECR2
9387  046002  013754  001722                  MOV     @#UBEADR,@-(R4)         ;LOAD UBEBA
9388  046006  012754  170000                  MOV     #170000,@-(R4)          ;LOAD UBECC
9389  046012  004737  054604                  JSR     PC,@#RESKT              ;GO BACK TO ORIGINAL CORE
9390  046016  104407                          RESREG
9391  046020  012777  064545  134264          MOV     #64545,@UBETBL+6        ;RESTART UBE
9392  046026  000002                          RTI                             ;RETURN
9393
9394                                  ;UBE ERROR-IS IT LAST MEMORY?
9395  046030  005037  001732          UBE2:   CLR     @#MEMFLG
9396  046034  162704  000004                  SUB     #4,R4                   ;ADJUST R4
9397  046040  017403  000002                  MOV     @2(R4),R3               ;GET BECR2
9398  046044  042703  000003                  BIC     #3,R3                   ;GET RID OF ADDRESS BITS
9399  046050  022703  000400                  CMP     #400,R3                 ;WAS ERROR A TIMEOUT?
9400  046054  001041                          BNE     UBEERR                  ;BRANCH IF NO
9401  046056  017437  000000  001540          MOV     @(R4),@#PA1500          ;SAVE BUS ADR OF ERROR
9402  046064  017437  000002  001542          MOV     @2(R4),@#PA1716
9403  046072  042737  177774  001542          BIC     #177774,@#PA1716
9404  046100  162737  000004  001540          SUB     #4,@#PA1500             ;ADJUST PHYSICAL ADR THAT FAILED
9405  046106  005637  001542                  SBC     @#PA1716                ;UBE STOPS AT ADR+4
9406  046112  023737  001540  001624          CMP     @#PA1500,@#MXMMLO       ;AT MAXIMUM MEMORY LO?
9407  046120  001015                          BNE     MHOLE                   ;BRANCH IF NO
9408  046122  023737  001542  001622          CMP     @#PA1716,@#MXMMHI       ;AT MAX MEMORY HI?
9409  046130  001011                          BNE     MHOLE                   ;BRANCH IF NO
9410  046132  004737  053646                  JSR     PC,@#UBEINIT
9411  046136  004737  054604                  JSR     PC,@#RESKT
9412  046142  104407                          RESREG
9413  046144  012777  064545  134140          MOV     #64545,@UBETBL+6
9414  046152  000002                          RTI
9415
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9416  046154  010637  001732          MHOLE:  MOV     SP,@#MEMFLG
9417  046160  013737  001212  001734  UBEERR: MOV     @#$LPERR,@#ERRADR;SAVE LOOP ARROR ADR
9418  046166  012737  046230  001212          MOV     #UBE3,@#$LPERR          ;SET LOOP ADR
9419  046174  012703  000022                  MOV     #22,R3
9420  046200  005737  001732                  TST     @#MEMFLG
9421  046204  001002                          BNE     1$
9422  046206  104007                          ERROR   7
9423  046210  000407                          BR      UBE3
9424  046212  013737  001540  001226  1$:     MOV     @#PA1500,@#$GDDAT
9425  046220  013737  001542  001230          MOV     @#PA1716,@#$BDDAT
9426  046226  104012                          ERROR   12
9427
9428                                  ;RESTART UBE IN SAME MEMORY
9429  046230  013737  001734  001212  UBE3:   MOV     @#ERRADR,@#$LPERR       ;RESTORE ERROR LOOP ADR
9430  046236  010446                          MOV     R4,-(SP)                ;SAVE R4
9431  046240  012704  002304                  MOV     #UBETBL,R4              ;GET ADDRESS OF UBE TABLE
9432  046244  012734  170000                  MOV     #170000,@(R4)+          ;SET UBECC
9433  046250  013734  001722                  MOV     @#UBEADR,@(R4)+         ;SET UBEBA <15:00>
9434  046254  005074  000004                  CLR     @4(R4)                  ;CLEAR ALL ERRORS
9435  046260  013734  001724                  MOV     @#UBEADR+2,@(R4)+       ;SET EXT ADR BITS
9436  046264  012774  064545  000000          MOV     #64545,@(R4)            ;START UBE
9437  046272  012604                          MOV     (SP)+,R4                ;RESTORE R4
9438  046274  004737  054604                  JSR     PC,@#RESKT
9439  046300  104407                          RESREG
9440  046302  000002                          RTI                             ;RETURN
9441
9442                                  ;;******************************************************************
9443                                  ;SBTTL  MASS BUS TESTER SERVICE ROUTINE
9444                                  ;*      SEE DOCUMENTATION FOR FUNCTIONAL DESCRIPTION OF ROUTINE
9445                                  ;;******************************************************************
9446  046304  104406                  MBTSRV: SAVREG
9447  046306  004737  054516                  JSR     PC,@#LDKT               ;GO TO LOW CORE
9448  046312  005037  001732                  CLR     @#MEMFLG
9449  046316  012704  002322                  MOV     #MBTTBL,R4              ;GET ADDRESS OF ADDRESS OF CS1 REG
9450  046322  032734  040000                  BIT     #BIT14,@(R4)+           ;ANY ERRORS?
9451  046326  001007                          BNE     1$                      ;BRANCH IF YES
9452  046330  004737  054604          2$:     JSR     PC,@#RESKT              ;GO BACK TO ORIGINAL CORE
9453  046334  104407                          RESREG
9454  046336  112777  000161  133756          MOVB    #161,@MBTTBL
9455  046344  000002                          RTI                             ;RESTART MBT AND RETURN
9456  046346  062704  000010          1$:     ADD     #10,R4                  ;ADJUST R4
9457  046352  032774  004000  000000          BIT     #BIT11,@(R4)            ;NON-EXISTANT MEMORY ERROR?
9458  046360  001443                          BEQ     MBTERR                  ;BRANCH IF NO
9459  046362  162704  000006                  SUB     #6,R4                   ;ADJUST R4
9460  046366  013437  001540                  MOV     @(R4)+,@#PA1500         ;GET BUS ADR
9461  046372  013405                          MOV     @(R4)+,R5               ;GET BUS ADR EXT
9462  046374  072527  000010                  ASH     #10,R5                  ;SHIFT EXTENDED BITS RIGHT
9463  046400  042705  177774                  BIC     #177774,R5              ;CLEAR ALL BITS BUT 0 & 1
9464  046404  010537  001542                  MOV     R5,@#PA1716
9465  046410  162737  000004  001540          SUB     #4,@#PA1500             ;ADJUST BUS ADR
9466  046416  005637  001542                  SBC     @#PA1716
9467  046422  023737  001540  001624          CMP     @#PA1500,@#MXMMLO       ;IS IT LAST MEMORY?
9468  046430  001015                          BNE     MEMHOLE                 ;BRANCH IF NO
9469  046432  023737  001542  001622          CMP     @#PA1716,@#MXMMHI       ;CHECK EXT ADR BITS
9470  046440  001011                          BNE     MEMHOLE
9471  046442  005724                          TST     (R4)+                   ;INCREMENT R4
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9472  046444  052774  000047  000000          BIS     #47,@(R4)               ;CLEAR THE ERROR
9473  046452  012734  000007                  MOV     #7,@(R4)+               ;SELECT UNIT 7
9474  046456  005074  177766                  CLR     @-12(R4)                ;CLEAR WORD COUNT
9475  046462  000722                          BR      2$                      ;CONTINUE
9476
9477  046464  010637  001732          MEMHOLE:MOV     SP,@#MEMFLG
9478  046470  013737  001212  001734  MBTERR: MOV     @#$LPERR,@#ERRADR       ;SAVE LOOP ADDRESS
9479  046476  012737  046540  001212          MOV     #1$,@#$LPERR            ;SET NEW LOOP ADR
9480  046504  012703  000020                  MOV     #20,R3                  ;PUT DEVICE ID IN R3
9481  046510  005737  001732                  TST     @#MEMFLG
9482  046514  001002                          BNE     2$
9483  046516  104007                          ERROR   7
9484  046520  000407                          BR      1$
9485  046522  013737  001540  001226  2$:     MOV     @#PA1500,@#$GDDAT
9486  046530  013737  001542  001230          MOV     @#PA1716,@#$BDDAT
9487  046536  104013                          ERROR   13
9488  046540  013737  001734  001212  1$:     MOV     @#ERRADR,@#$LPERR       ;RESTORE LOOP ADR
9489  046546  012704  002332                  MOV     #MBTTBL+10,R4           ;GET ADR OF MBTTBL+10
9490  046552  015400                          MOV     @-(R4),R0               ;GET BUS ADR EXTENDED
9491  046554  015401                          MOV     @-(R4),R1               ;GET BUS ADR
9492  046556  015402                          MOV     @-(R4),R2               ;GET WORD COUNT
9493  046560  006302                          ASL     R2                      ;ADJUST WORD COUNT
9494  046562  160201                          SUB     R2,R1                   ;FORM START ADR OF THIS XFER
9495  046564  005600                          SBC     R0
9496  046566  052774  000047  000010          BIS     #47,@10(R4)             ;CLEAR THE WORLD
9497  046574  012774  000007  000010          MOV     #7,@10(R4)              ;SELECT UNIT 7
9498  046602  005724                          TST     (R4)+                   ;ADJUST R4
9499  046604  010134                          MOV     R1,@(R4)+               ;RESTORE BUS ADR
9500  046606  010074  000000                  MOV     R0,@(R4)
9501  046612  004737  054604                  JSR     PC,@#RESKT              ;GO BACK TO ORIGINAL CORE
9502  046616  104407                          RESREG
9503  046620  112777  000161  133474          MOVB    #161,@MBTTBL            ;START MBT AGAIN
9504  046626  000002                          RTI                             ;RETURN
9505                                  ;;**************************************************************
9506                                  .SBTTL  LINE CLOCK SERVICE ROUTINE
9507                                  ;*      THIS ROUTINE FIRST REMAPS PROGRAM EXECUTION TO LOW
9508                                  ;*      MEMORY. IT THEN INCREMENTS AND KEEPS TRACK OF THE
9509                                  ;*      SECOND AND MINUTE COUNTS KEPT IN LOCATIONS "LTICKS"
9510                                  ;*      AND "MTICKS" RESPECTIVELY.
9511                                  ;;**************************************************************
9512  046630  104406          LKSRV:  SAVREG
9513  046632  004737  054516                  JSR     PC,@#LDKT               ;GO TO LOW CORE
9514  046636  105237  001644                  INCB    @#LTICKS                ;INCREMENT TICK COUNT
9515  046642  122737  000074  001644          CMPB    #60.,@#LTICKS           ;ONE SECOND YET?
9516  046650  001014                          BNE     1$                      ;BRANCH IF NO
9517  046652  105237  001645                  INCB    @#LTICKS+1              ;INCREMENT SECOND COUNT
9518  046656  105037  001644                  CLRB    @#LTICKS                ;CLEAR SECOND COUNT
9519  046662  122737  000074  001645          CMPB    #60.,@#LTICKS+1         ;ONE MINUTE YET?
9520  046670  001004                          BNE     1$                      ;BRANCH IF NO
9521  046672  105037  001645                  CLRB    @#LTICKS+1
9522  046676  005237  001642                  INC     @#MTICKS                ;INCREMENT MINUTE COUNT
9523  046702  004737  054604          1$:     JSR     PC,@#RESKT              ;RESTORE THE KT
9524  046706  104407                          RESREG
9525  046710  012737  000100  177546          MOV     #BIT6,@#LKS             ;CLEAR READY BIT IN CLOCK
9526  046716  000002                          RTI                             ;RETURN
9527
```

```
                                        .SBTTL  SCOPE HANDLER ROUTINE
                                        ;;**********************************************************************
                                        ;*THIS ROUTINE CONTROLS THE LOOPING OF SUBTESTS. IT WILL INCREMENT
                                        ;*AND LOAD THE TEST NUMBER($TSTNM) INTO THE DISPLAY REG.(DISPLAY<7:0>)
                                        ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                        ;*SW14=1         LOOP ON TEST
                                        ;*SW11=1         INHIBIT ITERATIONS
                                        ;*SW09=1         LOOP ON ERROR
                                        ;*CALL
                                        ;*      SCOPE           ;;SCOPE=IOT

046720                                  $SCOPE:
046720  032777  040000  132314  1$:     BIT     #BIT14,@SWR     ;;LOOP ON PRESENT TEST?
046726  001077                          BNE     $OVER           ;;YES IF SW14=1
                                        ;#####START OF CODE FOR THE XOR TESTER#####
046730  000416                  $XTSTR: BR      6$              ;;IF RUNNING ON THE "XOR" TESTER CHANGE
                                                                ;;THIS INSTRUCTION TO A "NOP" (NOP=240)
046732  013746  000004                  MOV     @#ERRVEC,-(SP)  ;;SAVE THE CONTENTS OF THE ERROR VECTOR
046736  012737  046756  000004          MOV     #5$,@#ERRVEC    ;;SET FOR TIMEOUT
046744  005737  177060                  TST     @#177060        ;;TIME OUT ON XOR?
046750  012637  000004                  MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
046754  000453                          BR      $SVLAD          ;;GO TO THE NEXT TEST
046756  022626                  5$:     CMP     (SP)+,(SP)+     ;;CLEAR THE STACK AFTER A TIME OUT
046760  012637  000004                  MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
046764  000413                          BR      7$              ;;LOOP ON THE PRESENT TEST
046766                          6$:;#####END OF CODE FOR THE XOR TESTER#####
046766  105767  132212          2$:     TSTB    $ERFLG          ;;HAS AN ERROR OCCURRED?
046772  001421                          BEQ     3$              ;;BR IF NO
046774  126767  132217  132202          CMPB    $ERMAX,$ERFLG   ;;MAX. ERRORS FOR THIS TEST OCCURRED?
047002  101015                          BHI     3$              ;;BR IF NO
047004  032777  001000  132230          BIT     #BIT09,@SWR     ;;LOOP ON ERROR?
047012  001404                          BEQ     4$              ;;BR IF NO
047014  016767  132172  132166  7$:     MOV     $LPERR,$LPADR   ;;SET LOOP ADDRESS TO LAST SCOPE
047022  000441                          BR      $OVER
047024  105067  132154          4$:     CLRB    $ERFLG          ;;ZERO THE ERROR FLAG
047030  005067  132270                  CLR     $TIMES          ;;CLEAR THE NUMBER OF ITERATIONS TO MAKE
047034  000415                          BR      1$              ;;ESCAPE TO THE NEXT TEST
047036  032777  004000  132176  3$:     BIT     #BIT11,@SWR     ;;INHIBIT ITERATIONS?
047044  001011                          BNE     1$              ;;BR IF YES
047046  005767  132126                  TST     $PASS           ;;IF FIRST PASS OF PROGRAM
047052  001406                          BEQ     1$              ;;      INHIBIT ITERATIONS
047054  005267  132126                  INC     $ICNT           ;;INCREMENT ITERATION COUNT
047060  026767  132240  132120          CMP     $TIMES,$ICNT    ;;CHECK THE NUMBER OF ITERATIONS MADE
047066  002017                          BGE     $OVER           ;;BR IF MORE ITERATION REQUIRED
047070  012767  000001  132110  1$:     MOV     #1,$ICNT        ;;REINITIALIZE THE ITERATION COUNTER
047076  016767  000054  132220          MOV     $MXCNT,$TIMES   ;;SET NUMBER OF ITERATIONS TO DO
047104                          $SVLAD:
047104  011667  132100                  MOV     (SP),$LPADR     ;;SAVE SCOPE LOOP ADDRESS
047110  011667  132076                  MOV     (SP),$LPERR     ;;SAVE ERROR LOOP ADDRESS
047114  005067  132206                  CLR     $ESCAPE         ;;CLEAR THE ESCAPE FROM ERROR ADDRESS
047120  112767  000001  132071          MOVB    #1,$ERMAX       ;;ONLY ALLOW ONE(1) ERROR ON NEXT TEST
047126  105767  132052          $OVER:  TSTB    $ERFLG          ;;ANY ERRORS?
047132  001403                          BEQ     1$              ;;BRANCH IF NO
047134  116767  132044  132041          MOVB    $ERFLG,$TSTNM+1
047142  016777  132034  132074  1$:     MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER
```

```
9584  047150  016716  132034              MOV     $LPADR,(SP)     ;;FUDGE RETURN ADDRESS
9585  047154  000002                      RTI                     ;;FIXES PS
9586  047156  000010              $MXCNT: 10                      ;;MAX. NUMBER OF ITERATIONS
9587                               .SBTTL  ERROR HANDLER ROUTINE
9588
9589                               ;;**********************************************************************
9590                               ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
9591                               ;*SAVE THE ERROR ITEM NUMBER AND THE ADDRESS OF THE ERROR CALL
9592                               ;*AND GO TO $ERRTYP ON ERROR
9593                               ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
9594                               ;*SW15=1        HALT ON ERROR
9595                               ;*SW13=1        INHIBIT ERROR TYPEOUTS
9596                               ;*SW10=1        BELL ON ERROR
9597                               ;*SW09=1        LOOP ON ERROR
9598                               ;*CALL
9599                               ;*      ERROR   N       ;;ERROR=EMT AND N=ERROR ITEM NUMBER
9600
9601  047160                       $ERROR:
9602  047160  116737  132020  001203         MOVB    $ERFLG,@#$TSTNM+1
9603  047166  105267  132012          7$:     INCB    $ERFLG          ;;SET THE ERROR FLAG
9604  047172  001775                  BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
9605  047174  016777  132002  132042         MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER AND ERROR FLAG
9606  047202  032777  002000  132032         BIT     #BIT10,@SWR     ;;BELL ON ERROR?
9607  047210  001402                  BEQ     1$              ;;NO - SKIP
9608  047212  104401  001330                  TYPE    ,$BELL          ;;RING BELL
9609  047216  005267  131772          1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
9610  047222  011667  131772                  MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
9611  047226  162767  000002  131764         SUB     #2,$ERRPC
9612  047234  117767  131760  131754         MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
9613  047242  032777  020000  131772         BIT     #BIT13,@SWR     ;;SKIP TYPEOUT IF SET
9614  047250  001004                  BNE     20$             ;;SKIP TYPEOUTS
9615  047252  004767  000056                  JSR     PC,$ERRTYP      ;;GO TO USER ERROR ROUTINE
9616  047256  104401  001335                  TYPE    ,$CRLF
9617  047262                           20$:
9618  047262  005777  131754          2$:     TST     @SWR            ;;HALT ON ERROR
9619  047266  100001                  BPL     3$              ;;SKIP IF CONTINUE
9620  047270  000000                  HALT                    ;;HALT ON ERROR!
9621  047272  032777  001000  131742  3$:     BIT     #BIT09,@SWR     ;;LOOP ON ERROR SWITCH SET?
9622  047300  001402                  BEQ     4$              ;;BR IF NO
9623  047302  016716  131704                  MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
9624  047306  005767  132014          4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
9625  047312  001402                  BEQ     5$              ;;BR IF NONE
9626  047314  016716  132006                  MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
9627  047320                           5$:
9628  047320  022737  041230  000042         CMP     #$ENDAD,@#42    ;;ACT-11 AUTO-ACCEPT?
9629  047326  001001                  BNE     6$              ;;BRANCH IF NO
9630  047330  000000                  HALT                    ;;YES
9631  047332                           6$:
9632  047332  000002                  RTI                     ;;RETURN
9633                               ;;**********************************************************************
9634                               .SBTTL  ERROR MESSAGE TYPEOUT ROUTINE
9635
9636                               ;*THIS ROUTINE FIRST TYPES A STANDARD MESSAGE CONSISTING OF THE
9637                               ;*VIRTUAL PC, THE PHYSICAL PC, THE PSW AT THE TIME OF THE ERROR CALL,
9638                               ;*AND THE  SUB-PASS COUNT. THE SUB-PASS COUNT CONSISTS OF THE SUB PASS COUNT IN THE
9639                               ;*HIGH BYTE AND THE PASS COUNT IN THE LOW BYTE.
```

```
 9640                                   ;*
 9641                                   ;*IT THEN USES THE "ITEM CONTROL BYTE" ($ITEMB) TO DETERMINE WHICH
 9642                                   ;*ERROR IS TO BE REPORTED. IT THEN OBTAINS, FROM THE "ERROR TABLE"
 9643                                   ;*THE ERROR MESSAGE POINTER AND TYPES THE ERROR MESSAGE. THE DATA
 9644                                   ;*HEADER POINTER IS THEN OBTAINED AND A DATA HEADER IS TYPED.
 9645                                   ;*THE DATA POINTER AND DATA FORMAT ARE THEN OBTAINED. THERE ARE
 9646                                   ;*FOUR TYPES OF DATA FORMAT, AS FOLLOWS:
 9647                                   ;*
 9648                                   ;*      0       TYPE THE CONTENTS OF THE DATA TABLE WORD IN
 9649                                   ;*              6 DIGIT OCTAL FORMAT
 9650                                   ;*      1       CONVERT THE CONTENTS OF THE DATA TABLE WORD TO
 9651                                   ;*              18 BITS AND TYPE AN 6 DIGIT OCTAL NUMBER
 9652                                   ;*      2       TYPE THE CONTENTS OF THE DATA TABLE WORD AND
 9653                                   ;*              THE WORD+2 IN 6 DIGIT OCTAL FORMAT
 9654                                   ;*      3       USE THE CONTENTS OF THE DATA TABLE WORD AS A
 9655                                   ;*              DEVICE ID AND TYPE THE DEVICES NAME
 9656                                   ;*      4       CONVERT THE TWO WORDS POINTED TO BY THE DATA
 9657                                   ;*              TABLE TO FLOATING POINT FORMAT AND TYPE.
 9658                                   ;*      5       CONVERT THE FOUR WORDS POINTED TO BY THE DATA
 9659                                   ;*              TABLE TO FLOATING DOUBLE FORMAT AND TYPE.
 9660                                   ;;*****************************************************************
 9661
 9662  047334  104406                  $ERRTYP:SAVREG
 9663  047336  104401  001335                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
 9664  047342  004737  051010                  JSR     PC,@#TYPTIME    ;GO TYPE THE TIME
 9665  047346  104401  055306                  TYPE    ,MSG3
 9666  047352  104401  001335                  TYPE    ,$CRLF
 9667  047356  016746  131636                  MOV     $ERRPC,-(SP)    ;;SAVE $ERRPC FOR TYPEOUT
 9668                                                                  ;;TYPE THE VIRTUAL PC
 9669  047362  104402                          TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
 9670  047364  104401  050556                  TYPE    ,8$
 9671  047370  013700  001536                  MOV     @#VADR,R0               ;SAVE VADR
 9672  047374  013737  001220  001536          MOV     @#$ERRPC,@#VADR         ;SAVE THE VIR PC FOR CONVERSION
 9673  047402  122737  000014  001216          CMPB    #14,@#$ITEMB
 9674  047410  003403                          BLE     51$
 9675  047412  105737  001216                  TSTB    @#$ITEMB                ;ERROR ZERO?
 9676  047416  001005                          BNE     42$                     ;BRANCH IF NO
 9677  047420  004737  053724          51$:    JSR     PC,@#CNVADR             ;CONVERT TO 18 BITS
 9678  047424  010037  001536                  MOV     R0,@#VADR
 9679  047430  000407                          BR      41$
 9680  047432  013737  001536  001540  42$:    MOV     @#VADR,@#PA1500
 9681  047440  005037  001542                  CLR     @#PA17!6
 9682  047444  010037  001536                  MOV     R0,@#VADR
 9683  047450  012746  001540          41$:    MOV     #PA1500,-(SP)           ;PUT ADDRESS OFPC ON STACK
 9684  047454  004737  052060                  JSR     PC,@#$DB20              ;CONVERT TO ASCII
 9685  047460  062716  000005                  ADD     #5,(SP)                 ;GET RID OF 5 MS DIGITS
 9686  047464  012667  000002                  MOV     (SP)+,30$               ;SAVE POINTER TO ASCII
 9687  047470  104401                          TYPE                            ;TYPE IT
 9688  047472  000000          30$:    .WORD
 9689  047474  104401  050556                  TYPE    ,8$
 9690  047500  016646  000030                  MOV     30(SP),-(SP)            ;GET PSW AT TIME OF ERROR
 9691  047504  104402                          TYPOC                           ;TYPE IT
 9692  047506  104401  050556                  TYPE    ,8$
 9693  047512  116746  131464                  MOVB    $TSTNM,-(SP)
 9694  047516  105066  000001                  CLRB    1(SP)
 9695  047522  104402                          TYPOC                   ;TYPE THE TEST NUMBER
```

```
9696  047524  104401  050556                  TYPE    ,8$
9697  047530  013746  001574                  MOV     @#$UBPASS,-(SP)
9698  047534  162716  000060                  SUB     #60,(SP)
9699  047540  104402                          TYPOC
9700  047542  104401  050556                  TYPE    ,8$
9701  047546  016746  131426                  MOV     $PASS,-(SP)     ;;SAVE $PASS FOR TYPEOUT
9702                                                                  ;;TYPE THE PASS COUNT
9703  047552  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
9704  047554  104401  001335                  TYPE    ,$CRLF
9705  047560  005000                          CLR     R0
9706  047562  153700  001216                  BISB    @#$ITEMB,R0             ;PICK UP THE INDEX
9707  047566  001431                          BEQ     6$                      ;EXIT IF ZERO
9708  047570  022700  000007          1$:     CMP     #7,R0           ;IS THIS ERROR 7?
9709  047574  001551                          BEQ     15$             ;BRANCH IF YES
9710  047576  005300                          DEC     R0              ;;ADJUST THE INDEX SO THAT IT WILL
9711  047600  006300                          ASL     R0              ;;      WORK FOR THE ERROR TABLE
9712  047602  006300                          ASL     R0
9713  047604  006300                          ASL     R0
9714  047606  062700  003126                  ADD     #$ERRTB,R0      ;;FORM TABLE POINTER
9715  047612  012067  000004                  MOV     (R0)+,2$        ;;PICKUP "ERROR MESSAGE" POINTER
9716  047616  001404                          BEQ     3$              ;;SKIP TYPEOUT IF NO POINTER
9717  047620  104401                          TYPE                    ;;TYPE THE "ERROR MESSAGE"
9718  047622  000000          2$:     .WORD   0                       ;;"ERROR MESSAGE" POINTER GOES HERE
9719  047624  104401  001335                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
9720  047630  012067  000004          3$:     MOV     (R0)+,4$        ;;PICKUP "DATA HEADER" POINTER
9721  047634  001404                          BEQ     5$              ;;SKIP TYPEOUT IF 0
9722  047636  104401                          TYPE                    ;;TYPE THE "DATA HEADER"
9723  047640  000000          4$:     .WORD   0                       ;;"DATA HEADER" POINTER GOES HERE
9724  047642  104401  001335                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
9725  047646  012001          5$:     MOV     (R0)+,R1                        ;;PICKUP "DATA TABLE" POINTER
9726  047650  001004                          BNE     7$              ;;GO TYPE THE DATA
9727  047652  104407          6$:     RESREG
9728  047654  104401  001335                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
9729  047660  000207                          RTS     PC              ;;RETURN
9730  047662  011002          7$:     MOV     (R0),R2         ;GET "DATA FORMAT" POINTER
9731  047664  122712  000001          10$:    CMPB    #1,(R2)         ;DATA FORMAT 1?
9732  047670  001424                          BEQ     9$              ;BRANCH IF YES
9733  047672  122712  000002                  CMPB    #2,(R2)         ;DATA FORMAT 2?
9734  047676  001441                          BEQ     11$             ;BRANCH IF YES
9735  047700  122712  000003                  CMPB    #3,(R2)         ;DATA FORMAT 3?
9736  047704  001445                          BEQ     24$             ;BRANCH IF YES
9737  047706  122712  000004                  CMPB    #4,(R2)         ;DATA FORMAT 4?
9738  047712  001456                          BEQ     40$             ;BRANCH IF YES
9739  047714  122712  000005                  CMPB    #5,(R2)         ;DATA FORMAT 5?
9740  047720  001465                          BEQ     60$             ;BRANCH IF YES
9741                                  ;;**********************************************************************
9742                                  ;DATA FORMAT 0
9743  047722  005202                          INC     R2              ;INCREMENT FORMAT POINTER
9744  047724  013146                          MOV     @(R1)+,-(SP)    ;PUSH DATA TO BE TYPED
9745  047726  104402                          TYPOC
9746  047730  005711          13$:    TST     (R1)            ;ANY MORE DATA?
9747  047732  001747                          BEQ     .               ;BRANCH IF NO
9748  047734  104401  050556                  TYPE    ,8$             ;TYPE TWO SPACES
9749  047740  000751                          BR      10$
9750                                  ;;**********************************************************************
9751                                  ;DATA FORMAT 1
```

```
9752  047742  005202                  9$:     INC     R2              ;INCREMENT FORMAT POINTER
9753  047744  004737  053724                  JSR     PC,@#CNVADR     ;GET 18 BIT ADR
9754  047750  012746  001540          14$:    MOV     #PA1500,-(SP)   ;PUSH ADR OF 18 BIT ADR
9755  047754  004737  052060                  JSR     PC,@#$DB2O      ;CONVERT TO ASCII
9756  047760  062716  000005                  ADD     #5,(SP)         ;DELETE LEADING ZEROS
9757  047764  012667  000002                  MOV     (SP)+,12$       ;GET ADR OF ASCII STRING
9758  047770  104401                          TYPE
9759  047772  000000                  12$:    .WORD
9760  047774  062701  000002                  ADD     #2,R1           ;INCREMENT R1
9761  050000  000753                          BR      13$
9762                                  ;;*****************************************************************
9763                                  ;DATA FORMAT 2
9764  050002  005202                  11$:    INC     R2              ;INCREMENT FORMAT POINTER
9765  050004  011100                          MOV     (R1),R0
9766  050006  012037  001540                  MOV     (R0)+,@#PA1500
9767  050012  011037  001542                  MOV     (R0),@#PA1716
9768  050016  000754                          BR      14$
9769                                  ;;*****************************************************************
9770                                  ;DATA FORMAT 3
9771  050020  005202                  24$:    INC     R2              ;INCREMENT FORMAT POINTER
9772  050022  013167  000016                  MOV     @(R1)+,25$      ;GET DEVICE ID
9773  050026  062767  055236  000010          ADD     #MSGINX,25$     ;FORM ADR OF ASCIZ ADR
9774  050034  017767  000004  000002          MOV     @25$,25$        ;GET ADR OF ASCIZ
9775  050042  104401                          TYPE
9776  050044  000000                  25$:    .WORD
9777  050046  000730                          BR      13$             ;CONTINUE
9778                                  ;;*****************************************************************
9779                                  ;DATA FORMAT 4
9780  050050  005202                  40$:    INC     R2
9781  050052  012167  000002                  MOV     (R1)+,44$       ;GET ADDRESS OF DATA
9782  050056  104410                          FL20                    ;CONVERT TO FLOATING FORMAT
9783  050060  000000                  44$:    .WORD
9784  050062  012667  000002                  MOV     (SP)+,45$       ;GET ADDRESS OF ASCIZ STRING
9785  050066  104401                          TYPE                    ;TYPE THE DATA
9786  050070  000000                  45$:    .WORD
9787  050072  000716                          BR      13$
9788                                  ;;*****************************************************************
9789                                  ;DATA FORMAT 5
9790  050074  005202                  60$:    INC     R2              ;INCREMENT FORMAT POINTER
9791  050076  012167  000002                  MOV     (R1)+,61$       ;GET ADDRESS OF DATA
9792  050102  104411                          FLD20                   ;CONVERT TO FLOATING ASCII
9793  050104  000000                  61$:    .WORD
9794  050106  012667  000002                  MOV     (SP)+,62$       ;GET ADDRESS OF ASCII STRING
9795  050112  104401                          TYPE                    ;TYPE THE DATA
9796  050114  000000                  62$:    .WORD
9797  050116  000704                          BR      13$
9798                                  ;;*****************************************************************
9799                                  ;ERROR 7 DECODE
9800  050120  010300                  15$:    MOV     R3,R0           ;SAVE R3
9801  050122  062700  055236                  ADD     #MSGINX,R0      ;GEN ADRS OF ASCIZ
9802  050126  011067  000002                  MOV     (R0),16$
9803  050132  104401                          TYPE
9804  050134  000000                  16$:    .WORD
9805  050136  104401  050144                  TYPE    ,65$            ;;TYPE ASCIZ STRING
9806  050142  000404                          BR      64$             ;;GET OVER THE ASCIZ
9807                                  ;;65$:  .ASCIZ  /FAILED/<CRLF>
```

```
                                64$:
                                        MOV     R3,R0           ;SAVE DEVICE ID
                                        CMP     #10,R0          ;MASS BUS DEVICE?
                                        BLE     17$             ;BRANCH IF YES
                                        TYPE    ,MSG12
                                        BR      18$
                                ;;*****************************************************************
                                ;MASS BUS ERR
                                17$:    CMP     #20,R3          ;MBT ERROR?
                                        BEQ     26$             ;BRANCH IF MBT ERROR
                                        BLT     27$             ;BRANCH IF UBE ERROR
                                        TYPE    ,MSG13
                                        CMP     #12,R0          ;WAS IT RS?
                                        BNE     29$             ;BRANCH IF NO
                                ;;*****************************************************************
                                ;UNIBUS ERROR OR RS04 ERROR
                                18$:    ADD     #REGINX,R0      ;FORM ADR OF REG TABLE
                                        MOV     (R0),R0         ;GET ADR OF REG TABLE
                                        CMP     #2,R3           ;RP3 OR RK?
                                        BEQ     20$             ;BRANCH IF RK
                                        BMI     21$             ;BRANCH IF NOT RP03
                                        MOV     #7,R4           ;SET RP03 SOB COUNT
                                        BR      22$
                                20$:    MOV     #6,R4           ;SET RK05 SOB COUNT
                                        BR      22$
                                21$:    MOV     #11,R4          ;SET RS04 SOB COUNT
                                        BR      22$
                                26$:    TYPE    ,MSG16
                                        MOV     #11,R4          ;SET MBT SOB COUNT
                                28$:    ADD     #REGINX,R0
                                        MOV     (R0),R0         ;GET ADR OF MBT TABLE
                                        BR      22$             ;GO TYPE REGISTERS
                                27$:    TYPE    ,MSG17
                                        MOV     #4,R4           ;SET UBE SOB COUNT
                                        BR      28$             ;GO TYPE UBE REGISTERS
                                22$:    MOV     @(R0)+,-(SP)    ;GET DATA IN REG
                                        TYPOC                   ;TYPE IT
                                        TYPE    ,8$             ;TYPE TWO SPACES
                                        SOB     R4,22$          ;CONTINUE
                                ;;*****************************************************************
                                ;THIS CODE TYPES A PHYSICAL BUS ADDRESS IF THE ERROR WAS AN RP03 OR RK05
                                        CMP     #22,R3          ;UBE ERROR?
                                        BEQ     73$             ;BRANCH IF YES
                                        CMP     #2,R3           ;RK05?
                                        BLT     32$             ;BRANCH IF NOT RK OR RP03
                                        BNE     70$             ;BRANCH IF RP03
                                        TYPE    ,MSG22
                                        MOV     #RKCS,R0        ;GET ADR OF ADP OF RKCS REG
                                        BR      71$
                                70$:    MOV     #RP3CS,R0       ;GET ADR OF ADP OF RP3CS REG
                                        TYPE    ,MSG23
                                71$:    MOV     @(R0)+,R1       ;GET BUS ADR EXTENDED BITS
                                        TST     (R0)+           ;ADJUST R0
                                        MOV     @(R0)+,@#PA1500 ;GET BUS ADRESS THAT FAILED
                                        ASH     #-4,R1          ;GET BITS 4&5 INTO BITS 0&1
                                        BIC     #177774,R1      ;GET RID OF UNUSED BITS
```

```
9864  050400 010137 001542                    MOV     R1,@#PA1716     ;SAVE EXTENDED BITS
9865  050404 162737 000002 001540  74$:       SUB     #2,@#PA1500     ;DECREMENT BUS ADR
9866  050412 005637 001542                    SBC     @#PA1716
9867  050416 012746 001540                    MOV     #PA1500,-(SP)
9868  050422 004737 052060                    JSR     PC,@#$DB2O      ;CONVERT TO ASCIZ STRING
9869  050426 062716 000003                    ADD     #3,(SP)         ;GET RID OF LEADING ZEROS
9870  050432 012667 000002                    MOV     (SP)+,72$
9871  050436 104401                           TYPE
9872  050440 000000                 72$:      .WORD
9873  050442 104401 001335          32$:      TYPE    ,$CRLF
9874  050446 000167 177200                    JMP     6$              ;EXIT
9875  050452 012700 002306          73$:      MOV     #UBETBL+2,R0    ;GET ADR OF UBE TABLE +2
9876  050456 013037 001540                    MOV     @(R0)+,@#PA1500 ;GET BUS ADR THAT FAILED
9877  050462 013037 001542                    MOV     @(R0)+,@#PA1716 ;GET BAE BITS
9878  050466 042737 177774 001542             BIC     #177774,@#PA1716;MASK OFF ADR BITS
9879  050474 000743                           BR      74$
9880                                ;;**********************************************************
9881                                ;RP04 ERROR
9882  050476 062700 055212          29$:      ADD     #REGINX,R0
9883  050502 011000                           MOV     (R0),R0         ;FORM ADR OF RP04 TABLE
9884  050504 012704 000011                    MOV     #11,R4          ;SET SOB COUNT
9885  050510 013046                 31$:      MOV     @(R0)+,-(SP)    ;GET DATA TO BE TYPED
9886  050512 104402                           TYPOC                   ;TYPE DATA
9887  050514 104401 050556                    TYPE    ,8$
9888  050520 077405                           SOB     R4,31$          ;CONTINUE
9889  050522 104401 001335                    TYPE    ,$CRLF
9890  050526 104401 001335                    TYPE    ,$CRLF
9891  050532 012704 000004                    MOV     #4,R4           ;SET SOB COUNT
9892  050536 104401 055756                    TYPE    ,MSG14
9893  050542 013046                 50$:      MOV     @(R0)+,-(SP)    ;GET DTA TO BE TYPED
9894  050544 104402                           TYPOC                   ;TYPE IT
9895  050546 104401 050556                    TYPE    ,8$
9896  050552 077405                           SOB     R4,50$          ;CONTINUE
9897  050554 000732                           BR      32$
9898  050556 020040     000         8$:       .ASCIZ  /  /            ;;TWO(2) SPACES
9899         050562                           .EVEN
9900                                .SBTTL  TYPE ROUTINE
9901
9902                                ;;**********************************************************
9903                                ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
9904                                ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
9905                                ;*NOTE1:        $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
9906                                ;*NOTE2:        $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
9907                                ;*NOTE3:        $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
9908                                ;*
9909                                ;*CALL:
9910                                ;*1) USING A TRAP INSTRUCTION
9911                                ;*      TYPE    ,MESADR         ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
9912                                ;*OR
9913                                ;*      TYPE
9914                                ;*      MESADR
9915                                ;*
9916
9917  050562 105767 130473          $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
9918  050566 100002                         BPL     1$              ;;BR IF YES
9919  050570 000000                         HALT                    ;;HALT HERE IF NO TERMINAL
```

```
9920  050572  000407                      BR      3$              ;;LEAVE
9921  050574  010046                1$:   MOV     R0,-(SP)        ;;SAVE R0
9922  050576  017600  000002              MOV     @2(SP),R0       ;;GET ADDRESS OF ASCIZ STRING
9923  050602  112046                2$:   MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
9924  050604  001005                      BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
9925  050606  005726                      TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
9926  050610  012600                60$:  MOV     (SP)+,R0        ;;RESTORE R0
9927  050612  062716  000002        3$:   ADD     #2,(SP)         ;;ADJUST RETURN PC
9930  050616  000002                      RTI                     ;;RETURN
9931  050620  122716  000011        4$:   CMPB    #HT,(SP)        ;;BRANCH IF <HT>
9932  050624  001430                      BEQ     8$
9933  050626  122716  000200              CMPB    #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
9934  050632  001006                      BNE     5$
9935  050634  005726                      TST     (SP)+           ;;POP  <CR><LF> EQUIV
9936  050636  104401                      TYPE                    ;;TYPE A CR AND LF
9937  050640  001335                      $CRLF
9940  050642  105067  000136              CLRB    $CHARCNT        ;;CLEAR CHARACTER COUNT
9941  050646  000755                      BR      2$              ;;GET NEXT CHARACTER
9942  050650  004767  000056        5$:   JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
9943  050654  126726  130400        6$:   CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
9944  050660  001350                      BNE     2$              ;;IF NO GO GET NEXT CHAR.
9945  050662  016746  130370              MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
                                                                  ;;AND THE NULL CHAR.
9946  050666  105366  000001        7$:   DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
9947  050672  002770                      BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
9950  050674  004767  000032              JSR     PC,$TYPEC       ;;GO TYPE A NULL
9951  050700  105367  000100              DECB    $CHARCNT        ;;DO NOT COUNT AS A COUNT
9952  050704  000770                      BR      7$              ;;LOOP
9953
9954                                      ;HORIZONTAL TAB PROCESSOR
9955
9956  050706  112716  000040        8$:   MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
9957  050712  004767  000014        9$:   JSR     PC,$TYPEC       ;;TYPE A SPACE
9960  050716  132767  000007  000060      BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
9961  050724  001372                      BNE     9$              ;;TAB STOP
9962  050726  005726                      TST     (SP)+           ;;POP SPACE OFF STACK
9963  050730  000724                      BR      2$              ;;GET NEXT CHARACTER
9964  050732  005737  001530        $TYPEC: TST     @#NOTYPE        ;;INHIBIT TYPING?
9965  050736  100423                      BMI     $TYPEX          ;;BRANCH IF YES
9966  050740  105777  130306              TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
9967  050744  100372                      BPL     $TYPEC
9970  050746  116677  000002  130300      MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.
9971  050754  122766  000015  000002      CMPB    #CR,2(SP)       ;;IS CHARACTER A CARRIAGE RETURN?
9972  050762  001003                      BNE     1$              ;;BRANCH IF NO
9973  050764  105067  000014              CLRB    $CHARCNT        ;;YES--CLEAR CHARACTER COUNT
9974  050770  000406                      BR      $TYPEX          ;;EXIT
9975  050772  122766  000012  000002  1$: CMPB    #LF,2(SP)       ;;IS CHARACTER A LINE FEED?
9976  051000  001402                      BEQ     $TYPEX          ;;BRANCH IF YES
9977  051002  105227                      INCB    (PC)+           ;;COUNT THE CHARACTER
10000 051004  000000        $CHARCNT:.WORD  0                     ;;CHARACTER COUNT STORAGE
10001 051006  000207        $TYPEX: RTS     PC
10002
10003                                     ;;**********************************************************************
10004                                     .SBTTL  ROUTINE TO TYPE THE ELAPSED RUN TIME OF THE PROGRAM
10005                                     ;*      THIS ROUTINE CONVERTS THE CONTENTS OF LOCATIONS "LTICK
10006                                     ;*      AND "MTICKS" TO SECONDS AND MINUTES/HOURS RESPECTIVELY
```

```
 9976                                          ;*      AND TYPES THEM IN THE FOLLOWING FORMAT:
 9977                                          ;*              HHH:MM:SS
 9978                                          ;;*****************************************************************
 9979  051010  104406                         TYPTIME:SAVREG
 9980  051012  004737  054516                         JSR     PC,@#LDKT       ;GO BACK TO LOW CORE
 9981  051016  113701  001645                         MOVB    @#LTICKS+1,R1   ;GET SECOND COUNT
 9982  051022  005000                                 CLR     R0
 9983  051024  071027  000012                         DIV     #10.,R0
 9984  051030  062701  000060                         ADD     #60,R1
 9985  051034  110137  051246                         MOVB    R1,@#TIMEBUF+10
 9986  051040  010001                                 MOV     R0,R1
 9987  051042  005000                                 CLR     R0
 9988  051044  071027  000006                         DIV     #6,R0
 9989  051050  062701  000060                         ADD     #60,R1
 9990  051054  110137  051245                         MOVB    R1,@#TIMEBUF+7
 9991  051060  013701  001642                         MOV     @#HTICKS,R1     ;GET MINUTE COUNT
 9992  051064  005000                                 CLR     R0
 9993  051066  071027  000012                         DIV     #10.,R0         ;GET HOURS AND MINUTES
 9994  051072  062701  000060                         ADD     #60,R1          ;MAKE REMAINDER ASCII
 9995  051076  110167  000141                         MOVB    R1,TIMEBUF+5    ;PUT IN BUFFER
 9996  051102  010001                                 MOV     R0,R1
 9997  051104  005000                                 CLR     R0
 9998  051106  071027  000006                         DIV     #6.,R0
 9999  051112  062701  000060                         ADD     #60,R1
10000  051116  110167  000120                         MOVB    R1,TIMEBUF+4
10001  051122  005700                                 TST     R0
10002  051124  001434                                 BEQ     2$
10003  051126  010001                                 MOV     R0,R1
10004  051130  005000                                 CLR     R0
10005  051132  071027  000012                         DIV     #10.,R0
10006  051136  062701  000060                         ADD     #60,R1
10007  051142  110167  000072                         MOVB    R1,TIMEBUF+2
10008  051146  005700                                 TST     R0
10009  051150  001422                                 BEQ     2$
10010  051152  010001                                 MOV     R0,R1
10011  051154  005000                                 CLR     R0
10012  051156  071027  000010                         DIV     #10,R0
10013  051162  062701  000060                         ADD     #60,R1
10014  051166  110167  000045                         MOVB    R1,TIMEBUF+1
10015  051172  005700                                 TST     R0
10016  051174  001410                                 BEQ     2$
10017  051176  010001                                 MOV     R0,R1
10018  051200  005000                                 CLR     R0
10019  051202  071027  000012                         DIV     #10.,R0
10020  051206  062701  000060                         ADD     #60,R1
10021  051212  110167  000020                         MOVB    R1,TIMEBUF
10022  051216  104401  051236               2$:       TYPE    ,TIMEBUF
10023  051222  104401  001335                         TYPE    ,$CRLF
10024  051226  004737  054604                         JSR     PC,@#RESKT      ;GO BACK TO ORIGINAL MEMORY
10025  051232  104407                                 RESREG
10026  051234  000207                                 RTS     PC
10027  051236     001     001     001  TIMEBUF:.BYTE   1,1,1,72,1,1,72,60,60,0
10028  051241     072     001     001
10029  051244     072     060     060
10030  051247     000
10031                                                  .EVEN
```

```
10032                                   ;;*****************************************************************
10033                                   .SBTTL  ROUTINE TO TYPE THE AVAILABLE DEVICES AND UNIT NUMBERS
10034                                   ;*      THIS ROUTINE SEARCHES THE SYSTEM SIZE TABLE FOR NON-
10035                                   ;*      ZERO ENTRIES.WHEN IT FINDS ONE, IT TYPES THE NAME OF THE
10036                                   ;*      DEVICE AND THE UNIT NUMBERS THAT WERE FOUND TO BE
10037                                   ;*      AVAILABLE FOR THAT DEVICE.
10038                                   ;;*****************************************************************
10039  051250  104401  057740  TYPSIZ: TYPE    ,SWITCH
10040  051254  104401  056401         TYPE    ,MSG2S
10041  051260  013746  001532         MOV     @#OPT.CP,-(SP)  ;PUT CONTENTS OF OPT.CP ON STACK
10042  051264  104402                 TYPOC                   ;TYPE OPT.CP
10043  051266  104401  001335         TYPE    ,$CRLF
10044  051272  104401  055366         TYPE    ,MSG4
10045  051276  012700  000010         MOV     #10,R0          ;SET SOB COUNT
10046  051302  005001                 CLR     R1
10047  051304  105761  001646  1$:    TSTB    SYSSIZE(R1)     ;DEVICE AVAILABLE?
10048  051310  001004                 BNE     2$              ;BRANCH IF YES
10049  051312  062701  000002  7$:    ADD     #2,R1           ;INCREMENT INDEX
10050  051316  077006                 SOB     R0,1$           ;CONTINUE
10051  051320  000207                 RTS     PC              ;RETURN
10052  051322  010102  2$:    MOV     R1,R2           ;GET INDEX
10053  051324  062702  055236         ADD     #MSGINX,R2      ;GET ADR OF MESSAGE ADR
10054  051330  011267  000002         MOV     (R2),3$         ;GET ADDRESS OF MESSAGE
10055  051334  104401                 TYPE
10056  051336  000000  3$:    .WORD
10057  051340  112767  000060  000034 MOVB    #60,4$          ;INIT UNIT NO. BUFFER (ASCII)
10058  051346  116102  001646         MOVB    SYSSIZE(R1),R2  ;GET WORD WITH AVAILABLE UNITS
10059  051352  012703  000010         MOV     #10,R3          ;SET SOB COUNT
10060  051356  006002  6$:    ROR     R2              ;GET UNITS
10061  051360  103002                 BCC     5$              ;BRANCH IF NOT A UNIT
10062  051362  104401  051402         TYPE    ,4$
10063  051366  005267  000010  5$:    INC     4$
10064  051372  077307                 SOB     R3,6$           ;CONTINUE
10065  051374  104401  001335         TYPE    ,$CRLF
10066  051400  000744                 BR      7$
10067  051402     000     054     040  4$:    .BYTE   0,54,40,0       ;NUMBER,COMMA,SPACE,TERMINATOR
10068  051405     000
10069                                   .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE
10070
10071                                   ;;*****************************************************************
10072                                   ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
10073                                   ;*OCTAL (ASCII) NUMBER AND TYPE IT.
10074                                   ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
10075                                   ;*CALL:
10076                                   ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
10077                                   ;*      TYPOS                   ;;CALL FOR TYPEOUT
10078                                   ;*      .BYTE   N               ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
10079                                   ;*      .BYTE   M               ;;M=1 OR 0
10080                                   ;*                                      ;;1=TYPE LEADING ZEROS
10081                                   ;*                                      ;;0=SUPPRESS LEADING ZEROS
10082                                   ;*
10083                                   ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
10084                                   ;*$TYPOS OR $TYPOC
10085                                   ;*CALL:
10086                                   ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
10087                                   ;*      TYPON                   ;;CALL FOR TYPEOUT
```

```
10088                                   ;*
10089                                   ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
10090                                   ;*CALL:
10091                                   ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
10092                                   ;*      TYPOC                   ;;CALL FOR TYPEOUT
10093
10094  051406  017646  000000          $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
10095  051412  116667  000001  000211          MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
10096  051420  112667  000207                  MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
10097  051424  062716  000002                  ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
10098  051430  000406                          BR      $TYPON
10099  051432  112767  000001  000171 $TYPOC: MOVB    #1,$OFILL       ;;SET THE ZERO FILL SWITCH
10100  051440  112767  000006  000165          MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
10101  051446  112767  000005  000154 $TYPON: MOVB    #5,$OCNT        ;;SET THE ITERATION COUNT
10102  051454  010346                          MOV     R3,-(SP)        ;;SAVE R3
10103  051456  010446                          MOV     R4,-(SP)        ;;SAVE R4
10104  051460  010546                          MOV     R5,-(SP)        ;;SAVE R5
10105  051462  116704  000145                  MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
10106  051466  005404                          NEG     R4
10107  051470  062704  000006                  ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
10108  051474  110467  000132                  MOVB    R4,$OMODE       ;;SAVE IT FOR USE
10109  051500  116704  000125                  MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
10110  051504  016605  000012                  MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
10111  051510  005003                          CLR     R3              ;;CLEAR THE OUTPUT WORD
10112  051512  006105                  1$:     ROL     R5              ;;ROTATE MSB INTO "C"
10113  051514  000404                          BR      3$              ;;GO DO MSB
10114  051516  006105                  2$:     ROL     R5              ;;FORM THIS DIGIT
10115  051520  006105                          ROL     R5
10116  051522  006105                          ROL     R5
10117  051524  010503                          MOV     R5,R3
10118  051526  006103                  3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
10119  051530  105367  000076                  DECB    $OMODE          ;;TYPE THIS DIGIT?
10120  051534  100016                          BPL     7$              ;;BR IF NO
10121  051536  042703  177770                  BIC     #177770,R3      ;;GET RID OF JUNK
10122  051542  001002                          BNE     4$              ;;TEST FOR 0
10123  051544  005704                          TST     R4              ;;SUPPRESS THIS 0?
10124  051546  001403                          BEQ     5$              ;;BR IF YES
10125  051550  005204                  4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
10126  051552  052703  000060                  BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
10127  051556  052703  000040          5$:     BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
10128  051562  110367  000040                  MOVB    R3,8$           ;;SAVE FOR TYPING
10129  051566  104401  051626                  TYPE    ,8$             ;;GO TYPE THIS DIGIT
10130  051572  105367  000032          7$:     DECB    $OCNT           ;;COUNT BY 1
10131  051576  003347                          BGT     2$              ;;BR IF MORE TO DO
10132  051600  002402                          BLT     6$              ;;BR IF DONE
10133  051602  005204                          INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
10134  051604  000744                          BR      2$              ;;GO DO THE LAST DIGIT
10135  051606  012605                  6$:     MOV     (SP)+,R5        ;;RESTORE R5
10136  051610  012604                          MOV     (SP)+,R4        ;;RESTORE R4
10137  051612  012603                          MOV     (SP)+,R3        ;;RESTORE R3
10138  051614  016666  000002  000004          MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
10139  051622  012616                          MOV     (SP)+,(SP)
10140  051624  000002                          RTI                     ;;RETURN
10141  051626     000          8$:     .BYTE   0               ;;STORAGE FOR ASCII DIGIT
10142  051627     000                  .BYTE   0               ;;TERMINATOR FOR TYPE ROUTINE
10143  051630     000          $OCNT:  .BYTE   0               ;;OCTAL DIGIT COUNTER
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10144  051631  000                     $OFILL: .BYTE   0               ;;ZERO FILL SWITCH
10145  051632  000000                  $OMODE: .WORD   0               ;;NUMBER OF DIGITS TO TYPE
10146                                  .SBTTL  CONVERT BINARY TO DECIMAL AND TYPE ROUTINE
10147
10148                                  ;;**************************************************************
10149                                  ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 5-DIGIT
10150                                  ;*SIGNED DECIMAL (ASCII) NUMBER AND TYPE IT. DEPENDING ON WHETHER THE
10151                                  ;*NUMBER IS POSITIVE OR NEGATIVE A SPACE OR A MINUS SIGN WILL BE TYPED
10152                                  ;*BEFORE THE FIRST DIGIT OF THE NUMBER. LEADING ZEROS WILL ALWAYS BE
10153                                  ;*REPLACED WITH SPACES.
10154                                  ;*CALL:
10155                                  ;*      MOV     NUM,-(SP)       ;;PUT THE BINARY NUMBER ON THE STACK
10156                                  ;*      TYPDS                   ;;GO TO THE ROUTINE
10157
10158  051634                          $TYPDS:
10159  051634  010046                         MOV     R0,-(SP)        ;;PUSH R0 ON STACK
10160  051636  010146                         MOV     R1,-(SP)        ;;PUSH R1 ON STACK
10161  051640  010246                         MOV     R2,-(SP)        ;;PUSH R2 ON STACK
10162  051642  010346                         MOV     R3,-(SP)        ;;PUSH R3 ON STACK
10163  051644  010546                         MOV     R5,-(SP)        ;;PUSH R5 ON STACK
10164  051646  012746  020200                 MOV     #20200,-(SP)    ;;SET BLANK SWITCH AND SIGN
10165  051652  016605  000020                 MOV     20(SP),R5       ;;GET THE INPUT NUMBER
10166  051656  100004                         BPL     1$              ;;BR IF INPUT IS POS.
10167  051660  005405                         NEG     R5              ;;MAKE THE BINARY NUMBER POS.
10168  051662  112766  000055  000001         MOVB    #'-,1(SP)       ;;MAKE THE ASCII NUMBER NEG.
10169  051670  005000                  1$:    CLR     R0              ;;ZERO THE CONSTANTS INDEX
10170  051672  012703  052050                 MOV     #$DBLK,R3       ;;SETUP THE OUTPUT POINTER
10171  051676  112723  000040                 MOVB    #' ,(R3)+       ;;SET THE FIRST CHARACTER TO A BLANK
10172  051702  005002                  2$:    CLR     R2              ;;CLEAR THE BCD NUMBER
10173  051704  016001  052040                 MOV     $DTBL(R0),R1    ;;GET THE CONSTANT
10174  051710  160105                  3$:    SUB     R1,R5           ;;FORM THIS BCD DIGIT
10175  051712  002402                         BLT     4$              ;;BR IF DONE
10176  051714  005202                         INC     R2              ;;INCREASE THE BCD DIGIT BY 1
10177  051716  000774                         BR      3$
10178  051720  060105                  4$:    ADD     R1,R5           ;;ADD BACK THE CONSTANT
10179  051722  005702                         TST     R2              ;;CHECK IF BCD DIGIT=0
10180  051724  001002                         BNE     5$              ;;FALL THROUGH IF 0
10181  051726  105716                         TSTB    (SP)            ;;STILL DOING LEADING 0'S?
10182  051730  100407                         BMI     7$              ;;BR IF YES
10183  051732  106316                  5$:    ASLB    (SP)            ;;MSD?
10184  051734  103003                         BCC     6$              ;;BR IF NO
10185  051736  116663  000001  177777         MOVB    1(SP),-1(R3)    ;;YES--SET THE SIGN
10186  051744  052702  000060          6$:    BIS     #'0,R2          ;;MAKE THE BCD DIGIT ASCII
10187  051750  052702  000040          7$:    BIS     #' ,R2          ;;MAKE IT A SPACE IF NOT ALREADY A DIGIT
10188  051754  110223                         MOVB    R2,(R3)+        ;;PUT THIS CHARACTER IN THE OUTPUT BUFFER
10189  051756  005720                         TST     (R0)+           ;;JUST INCREMENTING
10190  051760  020027  000010                 CMP     R0,#10          ;;CHECK THE TABLE INDEX
10191  051764  002746                         BLT     2$              ;;GO DO THE NEXT DIGIT
10192  051766  003002                         BGT     8$              ;;GO TO EXIT
10193  051770  010502                         MOV     R5,R2           ;;GET THE LSD
10194  051772  000764                         BR      6$              ;;GO CHANGE TO ASCII
10195  051774  105726                  8$:    TSTB    (SP)+           ;;WAS THE LSD THE FIRST NON-ZERO?
10196  051776  100003                         BPL     9$              ;;BR IF NO
10197  052000  116663  177777  177776         MOVB    -1(SP),-2(R3)   ;;YES--SET THE SIGN FOR TYPING
10198  052006  105013                  9$:    CLRB    (R3)            ;;SET THE TERMINATOR
10199  052010  012605                         MOV     (SP)+,R5        ;;POP STACK INTO R5
```

```
10200  052012  012603                        MOV     (SP)+,R3        ;;POP STACK INTO R3
10201  052014  012602                        MOV     (SP)+,R2        ;;POP STACK INTO R2
10202  052016  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
10203  052020  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
10204  052022  104401  052050                TYPE    $DBLK           ;;NOW TYPE THE NUMBER
10205  052026  016666  000002  000004        MOV     2(SP),4(SP)     ;;ADJUST THE STACK
10206  052034  012616                        MOV     (SP)+,(SP)
10207  052036  000002                        RTI                     ;;RETURN TO USER
10208  052040  023420                $DTBL:  10000.
10209  052042  001750                        1000.
10210  052044  000144                        100.
10211  052046  000012                        10.
10212  052050  000004                $DBLK:  .BLKW   4
10213                                 .SBTTL  DOUBLE LENGTH BINARY TO OCTAL ASCII CONVERT ROUTINE
10214
10215                                 ;;**********************************************************************
10216                                 ;*THIS ROUTINE WILL CONVERT A 32-BIT UNSIGNED BINARY NUMBER TO AN
10217                                 ;*UNSIGNED OCTAL ASCIZ NUMBER.
10218                                 ;*CALL
10219                                 ;*      MOV     #PNTR,-(SP)     ;;POINTER TO LOW WORD OF BINARY NUMBER
10220                                 ;*      JSR     PC,@#$DB2O      ;;CALL THE ROUTINE
10221                                 ;*      RETURN                  ;;THE ADDRESS OF THE FIRST ASCIZ CHAR. IS ON THE STACK
10222
10223
10224  052060  104406                $DB2O:  SAVREG                  ;;SAVE ALL REGISTERS
10225  052062  016601  000002                MOV     2(SP),R1        ;;PICKUP THE POINTER TO LOW WORD
10226  052066  012705  052215                MOV     #$OCTVL+13.,R5  ;;POINTER TO DATA TABLE
10227  052072  012704  000014                MOV     #12.,R4         ;;DO ELEVEN CHARACTERS
10228  052076  012703  177770                MOV     #^C7,R3         ;;MASK
10229  052102  012100                        MOV     (R1)+,R0        ;;LOWER WORD
10230  052104  012101                        MOV     (R1)+,R1        ;;HIGH WORD
10231  052106  005002                        CLR     R2              ;;TERMINATOR
10232  052110  110245                1$:     MOVB    R2,-(R5)        ;;PUT CHARACTER IN DATA TABLE
10233  052112  010002                        MOV     R0,R2           ;;GET THIS DIGIT
10234  052114  005304                        DEC     R4              ;;COUNT THIS CHARACTER
10235  052116  003016                        BGT     3$              ;;BR IF NOT THE LAST DIGIT
10236  052120  001414                        BEQ     2$              ;;BR IF IT IS THE LAST DIGIT
10237  052122  005205                        INC     R5              ;;ALL DIGITS DONE-ADJUST POINTER FOR FIRST
10238  052124  010566  000002                MOV     R5,2(SP)        ;;ASCIZ CHAR. & PUT IT ON THE STACK
10239  052130  122765  000061  000003        CMPB    #61,3(R5)       ;;LAST NUMBER LEGAL?
10240  052136  002003                        BGE     4$              ;;BRANCH IF YES
10241  052140  112765  000060  000003        MOVB    #60,3(R5)       ;;MAKE IT A ZERO
10242  052146  104407                4$:     RESREG                  ;;RESTORE ALL REGISTERS
10243  052150  000207                        RTS     PC              ;;RETURN TO USER
10244  052152  006203                2$:     ASR     R3              ;;POSITION THE MASK FOR THE LAST DIGIT
10245  052154  006001                3$:     ROR     R1              ;;POSITION THE BINARY NUMBER FOR
10246  052156  006000                        ROR     R0              ;;      THE NEXT OCTAL DIGIT
10247  052160  006001                        ROR     R1
10248  052162  006000                        ROR     R0
10249  052164  006001                        ROR     R1
10250  052166  006000                        ROR     R0
10251  052170  040302                        BIC     R3,R2           ;;MASK OUT ALL JUNK
10252  052172  062702  000060                ADD     #'0,R2          ;;MAKE THIS CHAR. ASCII
10253  052176  000744                        BR      1$              ;;GO PUT IT IN THE DATA TABLE
10254  052200  000016                $OCTVL: .BLKB   14.             ;;RESERVE DATA TABLE
10255                                 .SBTTL  SAVE AND RESTORE R0-R5 ROUTINES
```

```
10256
10257                                   ;;*****************************************************************
10258                                   ;*SAVE R0-R5
10259                                   ;*CALL:
10260                                   ;*      SAVREG
10261                                   ;*UPON RETURN FROM $SAVREG THE STACK WILL LOOK LIKE:
10262                                   ;*
10263                                   ;*TOP---(+16)
10264                                   ;* +2---(+18)
10265                                   ;* +4---R5
10266                                   ;* +6---R4
10267                                   ;* +8---R3
10268                                   ;*+10---R2
10269                                   ;*+12---R1
10270                                   ;*+14---R0
10271
10272  052216                           $SAVREG:
10273  052216  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
10274  052220  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
10275  052222  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
10276  052224  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
10277  052226  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
10278  052230  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
10279  052232  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PS OF MAIN FLOW
10280  052236  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PC OF MAIN FLOW
10281  052242  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PS OF CALL
10282  052246  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PC OF CALL
10283  052252  000002                          RTI
10284
10285                                   ;*RESTORE R0-R5
10286                                   ;*CALL:
10287                                   ;*      RESREG
10288  052254                           $RESREG:
10289  052254  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PC OF CALL
10290  052260  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PS OF CALL
10291  052264  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PC OF MAIN FLOW
10292  052270  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PS OF MAIN FLOW
10293  052274  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
10294  052276  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
10295  052300  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
10296  052302  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
10297  052304  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
10298  052306  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
10299  052310  000002                          RTI
10300                                   ;;*****************************************************************
10301                                   .SBTTL  CONVERT FLOATING BINARY TO OCTAL ASCIZ
10302                                   ;*
10303                                   ;*THIS ROUTINE CONVERTS A 32 BIT FLOATING NUMBER TO AN OCTAL
10304                                   ;*ASCIZ STRING IN THE FOLLOWING FORMAT:
10305                                   ;*
10306                                   ;*              W  XXX  YYY ZZZZZZ
10307                                   ;*
10308                                   ;*      WHERE   W = SIGN BIT
10309                                   ;*              X = 8-BIT EXPONENT (RIGHT JUSTIFIED)
10310                                   ;*              Y = FRACTION BITS <57:51> (RIGHT JUSTIFIED)
10311                                   ;*              Z = FRACTION BITS <50:35>
```

```
10312                                   ;*
10313                                   ;*IT IS ENTERED BY A TRAP CALL WITH THE ADDRESS OF THE FLOATING
10314                                   ;*NUMBER IN THE WORD FOLLOWING THE CALL.
10315                                   ;*IT RETURNS WITH THE ADDRESS OF THE ASCIZ STRING ON THE STACK.
10316                                   ;**************************************************************
10317  052312  104406                  $FL20:  SAVREG
10318  052314  017600  000000                  MOV     @(SP),R0        ;GET ADDRESS OF DATA
10319  052320  062716  000002                  ADD     #2,(SP)         ;ADJUST RETURN PC
10320  052324  016001  000002                  MOV     2(R0),R1        ;PUT SECOND DATA WORD IN R1
10321  052330  011000                          MOV     (R0),R0         ;PUT FIRST DATA WORD IN R0
10322  052332  012704  001365                  MOV     #$FLBUFF+23,R4  ;GET ADDRESS OF BUFFER END IN R4
10323  052336  112744  000000                  MOVB    #0,-(R4)        ;PUT TERMINATOR IN BUFFER
10324  052342  012705  000005                  MOV     #5,R5           ;SET SOB COUNT FOR FRACTION DIGITS
10325  052346  010103                  1$:     MOV     R1,R3           ;GET LSB'S OF FRACTION
10326  052350  042703  177770                  BIC     #^C7,R3         ;SAVE LS 3 BITS
10327  052354  062703  000060                  ADD     #60,R3          ;MAKE THEM ASCII
10328  052360  110344                          MOVB    R3,-(R4)        ;STORE IN BUFFER
10329  052362  073027  177775                  ASHC    #-3,R0          ;SHIFT NUMBER TO NEXT 3 BITS
10330  052366  077511                          SOB     R5,1$           ;CONTINUE FOR 7 DIGITS
10331  052370  010103                          MOV     R1,R3           ;GET NEXT DIGITS
10332  052372  042703  177776                  BIC     #^C1,R3         ;ONLY WANT 1 BIT
10333  052376  062703  000060                  ADD     #60,R3          ;MAKE THEM ASCII
10334  052402  110344                          MOVB    R3,-(R4)        ;STORE IN BUFFER
10335  052404  112744  000040                  MOVB    #40,-(R4)       ;PUT SPACE IN BUFFER
10336  052410  073027  177777                  ASHC    #-1,R0
10337  052414  012705  000002                  MOV     #2,R5           ;SET SOB COUNT
10338  052420  010103                  3$:     MOV     R1,R3           ;GET LOW WORD
10339  052422  042703  177770                  BIC     #^C7,R3         ;MASK 3 BITS
10340  052426  062703  000060                  ADD     #60,R3          ;MAKE THEM ASCII
10341  052432  110344                          MOVB    R3,-(R4)        ;PUT IN BUFFER
10342  052434  073027  177775                  ASHC    #-3,R0          ;GET NEXT 3 BITS
10343  052440  077511                          SOB     R5,3$           ;CONVERT THEM
10344  052442  010103                          MOV     R1,R3           ;
10345  052444  042703  177776                  BIC     #^C1,R3         ;ONLY WANT 1 BIT
10346  052450  062703  000060                  ADD     #60,R3          ;MAKE IT ASCII
10347  052454  110344                          MOVB    R3,-(R4)        ;PUT IN BUFFER
10348  052456  112744  000040                  MOVB    #40,-(R4)       ;PUT SPACE IN BUFFER
10349  052462  112744  000040                  MOVB    #40,-(R4)
10350  052466  072127  177777                  ASH     #-1,R1          ;GET FIRST 3 BITS OF EXPONENT
10351  052472  012705  000002                  MOV     #2,R5           ;SET SOB COUNT FOR 2 DIGITS
10352  052476  010103                  2$:     MOV     R1,R3           ;GET LSB'S OF EXPONENT
10353  052500  042703  177770                  BIC     #^C7,R3         ;SAVE 3 BITS
10354  052504  062703  000060                  ADD     #60,R3          ;MAKE THEM ASCII
10355  052510  110344                          MOVB    R3,-(R4)        ;STORE IN BUFFER
10356  052512  072127  177775                  ASH     #-3,R3          ;GET NEXT 3 BITS
10357  052516  077511                          SOB     R5,2$           ;CONTINUE
10358  052520  010103                          MOV     R1,R3           ;GET LAST 2 BITS OF EXPONENT
10359  052522  042703  177774                  BIC     #^C3,R3         ;MAKE SURE ONLY 2 BITS
10360  052526  062703  000060                  ADD     #60,R3          ;MAKE THEM ASCII
10361  052532  110344                          MOVB    R3,-(R4)        ;STORE IN BUFFER
10362  052534  112744  000040                  MOVB    #40,-(R4)       ;PUT SPACE IN BUFFER
10363  052540  112744  000040                  MOVB    #40,-(R4)
10364  052544  042700  177776                  BIC     #^C1,R0         ;GET SIGN BIT (IT WAS EXTENDED)
10365  052550  062700  000060                  ADD     #60,R0          ;MAKE IT ASCII
10366  052554  110044                          MOVB    R0,-(R4)        ;PUT IT IN THE BUFFER
10367  052556  104407                          RESREG
```

```
10368  052560  011646                          MOV     (SP),-(SP)      ;SAVE RETURN PC
10369  052562  016666  000004  000002          MOV     4(SP),2(SP)     ;AND RETURN PSW
10370  052570  012766  001342  000004          MOV     #$FLBUFF,4(SP)  ;PUT BUFFER ADDRESS ON STACK
10371  052576  000006                          RTT                     ;RETURN
10372                                          .EVEN
10373                                  ;;*****************************************************************
10374                                  .SBTTL  CONVERT FLOATING DOUBLE BINARY TO OCTAL ASCIZ
10375                                  ;*
10376                                  ;*THIS ROUTINE CONVERTS A 64 BIT FLOATING NUMBER TO AN OCTAL
10377                                  ;*ASCIZ STRING IN THE FOLLOWING FORMAT:
10378                                  ;*
10379                                  ;*              U  VVV  WWW XXXXXX YYYYYY ZZZZZZ
10380                                  ;*
10381                                  ;*      WHERE   U = SIGN BIT
10382                                  ;*              V = 8-BIT EXPONENT (RIGHT JUSTIFIED)
10383                                  ;*              W = FRACTION BITS<57:51> (RIGHT JUSTIFIED)
10384                                  ;*              X = FRACTION BITS <50:35>
10385                                  ;*              Y = FRACTION BITS <34:19>
10386                                  ;*              Z = FRACTION BITS <18:03>
10387                                  ;*
10388                                  ;*IT IS ENTERED BY A TRAP CALL WITH THE ADDRESS OF THE FLOATING
10389                                  ;*NUMBER IN THE WORD FOLLOWING THE CALL.
10390                                  ;*IT RETURNS WITH THE ADDRESS OF THE ASCIZ STRING ON THE STACK.
10391                                  ;;*****************************************************************
10392  052600  104406                  $FLD20: SAVREG
10393  052602  017667  000000  000006          MOV     @(SP),1$        ;GET ADDRESS OF DATA TO CONVERT
10394  052610  062716  000002                  ADD     #2,(SP)         ;ADJUST RETURN PC
10395  052614  104410                          FL2O                    ;CONVERT MS 32 BITS
10396  052616  000000                  1$:     .WORD
10397  052620  012600                          MOV     (SP)+,R0        ;GET ADDRESS OF CONVERTED DATA
10398  052622  010067  126560                  MOV     R0,$BUFF        ;SAVE IT
10399  052626  062700  000041                  ADD     #41,R0          ;ADJUST TO END OF BUFFER
10400  052632  105040                          CLRB    -(R0)           ;PUT TERMINATOR IN BUFFER
10401  052634  016701  177756                  MOV     1$,R1           ;GET ADDRESS OF DATA TO CONVERT
10402  052640  062701  000004                  ADD     #4,R1           ;ADJUST TO LOWER 32 BITS
10403  052644  012102                          MOV     (R1)+,R2        ;SAVE THE DATA
10404  052646  012103                          MOV     (R1)+,R3
10405  052650  012701  000002                  MOV     #2,R1           ;SET LOOP COUNT
10406  052654  012704  000005          3$:     MOV     #5,R4           ;SET LOOP COUNT
10407  052660  010305                  4$:     MOV     R3,R5           ;GET LS 32 BITS OF DATA
10408  052662  042705  177770                  BIC     #^C7,R5         ;MASK 3 BITS
10409  052666  062705  000060                  ADD     #60,R5          ;MAKE THEM ASCII
10410  052672  110540                          MOVB    R5,-(R0)        ;PUT IN BUFFER
10411  052674  073227  177775                  ASHC    #-3,R2          ;GET NEXT 3 BITS
10412  052700  077411                          SOB     R4,4$           ;CONTINUE
10413  052702  010305                          MOV     R3,R5           ;GET LS 32 BITS
10414  052704  042705  177776                  BIC     #^C1,R5         ;ONLY WANT 1 BIT
10415  052710  062705  000060                  ADD     #60,R5          ;MAKE IT ASCII
10416  052714  110540                          MOVB    R5,-(R0)        ;PUT IN TABLE
10417  052716  112740  000040                  MOVB    #40,-(R0)       ;PUT SPACE IN TABLE
10418  052722  073227  177777                  ASHC    #-1,R2
10419  052726  077126                          SOB     R1,3$           ;CONVERT NEXT 16 BITS
10420  052730  104407                          RESREG
10421  052732  011646                          MOV     (SP),-(SP)      ;ADJUST STACK
10422  052734  016666  000004  000002          MOV     4(SP),2(SP)     ;TO RETURN WITH ADDRESS
10423  052742  016766  126440  000004          MOV     $BUFF,4(SP)     ;OF BUFFER ON STACK
```

```
10424  052750  000006                          RTT                     ;RETURN
10425
10426                                  ;;**********************************************************************
10427
10428                                  .SBTTL  RANDOM NUMBER GENERATOR ROUTINE
10429
10430                                  ;*THIS ROUTINE IS A DOUBLE PRECISION PSEUDO RANDOM NUMBER GENERATOR
10431                                  ;*WITH A RANGE OF 0 TO 2(+33)-1.
10432                                  ;*CALL:
10433                                  ;*      JSR     PC,$RAND        ;;CALL THE ROUTINE
10434                                  ;*      RETURN                  ;;RETURN HERE THE RANDOM
10435                                  ;*                              ;;NUMBER WILL BE IN
10436                                  ;*                              ;;$HINUM,$LONUM
10437
10438  052752                          $RAND:
10439  052752  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
10440  052754  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
10441  052756  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
10442  052760  016700  126600                  MOV     $LONUM,R0       ;;SET R0 WITH LOW
10443  052764  016701  126576                  MOV     $HINUM,R1       ;;SET R1 WITH HIGH
10444  052770  012702  177771                  MOV     #-7,R2          ;;SET SHIFT COUNT
10445  052774  006300                  1$:     ASL     R0              ;;SHIFT R0 LEFT AND
10446  052776  006101                          ROL     R1              ;;ROTATE CARRY INTO R1 AND
10447  053000  005202                          INC     R2              ;;CHECK FOR DONE
10448  053002  001374                          BNE     1$              ;;CONTINUE SHIFT LOOP
10449  053004  066700  126554                  ADD     $LONUM,R0       ;;ADD NUMBER TO MAKE X 129
10450  053010  005501                          ADC     R1              ;;PROPOGATE CARRY
10451  053012  066701  126550                  ADD     $HINUM,R1       ;;ADD NUMBER TO MAKE X 129
10452  053016  062700  001057                  ADD     #1057,R0        ;;ADD LOW CONSTANT
10453  053022  005501                          ADC     R1              ;;PROPOGATE CARRY
10454  053024  062701  047401                  ADD     #47401,R1       ;;ADD HIGH CONSTANT
10455  053030  010067  126530                  MOV     R0,$LONUM       ;;SAVE R0
10456  053034  010167  126526                  MOV     R1,$HINUM       ;;SAVE R1
10457  053040  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
10458  053042  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
10459  053044  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
10460  053046  000207                          RTS     PC              ;;RETURN
10461                                  ;;**********************************************************************
10462                                  .SBTTL  FLOATING POINT NUMBER GENERATOR
10463                                  ;*      THIS ROUTINE GENERATES TWO RANDOM FLOATING POINT NUMBERS
10464                                  ;*      IN EITHER SINGLE OR DOUBLE PRECISION. FOR SINGLE PRECISION
10465                                  ;*      THE NUMBERS ARE STORED IN FTMP0 AND FTMP2. DOUBLE PRECISION
10466                                  ;*      NUMBERS ARE STORED IN FTMP0 AND FTMP4.
10467                                  ;*      IN EITHER SINGLE OR DOUBLE THE EXTENDED EXPONENT IS STORED
10468                                  ;*      IN FREG0 AND FREG1.
10469                                  ;;**********************************************************************
10470  053050  012767  000002  000130  FLTDBL: MOV     #2,SOBDBL       ;SET LOOP FOR 2, FOUR WORD NUMBERS
10471  053056  016700  000124          FLTSGL: MOV     SOBDBL,R0       ;SET WORD LENGTH LOOP
10472  053062  012702  001424                  MOV     #FTMP0,R2       ;GET ADDRESS TO STORE WORDS IN
10473  053066  012701  000002          2$:     MOV     #2,R1           ;SET NUMBER OF WORDS TO 2
10474  053072  004767  177654          1$:     JSR     PC,$RAND        ;GET RANDOM NUMBER
10475  053076  022701  000002                  CMP     #2,R1           ;FIRST TIME?
10476  053102  001404                          BEQ     3$              ;BRANCH IF YES
10477  053104  022767  000002  000074          CMP     #2,SOBDBL       ;DOUBLE PRECISION?
10478  053112  001407                          BEQ     4$              ;BRANCH IF YES
10479  053114  016703  126446          3$:     MOV     $HINUM,R3       ;GET EXPONENT PART
```

```
10480  053120  042703  000177                BIC     #177,R3         ;CHECK FOR MINUS ZERO
10481  053124  022703  100000                CMP     #BIT15,R3
10482  053130  001760                        BEQ     1$              ;BRANCH IF MINUS ZERO
10483  053132  016722  126430          4$:   MOV     $HINUM,(R2)+    ;SAVE HINUM
10484  053136  016722  126422                MOV     $LONUM,(R2)+    ;SAVE LONUM
10485  053142  077125                        SOB     R1,1$           ;CONTINUE
10486  053144  077030                        SOB     R0,2$           ;CONTINUE FOR DOUBLE PREC
10487  053146  012746  001424                MOV     #FTMP0,-(SP)    ;PUT ADDRESS OF NUMBER ON STACK
10488  053152  012746  001002                MOV     #1002,-(SP)     ;PUT CONTROL WORD ON STACK
10489  053156  022767  000002  000022        CMP     #2,S0BDBL       ;DOUBLE PREC?
10490  053164  001002                        BNE     5$              ;BRANCH IF NO
10491  053166  012716  001004                MOV     #1004,(SP)      ;CHANGE CONTROL WORD
10492  053172  004767  000012          5$:   JSR     PC,EXPEXT       ;CALCULATE EXT EXPONENTS
10493  053176  012767  000001  000002        MOV     #1,S0BDBL       ;INIT S0BDBL FOR SINGLE PREC
10494  053204  000207                        RTS     PC              ;RETURN
10495  053206  000001                S0BDBL: .WORD   1
10496                                  ;;*****************************************************************
10497                                  .SBTTL  FLOATING POINT EXPONENT EXTENSION
10498                                  ;*      THIS ROUTINE CONVERTS THE ACTUAL EXPONENT OF A FLOATING POINT
10499                                  ;*      NUMBER INTO AN ACTUAL EXPONENT OF 200 AND AN EXTENDED
10500                                  ;*      EXPONENT EQUAL TO THE DIFFERANCE BETWEEN THE ORIGINAL
10501                                  ;*      ACTUAL EXPONENT AND 200.
10502                                  ;*
10503                                  ;*      THE ROUTINE IS ENTERED WITH A CONTROL WORD ON THE STACK.
10504                                  ;*      BIT 15 OF THE CONTROL WORD INDICATES WHETHER THE NUMBER
10505                                  ;*      IS IN MEMORY (<15>=0) OR IN AN ACCUMULATOR (<15>=1).
10506                                  ;*      IF THE NUMBER IS IN AN ACCUMULATOR, BITS <9:8> INDICATE
10507                                  ;*      THE ACCUMULATOR NUMBER. IF THE NUMBER(S) IS IN MEMORY,
10508                                  ;*      BITS <9:8> INDICATE THE NUMBER OF NUMBERS TO CONVERT AND
10509                                  ;*      BITS <2:0> INDICATE THE WORD LENGTH OF THE NUMBER(S).
10510                                  ;*      IN THE CASE OF A MEMORY CONVERSION, THE ADDRESS OF THE
10511                                  ;*      FIRST WORD TO CONVERT IS ALSO ON THE STACK (PRECEDING
10512                                  ;*      THE CONTROL WORD).
10513                                  ;;*****************************************************************
10514  053210  012605                EXPEXT: MOV     (SP)+,R5        ;SAVE RETURN PC
10515  053212  012600                        MOV     (SP)+,R0        ;GET CONTROL WORD
10516  053214  100437                        BMI     1$              ;BRANCH IF ACC CONVERSION
10517  053216  012601                        MOV     (SP)+,R1        ;GET START ADDRESS
10518  053220  162700  000400                SUB     #400,R0
10519  053224  012702  001424                MOV     #FTMP0,R2       ;GET OFFSET FROM FTMP0
10520  053230  160102                        SUB     R1,R2
10521  053232  005402                        NEG     R2
10522  053234  006202                        ASR     R2
10523  053236  062702  001444                ADD     #FREG0,R2       ;GEN ADDRESS OF EXT WORD
10524  053242  011103                3$:     MOV     (R1),R3         ;GET DATA
10525  053244  042703  100177                BIC     #100177,R3      ;GET EXPONENT
10526  053250  072327  177771                ASH     #-7,R3          ;RIGHT JUSTIFY EXPONENT
10527  053254  162703  000200                SUB     #200,R3         ;CONVERT TO 2'S COMPLIMENT
10528  053260  010312                        MOV     R3,(R2)         ;ADD TO EXTENDED EXPONENT
10529  053262  042711  077600                BIC     #77600,(R1)     ;MAKE ACTUAL
10530  053266  052711  040000                BIS     #BIT14,(R1)     ;EXPONENT 200
10531  053272  162700  000400                SUB     #400,R0         ;ANY MORE WORDS?
10532  053276  100435                        BMI     2$              ;BRANCH IF NO
10533  053300  110003                        MOVB    R0,R3           ;GET WORD LENGTH
10534  053302  006303                        ASL     R3
10535  053304  060301                        ADD     R3,R1           ;SELECT NEXT NUMBER ADDRESS
```

```
10536  053306  062702  000002            ADD     #2,R2           ;SELECT NEXT EXTENDED ADDRESS
10537  053312  000753                    BR      3$              ;CONTINUE
10538                                  ;ACCUMULATOR CONVERSION
10539  053314  072027  177776          1$:     ASH     #-2,R0          ;GET ACCUMULATOR NUMBER
10540  053320  042700  177477                  BIC     #177477,R0      ;
10541  053324  010002                          MOV     R0,R2           ;GENERATE
10542  053326  072227  177773                  ASH     #-5,R2          ;ADDRESS OF
10543  053332  062702  001410                  ADD     #$ACO,R2        ;EXTENDED EXPONENT
10544  053336  042767  000300  000004        BIC     #300,5$         ;GENERATE INSTRUCTION
10545  053344  050067  000000                BIS     R0,5$           ;TO GET EXPONENT
10546  053350  175003                  5$:     STEXP   AC0,R3          ;GET EXPONENT
10547  053352  060312                          ADD     R3,(R2)         ;ADD TO EXTENDED EXPONENT
10548  053354  005003                          CLR     R3
10549  053356  042767  000300  000004        BIC     #300,4$         ;GENERATE INSTRUCTION
10550  053364  050067  000000                BIS     R0,4$           ;TO LOAD EXPONENT BACK TO ACC
10551  053370  176403                  4$:     LDEXP   R3,AC0          ;LOAD EXPONENT OF 200
10552  053372  010546                  2$:     MOV     R5,-(SP)        ;RESTORE RETURN PC
10553  053374  000207                          RTS     PC              ;RETURN
10554                                  .SBTTL  POWER DOWN AND UP ROUTINES
10555
10556                                  ;;**********************************************************************
10557                                  ;POWER DOWN ROUTINE
10558  053376  012737  053550  000024  $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
10559  053404  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
10560  053412  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
10561  053414  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
10562  053416  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
10563  053420  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
10564  053422  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
10565  053424  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
10566  053426  017746  125610                  MOV     @SWR,-(SP)      ;;PUSH @SWR ON STACK
10567  053432  010667  000116                  MOV     SP,$SAVR6       ;;SAVE SP
10568  053436  012737  053450  000024          MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
10569  053444  000000                          HALT
10570  053446  000776                          BR      .-2             ;;HANG UP
10571
10572                                  ;;**********************************************************************
10573                                  ;POWER UP ROUTINE
10574  053450  012737  053550  000024  $PWRUP: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST DOWN
10575  053456  016706  000072                  MOV     $SAVR6,SP       ;;GET SP
10576  053462  005067  000066                  CLR     $SAVR6          ;;WAIT LOOP FOR THE TTY
10577  053466  005267  000062          1$:     INC     $SAVR6          ;;WAIT FOR THE INC
10578  053472  001375                          BNE     1$              ;;OF  WORD
10579  053474  011600                          MOV     (SP),R0         ;GET THE OLD SW. REG. VALUE
10580  053476  076600                          MED                     ;WRITE THE CONSOLE SW. REG.
10581  053500  000226                          WCNSSW                  ;  WITH ITS PREVIOUS VALUE
10582  053502  012677  125534                  MOV     (SP)+,@SWR      ;;POP STACK INTO @SWR
10583  053506  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
10584  053510  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
10585  053512  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
10586  053514  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
10587  053516  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
10588  053520  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
10589  053522  012737  053376  000024          MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
10590  053530  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
10591  053536  104401                          TYPE                    ;REPORT THE POWER FAILURE
```

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10592  053540  053556                  $PWRMG: .WORD   $POWER           ;;POWER FAIL MESSAGE POINTER
10593  053542  012716                          MOV     (PC)+,(SP)       ;;RESTART AT START
10594  053544  003276                  $PWRAD: .WORD   START            ;;RESTART ADDRESS
10595  053546  000002                          RTI
10596  053550  000000                  $ILLUP: HALT                     ;;THE POWER UP SEQUENCE WAS STARTED
10597  053552  000776                          BR      .-2              ;; BEFORE THE POWER DOWN WAS COMPLETE
10598  053554  000000                  $SAVR6: 0                        ;;PUT THE SP HERE
10599  053556  005015  047520  042527  $POWER: .ASCIZ  <15><12>"POWER"
10600  053564  000122
10601                                          .EVEN
10602                                  .SBTTL  TRAP DECODER
10603
10604                                  ;;**************************************************************
10605                                  ;*THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE "TRAP" INSTRUCTION
10606                                  ;*AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
10607                                  ;*OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL
10608                                  ;*GO TO THAT ROUTINE.
10609
10610  053566  010046                  $TRAP:  MOV     R0,-(SP)         ;;SAVE R0
10611  053570  016600  000002                  MOV     2(SP),R0         ;;GET TRAP ADDRESS
10612  053574  005740                          TST     -(R0)            ;;BACKUP BY 2
10613  053576  111000                          MOVB    (R0),R0          ;;GET RIGHT BYTE OF TRAP
10614  053600  006300                          ASL     R0               ;;POSITION FOR INDEXING
10615  053602  016000  053622                  MOV     $TRPAD(R0),R0    ;;INDEX TO TABLE
10616  053606  000200                          RTS     R0               ;;GO TO ROUTINE
10617
10618
10619                                  ;;THIS IS USE TO HANDLE THE "GETPRI" MACRO
10620
10621  053610  011646                  $TRAP2: MOV     (SP),-(SP)       ;;MOVE THE PC DOWN
10622  053612  016666  000004  000002          MOV     4(SP),2(SP)      ;;MOVE THE PSW DOWN
10623  053620  000002                          RTI                      ;;RESTORE THE PSW
10624
10625                                  .SBTTL  TRAP TABLE
10626
10627                                  ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
10628                                  ;*BY THE "TRAP" INSTRUCTION.
10629
10630                                  ;       ROUTINE
10631                                  ;       -------
10632  053622  053610                  $TRPAD: .WORD   $TRAP2
10633  053624  050562                          $TYPE   ;;CALL=TYPE     TRAP+1(104401)  TTY TYPEOUT ROUTINE
10634  053626  051432                          $TYPOC  ;;CALL=TYPOC    TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
10635  053630  051406                          $TYPOS  ;;CALL=TYPOS    TRAP+3(104403)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
10636  053632  051446                          $TYPON  ;;CALL=TYPON    TRAP+4(104404)  TYPE OCTAL NUMBER (AS PER LAST CALL)
10637  053634  051634                          $TYPDS  ;;CALL=TYPDS    TRAP+5(104405)  TYPE DECIMAL NUMBER (WITH SIGN)
10638
10639
10640  053636  052216                          $SAVREG ;;CALL=SAVREG   TRAP+6(104406)  SAVE R0-R5 ROUTINE
10641  053640  052254                          $RESREG ;;CALL=RESREG   TRAP+7(104407)  RESTORE R0-R5 ROUTINE
10642  053642  052312                          $FL20   ;;CALL=FL20     TRAP+10(104410)
10643  053644  052600                          $FLD20  ;;CALL=FLD20    TRAP+11(104411)
10644                                  ;;**************************************************************
10645                                  .SBTTL  UNIBUS EXERCISER INITIALIZATION ROUTINE
10646                                  ;*THIS ROUTINE INITIALIZES THE BASE ADDRESS FOR THE
10647                                  ;*UNIBUS EXERCISER AND LOADS UP THE EXERCISER REGISTERS.
```

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10648                                   ;;*****************************************************************
10649  053646  012703  001716           UBEINIT:MOV     #UBESAV,R3      ;GET ADDRESS OF NEXT UBE AORES
10650  053652  005023                           CLR     (R3)+           ;INITIALIZE
10651  053654  005023                           CLR     (R3)+
10652  053656  005023                           CLR     (R3)+
10653  053660  005013                           CLR     (R3)
10654
10655
10656                                   ;SET UP THE UBE AND START IT
10657  053662  012702  002304                   MOV     #UBETBL,R2      ;GET ADDRESS OF UBE TABLE
10658  053666  005072  000010                   CLR     @10(R2)         ;CLEAR ALL ERRORS
10659  053672  012772  045730  000012         MOV     #UBESRV,@12(R2) ;SET UP UBE VECTOR
10660  053700  012772  000340  000014         MOV     #PR7,@14(R2)    ;SET UP UBE VECTOR PSW
10661  053706  012732  170000                   MOV     #170000,@(R2)+  ;SET CC FOR 2K WORD TRANSFER
10662                                                                  ;UBE IS DOING BYTE TRANSFERS
10663  053712  013732  001722                   MOV     @#UBEADR,@(R2)+ ;LOAD UBE BUS ADDRESS
10664  053716  013732  001724                   MOV     @#UBEADR+2,@(R2)+;LOAD ADR BITS 16 & 17
10665  053722  000207                           RTS     PC              ;RETURN
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10666
10667
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10671
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10677
10678
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10682
10683                                ;;*****************************************************************
                                    ;SBTTL  CONVERT A VIRTUAL ADDRESS TO A PHYSICAL ADDRESS
                                    ;*      THIS ROUTINE CONVERTS A 16-BIT VIRTUAL ADDRESS TO A
                                    ;*      18-BIT PHYSICAL ADDRESS. THE VIRTUAL ADDRESS IS
                                    ;*      ASSUMED TO BE IN LOCATION "VADR" AND THE PHYSICAL
                                    ;*      ADDRESS IS PLACED IN LOCATIONS "PA1716" AND "PA1500".
                                    ;*
                                    ;*      IF MEMORY MANAGEMENT IS OFF THE PHYSICAL ADDRESS IS
                                    ;*      GENERATED BY SUBTRACTING THE CONTENTS OF LOCATION
                                    ;*      "SFACTOR" FROM THE VIRTUAL ADDRESS. THIS LOCATION
                                    ;*      CONTAINS THE BYTE OFFSET BETWEEN THE RELOCATED CODE
                                    ;*      AND THE NON-RELOCATED CODE.
                                    ;*
                                    ;*      IF MEMORY MANAGEMENT IS ON, THE CONTENTS OF THE
                                    ;*      APPROPRIATE PAR REGISTER IS ADDED(AFTER ADJUSTMENT)
                                    ;*      TO THE LEAST SIGNIFICANT 13 BITS OF THE VIRTUAL ADDRESS.
                                    ;;*****************************************************************
10684  053724  104406              CNVADR: SAVREG
10685  053726  013703  001536              MOV     @#VADR,R3               ;GET VIRTUAL ADDRESS TO CONVERT
10686  053732  105737  001545              TSTB    @#MMON                  ;IS MEMORY MGMT ON?
10687  053736  001426                      BEQ     1$                      ;BRANCH IF NO
10688  053740  005002                      CLR     R2
10689  053742  073227  000003              ASHC    #3,R2                   ;GET PAR SELECT BITS
10690  053746  072327  177775              ASH     #-3,R3                  ;RETURN VIR ADDR TO ORIGINAL
10691  053752  042703  160000              BIC     #160000,R3              ;MAKE SURE SIGN DIDN'T EXTEND
10692  053756  006102                      ROL     R2                      ;MAKE R2 EVEN FOR WORD ADDRESSING
10693  053760  062702  172340              ADD     #KIPAR0,R2              ;GET ADDRESS OF PAR
10694  053764  011205                      MOV     (R2),R5                 ;GET PAR DATA
10695  053766  005004                      CLR     R4                      ;SETUP R4
10696  053770  073427  000006              ASHC    #6,R4                   ;SHIFT PAR DATA
10697  053774  060305                      ADD     R3,R5                   ;FORM PHYSICAL ADDRESS
10698  053776  005504                      ADC     R4
10699  054000  010437  001542      2$:     MOV     R4,@#PA1716             ;SAVE PHYSICAL
10700  054004  010537  001540              MOV     R5,@#PA1500             ;ADDRESS
10701  054010  104407                      RESREG
10702  054012  000207                      RTS     PC                      ;RETURN
10703  054014  163703  001550      1$:     SUB     @#FACTOR,R3             ;FORM PHYSICAL ADDRESS
10704  054020  005004                      CLR     R4
10705  054022  010305                      MOV     R3,R5
10706  054024  000765                      BR      2$                      ;RETURN
10707
10708                                   ;;*****************************************************************
10709                                   ;SBTTL  ROUTINE TO CHECK RELOCATED DATA
10710                                   ;*ROUTINE TO CHECK DATA RELOCATED
10711                                   ;*CALL: R0=     HIGHEST ADDRESS +2 OF SOURCE DATA
10712                                   ;*      R2=     HIGHEST ADDRESS +2 OF DEST DATA
10713                                   ;*      R5=     LOWEST ADDRESS OF THE SOURCE DATA
10714                                   ;*
10715                                   ;*      THIS ROUTINE USES A COMPARE INSTRUCTION TO CHECK
10716                                   ;*      THE DATA THAT WAS RELOCATED. IF A PARITY ERROR OCCURS
10717                                   ;*      DURING THIS CHECK A SPECIAL ERROR MESSAGE IS TYPED
10718                                   ;*      INSTED OF THE UNEXPECTED TRAP MESSAGE.
10719                                   ;;*****************************************************************
10720  054026  012737  054070  000114  CHKDAT: MOV     #2$,@#CACHVEC           ;SETUP PARITY VECTOR.
10721  054034  024042                      CMP     -(R0),-(R2)             ;CHECK DATA
```

```
10722  054036  001012                          BNE     99$
10723  054040  005112                          COM     (R2)                    ;COMPLEMENT DEST DATA
10724  054042  005112                          COM     (R2)                    ;TWICE
10725  054044  021210                          CMP     (R2),(R0)               ;CHECK DATA
10726  054046  001006                          BNE     99$
10727  054050  020005                  1$:     CMP     R0,R5                   ;BRANCH IF ALL DATA NOT CHECKED
10728  054052  001365                          BNE     CHKDAT
10729  054054  012737  054414  000114          MOV     #.PARSRV,@#CACHVEC              ;RESTORE CACHVEC
10730  054062  000207                          RTS     PC                      ;RETURN
10731  054064  000262                  99$:    SEV
10732  054066  000207                          RTS     PC
10733  054070  013737  177744  001740  2$:     MOV     @#MEMERR,@#REPREG               ;SAVE ERROR REG
10734  054076  010237  001536                  MOV     R2,@#VADR
10735  054102  010037  001750                  MOV     R0,@#SRCADR
10736  054106  104005                          ERROR   5
10737  054110  000765                          BR      99$                             ;RETURN
10738
10739
10740                                  ;;*****************************************************************
10741                                  .SBTTL  ROUTINE TO CLEAR 'T' BIT
10742                                  ;;*****************************************************************
10743  054112  013746  177776  CLRTBIT:MOV     @#PSW,-(SP)     ;PUSH PSW ONTO STACK
10744  054116  011627                  MOV     (SP),(PC)+      ;SAVE IN RETPSW BELOW
10745  054120  000000          RETPSW: .WORD   0
10746  054122  042716  000020          BIC     #20,(SP)        ;CLEAR T BIT IN PSW ON STACK
10747                                  ;;*****************************************************************
10748                                  .SBTTL  ROUTINE TO RESTORE THE T BIT
10749                                  ;;*****************************************************************
10750  054126  012746  054134  RESPSW: MOV     #1$,-(SP)       ;SET RETURN PC FOR RTI
10751  054132  000002                  RTI                     ;CLEAR 'T' BIT IN PSW
10752  054134  000207          1$:     RTS     PC              ;RETURN
10753
10754  054136  042737  177400  177776  RESTPS: BIC     #177400,@#PSW   ;SET KERNEL MODE
10755  054144  016746  177750          MOV     RETPSW,-(SP)    ;PUSH ORIG PSW ONTO STACK
10756  054150  000766                  BR      RESPSW
10757
10758                                  ;;*****************************************************************
10759                                  .SBTTL  KEYBOARD INT SERV ROUTINE
10760                                  ;*THIS ROUTINE HANDLES INTERRUPTS FROM THE KEYBOARD
10761                                  ;*
10762                                  ;*TYPING A CONTROL 'C' WILL CAUSE THE PROCESSOR TO  HALT
10763                                  ;*
10764                                  ;*TYPING A CARRAGE RETURN WILL CAUSE A CARRIAGE RETURN-LINE FEED
10765                                  ;*TO BE TYPED.
10766                                  ;*
10767                                  ;*TYPING A CONTROL 'O' WILL INHIBIT ANY FURTHER TYPEOUT. THE SECOND CONTROL 'O'
10768                                  ;*WILL ENABLE TYPEOUT AGAIN AND ECHO A CR-LF.
10769                                  ;*
10770                                  ;*ANY OTHER CHARACTER WILL JUST BE ECHOED.
10771                                  ;;*****************************************************************
10772
10773          000003                  CNTRLC=3
10774          000017                  CNTRLO=17
10775
10776  054152  017746  125072  TKISR:  MOV     @$TKB,-(SP)             ;GET CHARACTER
10777  054156  042716  177600          BIC     #177600,(SP)            ;STRIP UNUSED BITS
```

```
10778  054162  022716  000003          CMP     #CNTRLC,(SP)            ;BRANCH IF NOT CONTROL C (↑C)
10779  054166  001010                  BNE     1$
10780  054170  012737  001334  001276  MOV     #$CRLF-1,@#$REGS        ;ECHO CR LF
10781  054176  106277  125050          ASRB    @$TPS
10782  054202  005726                  TST     (SP)+                   ;POP CHARACTER OFF THE STACK
10783  054204  000000                  HALT
10784  054206  000002                  RTI                             ;RETURN
10785
10786  054210  122716  000015  1$:     CMPB    #15,(SP)                ;BRANCH IF NOT <CR>
10787  054214  001007                  BNE     2$
10788  054216  012737  001334  001276  MOV     #$CRLF-1,@#$REGS        ;ECHO CR LF
10789  054224  106277  125022          ASRB    @$TPS
10790  054230  005726                  TST     (SP)+                   ;POP CHARACTEROFF STACK
10791  054232  000002                  RTI                             ;RETURN
10792
10793  054234  122716  000017  2$:     CMPB    #CNTRLO,(SP)            ;BRANCH IF NOT CONTROL O (↑O)
10794  054240  001012                  BNE     3$
10795  054242  005726                  TST     (SP)+
10796  054244  005167  125260          COM     NOTYPE
10797  054250  100405                  BMI     7$
10798  054252  012737  001334  001276  MOV     #$CRLF-1,@#$REGS        ;ECHO CR LF
10799  054260  106277  124766          ASRB    @$TPS
10800  054264  000002          7$:     RTI
10801
10802  054266  104406          3$:     SAVREG
10803  054270  011605                  MOV     (SP),R5                 ;RETRIEVE CHARACTER
10804  054272  004737  054516          JSR     PC,@#LDKT               ;GO TO LOW CORE
10805  054276  013700  001504          MOV     @#TKBFRP,R0             ;GET BUFFER PTR
10806  054302  110520          4$:     MOVB    R5,(R0)+                ;LOAD CHAR INTO BFR
10807  054304  105010                  CLRB    (R0)                    ;CLEAR NEXT LOC
10810  054306  022700  001526  5$:     CMP     #TKBFR+20,R0            ;BRANCH IF NOT END OF BFR
10809  054312  001002                  BNE     6$
10810  054314  012700  001506          MOV     #TKBFR,R0               ;RESET BUFFER PTR
10811  054320  010037  001504  6$:     MOV     R0,@#TKBFRP             ;RESTORE BFR PTR
10812  054324  004737  054604          JSR     PC,@#RESKT              ;GO BACK TO ORIGINAL MEMORY
10813  054330  104407                  RESREG
10814  054332  005737  001530  ECHO:   TST     @#NOTYPE                ;TYPEOUT DISABLED?
10815  054336  100004                  BPL     1$                      ;BRANCH IF NO
10816  054340  005726                  TST     (SP)+                   ;FIX UP STACK
10817  054342  105077  124704          CLRB    @$TPS                   ;CLEAR IE BIT
10818  054346  000002                  RTI                             ;RETURN
10819  054350  105777  124676  1$:     TSTB    @$TPS           ;PRINTER READY?
10820  054354  100375                  BPL     .-4                     ;BRANCH IF NO
10821  054356  112677  124672          MOVB    (SP)+,@$TPB             ;MOVE CHAR TO PRINTER
10822  054362  000002                  RTI                             ;RETURN
10823
10824
10825                          ;;*****************************************************************
10826                          .SBTTL  TELETYPE INTERRUPT SERVICE ROUTINE
10827                          ;*THIS ROUTINE TYPES A MESSAGE POINTED TO BY THE ADR STORED
10828                          ;*IN LOCATION $REGS. THIS ROUTINE IS INTERRUPT DRIVEN.
10829                          ;;*****************************************************************
10830  054364  005237  001276  TPISR:  INC     @#$REGS         ;STEP MESSAGE ADDRESS PTR
10831  054370  117746  124702          MOVB    @$REGS,-(SP)            ;GET CHAR TO BE TYPED
10832  054374  001356                  BNE     ECHO                    ;GO TYPE CHAR IF NOT '0'
10833  054376  005726                  TST     (SP)+                   ;POP STACK
```

```
10834  054400  005077  124646                  CLR     @$TPS                   ;CLEAR IE BIT
10835  054404  012737  001570  001276          MOV     #NULLS,@#$REGS
10836  054412  000002                          RTI                             ;RETURN
10837
10838                                  ;;*****************************************************************
10839                                  .SBTTL  PARITY ERROR SERVICE
10840                                  ;*      THIS ROUTINE FIELDS UNEXPECTED TRAPS TO 114. IT IS ASSUMED
10841                                  ;*      THAT THE ERROR WAS IN CACHE AND WAS CAUSED BY THE "OTHER
10842                                  ;*      WORD" RATHER THAN THE "WANTED WORD" WHICH MEANS THAT THE
10843                                  ;*      BAD DATA IS STILL IN THE CACHE. SO, TO CLEAR THE BAD DATA
10844                                  ;*      THE ERROR ADDRESS IS REFERENCED CAUSING THE CACHE TO GO
10845                                  ;*      TO MAIN MEMORY TO GET THE DATA. THIS PREVENTS AN
10846                                  ;*      ARBITRARY REFERENCE TO THE BAD WORD FROM TRAPPING.
10847                                  ;*
10848                                  ;*      AFTER THE ERROR IS REPORTED, BITS 2 AND 3 OF THE MEMORY
10849                                  ;*      ERROR REGISTER ARE TESTED TO SEE IF THE BAD DATA IS IN
10850                                  ;*      MAIN MEMORY. IF IT IS, THE PROGRAM RESTARTS SINCE THE
10851                                  ;*      GOOD DATA IS NOW LOST FOREVER. OTHERWISE THE PROGRAM
10852                                  ;*      RETURNS TO THE ADDRESS POINTED TO BY "$LPERR".
10853                                  ;;*****************************************************************
10854  054414                          .PARSRV:
10855  054414  005227                          INC     (PC)+                   ;MAKE FLAG ZERO FIRST TIME THRU
10856  054416  177777                  PARFLG: .WORD   -1                      ;NEGATIVE ONE FOR A FLAG
10857  054420  001401                          BEQ     5$                      ;BRANCH IF FIRST TIME IN
10858  054422  000000                          HALT                            ;I HAVE ENTERED THIS ROUTINE BEFORE
10859                                                                          ;I FINISHED REPORTING THE FIRST ERROR
10860                                                                          ;THE SECOND ENTRY ADDRESS IS ON THE
10861                                                                          ;STACK
10862  054424                          5$:
10863  054424  016637  000002  001736          MOV     2(SP),@#REPPSW          ;SAVE ERROR PSW
10864  054432  011637  001536                  MOV     (SP),@#VADR             ;SAVE PC
10865  054436  162737  000002  001536          SUB     #2,@#VADR               ;ADJUST ERROR PC
10866  054444  013737  177744  001740  PERET:  MOV     @#MEMERR,@#REPREG       ;SAVE ERROR REG FOR TYPEOUT
10867  054452  013737  001212  001742          MOV     @#$LPERR,@#REPADR       ;SAVE LOOP ADDRESS
10868  054460  012737  054470  001212          MOV     #2$,@#$LPERR            ;SET RETURN ADDRESS IF LOOPING
10869  054466  104004                          ERROR   4
10870  054470  013737  001742  001212  2$:     MOV     @#REPADR,@#$LPERR       ;RESTORE LOOP ADDRESS
10871  054476  012767  177777  177712          MOV     #-1,PARFLG              ;RESTORE NEGATIVE ONE FOR A FLAG
10872  054504  012716  054512          1$:     MOV     #X,(SP)                 ;PUT ADDRESS ON STACK TO GET ORIGINAL
10873                                                                          ;PSW BACK
10874  054510  000002                  RTI:    RTI                             ;GET OLD PSW
10875  054512  000177  124474          X:      JMP     @$LPERR                 ;JUMP TO START OF TEST THAT HAD THE PE
10876                                  ;;*****************************************************************
10877                                  .SBTTL  CONTEXT SWITCH DOWN SUBROUTINE
10878                                  ;*      SUBROUTINE TO SAVE & LOAD KIPAR'S 0,1 AND 2 (IF MEM MGMT ENABLED)
10879                                  ;*      THIS ROUTINE IS CALLED BY THE KEYBOARD INTERRUPT, LINE CLOCK
10880                                  ;*      INTERRUPT, UBE SERVICE ROUTINE, MBT SERVICE ROUTINE, AND TYPE TIME ROUTINE.
10881                                  ;;*****************************************************************
10882  054516  105737  001545          LDKT:   TSTB    @#MMON                  ;BRANCH IF MEM MGMT DISABLED
10883  054522  001427                          BEQ     1$
10884  054524  012604                          MOV     (SP)+,R4                ;SAVE RETURN PC
10885  054526  013737  177776  054660          MOV     @#PSW,@#$SAVPSW         ;SAVE THE CURRENT PSW
10886  054534  042737  140000  177776          BIC     #140000,@#PSW           ;GO TO KERNEL MODE
10887  054542  012700  172340                  MOV     #KIPAR0,R0              ;GET ADDRESS OF PAR0
10888  054546  012001                          MOV     (R0)+,R1                ;GET PAR0
10889  054550  012002                          MOV     (R0)+,R2                ;GET PAR1
```

```
10890  054552  012003                        MOV     (R0)+,R3        ;GET PAR2
10891  054554  012740  000400                MOV     #400,-(R0)      ;RELOC BACK TO LOW CORE
10892  054560  012740  000200                MOV     #200,-(R0)
10893  054564  005040                        CLR     -(R0)
10894  054566  012700  054652                MOV     #$SAVPAR,R0     ;GET ADDRESS OF SAVE BUFFER
10895  054572  010120                        MOV     R1,(R0)+        ;PUT PAR DATA IN MEMORY
10896  054574  010220                        MOV     R2,(R0)+
10897  054576  010320                        MOV     R3,(R0)+
10898  054600  010446                        MOV     R4,-(SP)        ;PUT RETURN PC ON STACK
10899  054602  000207              1$:       RTS     PC
10900
10901                                ;;*****************************************************************
10902                                .SBTTL  CONTEXT SWITCH UP SUBROUTINE
10903                                ;SUBROUTINE TO RESTORE KIPAR0, 1, AND 2 (IF MGMT ENABLED)
10904                                ;;*****************************************************************
10905  054604  105737  001545        RESKT:  TSTB    @#MMON          ;BRANCH IF MEM MGMT DISABLED
10906  054610  001417                        BEQ     1$
10907  054612  012604                        MOV     (SP)+,R4        ;GET RETURN PC
10908  054614  012700  054652                MOV     #$SAVPAR,R0     ;GET ADDRESS OF SAVE BUFF
10909  054620  012001                        MOV     (R0)+,R1        ;GET OLD PAR DATA
10910  054622  012002                        MOV     (R0)+,R2
10911  054624  012003                        MOV     (R0)+,R3
10912  054626  012700  172340                MOV     #KIPAR0,R0      ;GET ADDRESS OF PAR0
10913  054632  010120                        MOV     R1,(R0)+        ;RELOCATE BACK
10914  054634  010220                        MOV     R2,(R0)+
10915  054636  010310                        MOV     R3,(R0)
10916  054640  013737  054660  177776        MOV     @#$SAVPSW,@#PSW
10917  054646  010446                        MOV     R4,-(SP)
10918  054650  000207              1$:       RTS     PC
10919  054652  000003              $SAVPAR:.BLKW   3
10920  054660  000000              $SAVPSW:.WORD
10921                                ;;*****************************************************************
10922                                .SBTTL  KT ABORT SUBROUTINE
10923                                ;;*****************************************************************
10924  054662  005227              KTABRT: INC     (PC)+           ;MAKE FLAG ZERO FIRST TIME THRU
10925  054664  177777              KTFLG:  .WORD   -1              ;NEGATIVE ONE FOR A FLAG
10926  054666  001401                        BEQ     5$              ;BRANCH IF FIRST TIME IN
10927  054670  000000                        HALT                    ;I HAVE ENTERED THIS ROUTINE BEFORE
10928                                                                ;I FINISHED REPORTING THE FIRST ERROR
10929                                                                ;THE SECOND ENTRY ADDRESS IS ON THE
10930                                                                ;STACK
10931  054672                        5$:
10932  054672  016637  000002  001736        MOV     2(SP),@#REPPSW          ;SAVE ERROR PSW
10933  054700  011637  001536                MOV     (SP),@#VADR             ;SAVE ERROR PC
10934  054704  162737  000002  001536        SUB     #2,@#VADR
10935  054712  013737  177572  001744        MOV     @#MMR0,@#REPMR0         ;SAVE MMR0
10936  054720  013737  177576  001746        MOV     @#MMR2,@#REPMR2         ;SAVE MMR2
10937  054726  013737  001212  001742        MOV     @#$LPERR,@#REPADR       ;SAVE LOOP ADDRESS
10938  054734  012737  054744  001212        MOV     #1$,@#$LPERR            ;SET RETURN ADR IF LOOPING
10939  054742  104003                        ERROR   3
10940  054744  013737  001742  001212  1$:   MOV     @#REPADR,@#$LPERR       ;RESTORE LOOP ADR
10941  054752  042737  170000  177572        BIC     #170000,@#MMR0          ;CLEAR ERRORS
10942  054760  012767  177777  177676        MOV     #-1,KTFLG               ;RESTORE NEGATIVE ONE FOR A FLAG
10943  054766  013716  001212                MOV     @#$LPERR,(SP)           ;GET LOOP ADDRESS
10944  054772  000002                        RTI                             ;RETURN
10945
```

```
10946                                   ;;*****************************************************************
10947                                   .SBTTL  RESERVED INSTRUCTION ROUTINE
10948                                   ;;*****************************************************************
10949  054774                           RESERR:
10950  054774  005227                           INC     (PC)+           ;MAKE FLAG ZERO FIRST TIME THRU
10951  054776  177777                   RESFLG: .WORD   -1              ;NEGATIVE ONE FOR A FLAG
10952  055000  001401                           BEQ     5$              ;BRANCH IF FIRST TIME IN
10953  055002  000000                           HALT                    ;I HAVE ENTERED THIS ROUTINE BEFORE
10954                                                                   ;I FINISHED REPORTING THE FIRST ERROR
10955                                                                   ;THE SECOND ENTRY ADDRESS IS ON THE
10956                                                                   ;STACK
10957  055004                           5$:
10958  055004  016637  000002  001736           MOV     2(SP),@#REPPSW          ;SAVE PSW
10959  055012  011637  001536                   MOV     (SP),@#VADR             ;SAVE ERROR PC
10960  055016  162737  000002  001536           SUB     #2,@#VADR
10961  055024  013737  001212  001742           MOV     @#$LPERR,@#REPADR       ;SAVE LOOP ADR
10962  055032  012737  055042  001212           MOV     #1$,@#$LPERR            ;SET RETURN ADR IF LOOPING
10963  055040  104002                           ERROR   2
10964  055042  013737  001742  001212  1$:      MOV     @#REPADR,@#$LPERR       ;RESTORE LOOP ADR
10965  055050  012767  177777  177720           MOV     #-1,RESFLG              ;RESTORE NEGATIVE ONE FOR A FLAG
10966  055056  013716  001212                   MOV     @#$LPERR,(SP)           ;GET LOOP ADDRESS
10967  055062  000002                           RTI                             ;RETURN
10968
10969                                   ;;*****************************************************************
10970                                   .SBTTL  TRAP TO 4 SERVICE ROUTINE
10971                                   ;;*****************************************************************
10972  055064  005227                   ERPRT:  INC     (PC)+           ;MAKE FLAG ZERO FIRST TIME THRU
10973  055066  177777                   ERFLG:  .WORD   -1              ;NEGATIVE ONE FOR A FLAG
10974  055070  001401                           BEQ     5$              ;BRANCH IF FIRST TIME IN
10975  055072  000000                           HALT                    ;I HAVE ENTERED THIS ROUTINE BEFORE
10976                                                                   ;I FINISHED REPORTING THE FIRST ERROR
10977                                                                   ;THE SECOND ENTRY ADDRESS IS ON THE
10978                                                                   ;STACK
10979  055074                           5$:
10980  055074  016637  000002  001736           MOV     2(SP),@#REPPSW          ;SAVE ERROR PSW
10981  055102  011637  001536                   MOV     (SP),@#VADR             ;SAVE ERROR PC
10982  055106  162737  000002  001536           SUB     #2,@#VADR
10983  055114  012706  000700                   MOV     #USESTK,SP              ;RESTORE SP
10984  055120  013737  177766  001740           MOV     @#CPUERR,@#REPREG       ;GET ERROR REG
10985  055126  013737  001212  001740           MOV     @#$LPERR,@#REPREG       ;SAVE LOOP ADR
10986  055134  012737  055144  001212           MOV     #1$,@#$LPERR            ;SET RETURN ADR IF LOOPING
10987  055142  104001                           ERROR   1
10988  055144  013737  001740  001212  1$:      MOV     @#REPREG,@#$LPERR       ;SET LOOP ADR
10989  055152  012767  177777  177706           MOV     #-1,ERFLG       ;RESTORE NEGATIVE ONE FOR A FLAG
10990  055160  013746  001736                   MOV     @#REPPSW,-(SP)  ;SETUP STACK TO RETURN
10991  055164  013746  001212                   MOV     @#$LPERR,-(SP)
10992  055170  000002                           RTI                             ;RETURN
10993
10994                                   .SBTTL  MICROBREAK TRAP SERVICE ROUTINE
10995                                   ;;*****************************************************************
10996                                   ;*      THIS ROUTINE MERELY SETS A FLAG
10997                                   ;*      WHEN THE ROUTINE HAS BEEN ENTERED
10998                                   ;*
10999  055172  005267  000002          BKROUT: INC     BKFLAG          ;SET MICROBREAK FLAG TO
11000                                                                   ;INDICATE TRAP TO 4 OCCURRED
11001  055176  000002                           RTI                     ;RETURN FROM TRAP
```

```
 11002  055200  000000                BKFLAG: .WORD   0               ;MICROBREAK TRAP FLAG
 11003
```

```
11004                                   ;THE BELOW TABLE REPRESENTS THE 'NEW' PSW SET BY THE PROGRAM ON
11005                                   ;SUCCESSIVE SUB-PASSES.
11006                                   ;NOTE THE BELOW TABLE MAY BE MODIFIED TO CAUSE THE PROGRAM TO RUN
11007                                   ;UNDER USER DEFINED PARAMETERS BY PATCHING IN THE DESIRED PASS PARAMETER
11008                                   ;FOR EXAMPLE TO CAUSE THE PROGRAM TO RUN WITHOUT SETTING THE 'T' BIT
11009                                   ;IN ALL PASSES PATCH OUT THE 'T' BIT IN THE TABLE.
11010   055202  000000           PSWTAB: 000000                  ;
11011   055204  000020                   000020                 ;T-BIT TRAPPING
11012   055206  140000                   140000                 ;USER MODE
11013   055210  140020                   140020                 ;USER MODE, T-BIT TRAPPING
11014                                   ;MESSAGES
11015                                           .EVEN
11016   055212  002154           REGINX: RP3DS
11017   055214  002176                   RKDS
11018   055216  000000                   .WORD
11019   055220  000000                   .WORD
11020   055222  002216                   RP4CS1
11021   055224  002256                   RSCS1
11022   055226  000000                   .WORD
11023   055230  000000                   .WORD
11024   055232  002322                   MBTTBL
11025   055234  002304                   UBETBL
11026   055236  055503           MSGINX: .WORD   MSG5
11027   055240  055511                   .WORD   MSG6
11028   055242  056320                   .WORD   MSG21
11029   055244  056320                   .WORD   MSG21
11030   055246  055517                   .WORD   MSG10
11031   055250  055525                   .WORD   MSG11
11032   055252  056320                   .WORD   MSG21
11033   055254  056320                   .WORD   MSG21
11034   055256  056014                   .WORD   MSG15
11035   055260  056357                   .WORD   MSG24
11036   055262  046200  053517  046040   MSG1:   .ASCIZ  <CRLF>'LOW LIM?'
11037   055270  046511  000077
11038   055274  044510  044107  046040   MSG2:   .ASCIZ  'HIGH LIM?'
11039   055302  046511  000077
11040   055306  051105  047522  050122   MSG3:   .ASCIZ  /ERRORPC PHYS-PC  PSW    TEST NO SUBPAS-PASS CNT/
11041   055314  020103  044120  051531
11042   055322  050055  020103  050040
11043   055330  053523  020040  020040
11044   055336  042524  052123  047040
11045   055344  020117  052523  050102
11046   055352  051501  050055  051501
11047   055360  020123  047103  000124
11048   055366  044124  020105  047506   MSG4:   .ASCII  /THE FOLLOWING DEVICES AND DRIVES WILL BE USED FOR RELOCATION:/<CRLF>
11049   055374  046114  053517  047111
11050   055402  020107  042504  044526
11051   055410  042503  020123  047101
11052   055416  020104  051104  053111
11053   055424  051505  053440  046111
11054   055432  020114  042502  052440
11055   055440  042523  020104  047506
11056   055446  020122  042522  047514
11057   055454  040503  044524  047117
11058   055462  100072
11059   055464  042504  044526  042503           .ASCIZ  /DEVICE DRIVES/<CRLF>
```

```
11060  055472  042011  044522  042526
11061  055500  100123     000
11062  055503     122  030120  004463  MSG5:   .ASCIZ  ?RP03   ?
11063  055510     000
11064  055511     122  030113  004465  MSG6:   .ASCIZ  ?RK05   ?
11065  055516     000
11066  055517     122  030120  004464  MSG10:  .ASCIZ  ?RP04   ?
11067  055524     000
11068  055525     122  030123  004464  MSG11:  .ASCIZ  ?RS04   ?
11069  055532     000
11070  055533     104  053122  052123  MSG12:  .ASCIZ  /DRVSTA  ERRREG  CSREG   WRDCNT  BUSADR  DSKADR  CYLADR(RP03)  PHYS BUSA
11071  055540  020101  042440  051122
11072  055546  042522  020107  041440
11073  055554  051123  043505  020040
11074  055562  053440  042122  047103
11075  055570  020124  041040  051525
11076  055576  042101  020122  042040
11077  056004  045523  042101  020122
11078  056012  041440  046131  042101
11079  056020  024122  050122  031460
11080  056026  020051  050040  054510
11081  056034  020123  052502  040523
11082  056042  051104  000200
11083  056046  041440  030523  020040  MSG13:  .ASCIZ  / CS1    WRDCNT  BUSADR  BADREX  DSKADR   CS2     CS3    DRVSTA  ERRREG/
11084  055654  020040  051127  041504
11085  055662  052116  020040  052502
11086  055670  040523  051104  020040
11087  055676  040502  051104  054105
11088  055704  020040  051504  040513
11089  055712  051104  020040  041440
11090  055720  031123  020040  020040
11091  055726  041440  031523  020040
11092  055734  020040  051104  051526
11093  055742  040524  020040  051105
11094  055750  051122  043505  000200
11095  055756  042504  041523  046131  MSG14:  .ASCIZ  /DESCTL   ER2     ER3    RPCC/<CRLF>
11096  055764  020040  042440  031122
11097  055772  020040  020040  042440
11098  056000  031522  020040  020040
11099  056006  050122  041503  000200
11100  056014  040515  051523  041040  MSG15:  .ASCIZ  /MASS BUS TESTER /
11101  056022  051525  052040  051505
11102  056030  042524  020122     000
11103  056035     040  051503  020061  MSG16:  .ASCIZ  / CS1    WRDCNT  BUSADR  BADREX    MR2     CS2      ST     ER      CS3/<
11104  056042  020040  053440  042122
11105  056050  047103  020124  041040
11106  056056  051525  042101  020122
11107  056064  041040  042101  042522
11108  056072  020130  020040  046440
11109  056100  031122  020040  020040
11110  056106  041440  031123  020040
11111  056114  020040  020040  052123
11112  056122  020040  020040  042440
11113  056130  020122  020040  020040
11114  056136  041440  031523  000200
11115  056144  020040  041503  020040  MSG17:  .ASCIZ  /  CC    BUSADR    CR2     CR1  PHYS BUSADR/<CRLF>
```

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11116  056152  020040  052502  040523
11117  056160  051104  020040  020040
11118  056166  051103  020062  020040
11119  056174  020040  051103  020061
11120  056202  020040  054510  020123
11121  056210  052502  040523  051104
11122  056216  000200
11123  056220  044124  020105  052521  MSG20:  .ASCIZ  /THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 0123456789/<15><12>
11124  056226  041511  020113  051102
11125  056234  053517  020116  047506
11126  056242  020130  052512  050115
11127  056250  042105  047440  042526
11128  056256  020122  044124  020105
11129  056264  040514  054532  042040
11130  056272  043517  020123  040502
11131  056300  045503  030040  031061
11132  056306  032063  033065  034067
11133  056314  006471  000012
11134  056320  046111  042514  040507  MSG21:  .ASCIZ  /ILLEGAL DEVICE/<CRLF>
11135  056326  020114  042504  044526
11136  056334  042503  000200
11137  056340  020040  020040  020040  MSG22:  .ASCII  /        /
11138  056346  020040
11139  056350  020040  020040  020040  MSG23:  .ASCIZ  /      /
11140  056356     000
11141  056357     125  044516  052502  MSG24:  .ASCIZ  /UNIBUS EXERCISER /
11142  056364  020123  054105  051105
11143  056372  044503  042523  020122
11144  056400     000
11145  056401     117  052120  041456  MSG25:  .ASCIZ  /OPT.CP=/
11146  056406  036520     000
11147  056411     125  042516  050130  EM1:    .ASCIZ  /UNEXPECTED TRAP TO 4/
11148  056416  041505  042524  020104
11149  056424  051124  050101  052040
11150  056432  020117  000064
11151  056436  044526  052122  041520  DH1:    .ASCIZ  /VIRTPC  PHYSPC    PSW   CPUERR/
11152  056444  020040  044120  051531
11153  056452  041520  020040  020040
11154  056460  051520  020127  020040
11155  056466  050103  042525  051122
11156  056474     000
11157  056475     000     001     000  DF1:    .BYTE   0,1,0,0,0
11158  056500     000     000
11159                                   .EVEN
11160  056502  001536  001536  001736  DT1:    .WORD   VADR,VADR,REPPSW,REPREG,0
11161  056510  001740  000000
11162  056514  047125  054105  042520  EM2:    .ASCIZ  /UNEXPECTED TRAP TO 10/
11163  056522  052103  042105  052040
11164  056530  040522  020120  047524
11165  056536  030440  000060
11166  056542  044526  052122  041520  DH2:    .ASCIZ  /VIRTPC  PHYSPC    PSW/
11167  056550  020040  044120  051531
11168  056556  041520  020040  020040
11169  056564  051520  000127
11170                                   .EVEN
11171  056570  001536  001536  001736  DT2:    .WORD   VADR,VADR,REPPSW,0
```

```
11172  056576  000000
11173  056600  047125  054105  042520  EM3:    .ASCIZ  /UNEXPECTED TRAP TO 250(MGMT)/
11174  056606  052103  042105  052040
11175  056614  040522  020120  047524
11176  056622  031040  030065  046450
11177  056630  046507  024524     000
11178  056635     126  051111  050124  DH3:    .ASCIZ  /VIRTPC  PHYSPC    PSW    MMR0    MMR2/
11179  056642  020103  050040  054510
11180  056650  050123  020103  020040
11181  056656  050040  053523  020040
11182  056664  020040  046515  030122
11183  056672  020040  020040  046515
11184  056700  031122     000
11185          056704                  .EVEN
11186  056704  001536  001536  001736  DT3:    .WORD   VADR,VADR,REPPSW,REPMR0,REPMR2,0
11187  056712  001744  001746  000000
11188  056720  047125  054105  042520  EM4:    .ASCIZ  /UNEXPECTED TRAP TO 114/
11189  056726  052103  042105  052040
11190  056734  040522  020120  047524
11191  056742  030440  032061     000
11192  056747     126  051111  050124  DH4:    .ASCIZ  /VIRTPC  PHYSC PC  PSW   MEM ERR REG/
11193  056754  020103  050040  054510
11194  056762  041523  050040  020103
11195  056770  050040  053523  020040
11196  056776  046440  046505  042440
11197  057004  051122  051040  043505
11198  057012     000
11199          057014                  .EVEN
11200  057014  001536  001536  001736  DT4:    .WORD   VADR,VADR,REPPSW,REPREG,0
11201  057022  001740  000000
11202  057026     000     001     000  DF4:    .BYTE   0,1,0,0
11203  057031     000
11204  057032  040520  044522  054524  EM5:    .ASCIZ  /PARITY ERROR DURING DATA CHECK/
11205  057040  042440  051122  051117
11206  057046  042040  051125  047111
11207  057054  020107  040504  040524
11208  057062  041440  042510  045503
11209  057070     000
11210  057071     123  041522  042101  DH5:    .ASCIZ  /SRCADR  DSTADR  MEM ERR REG/
11211  057076  020122  042040  052123
11212  057104  042101  020122  046440
11213  057112  046505  042440  051122
11214  057120  051040  043505     000
11215  057125     000     001     000  DF5:    .BYTE   0,1,0
11216                                  .EVEN
11217  057130  001750  001536  001740  DT5:    .WORD   SRCADR,VADR,REPREG,0
11218  057136  000000
11219  057140  051105  047522  020122  EM6:    .ASCIZ  /ERROR DURING DATA CHECK-RELOC WAS BY CP/
11220  057146  052504  044522  043516
11221  057154  042040  052101  020101
11222  057162  044103  041505  026513
11223  057170  042522  047514  020103
11224  057176  040527  020123  054502
11225  057204  041440  000120
11226  057210  051123  040503  051104  DH6:    .ASCIZ  /SRCADR  DSTADR/
11227  057216  020040  051504  040524
```

```
11228  057224  051104     000
11229          057230                          .EVEN
11230  057230  001304  001536  000000  DT6:    .WORD   $TMP0,VADR,0
11231  057236  051105  047522  020122  EM10:   .ASCIZ  'ERROR DURING DATA CHECK-RELOC WAS BY I/O'
11232  057244  052504  044522  043516
11233  057252  042040  052101  020101
11234  057260  044103  041505  026513
11235  057266  042522  047514  020103
11236  057274  040527  020123  054502
11237  057302  044440  047457     000
11238  057307     123  041522  042101  DH10:   .ASCIZ  /SRCADR   DSTADR   DEVICE THAT DID XFER/
11239  057314  020122  020040  051504
11240  057322  040524  051104  020040
11241  057330  042040  053105  041511
11242  057336  020105  044124  052101
11243  057344  042040  042111  054040
11244  057352  042506  000122
11245  057356     000     001     003  DF10:   .BYTE   0,1,3,0
11246  057361     000
11247                                  .EVEN
11248  057362  001304  001536  001310  DT10:   .WORD   $TMP0,VADR,$TMP2,$TMP3,0
11249  057370  001312  000000
11250  057374  020040  020040  020040  DH11:   .ASCIZ  /                DATA1                                  DATA2/
11251  057402  020040  020040  020040
11252  057410  020040  042040  052101
11253  057416  030501  020040  020040
11254  057424  020040  020040  020040
11255  057432  020040  020040  020040
11256  057440  020040  020040  020040
11257  057446  020040  020040  020040
11258  057454  020040  042040  052101
11259  057462  031101     000
11260  057465     005     000     005  DF11:   .BYTE   5,0,5,0
11261  057470     000
11262          057472                          .EVEN
11263  057472  001464  001450  001474  DT11:   .WORD   FLTMP0,FREG2,FLTMP1,FREG3,0
11264  057500  001452  000000
11265  057504  041125  020105  047516  EM12:   .ASCIZ  /UBE NON-EXISTANT MEMORY ERROR/
11266  057512  026516  054105  051511
11267  057520  040524  052116  046440
11268  057526  046505  051117  020131
11269  057534  051105  047522  000122
11270  057542  044120  051531  041040  DH12:   .ASCIZ  /PHYS BUSADR/
11271  057550  051525  042101  000122
11272  057556     002                  DF12:   .BYTE   2
11273          057560                          .EVEN
11274  057560  001226  000000          DT12:   .WORD   $GDDAT,0
11275  057564  041115  020124  047516  EM13:   .ASCIZ  /MBT NON-EXISTANT MEMORY ERROR/
11276  057572  026516  054105  051511
11277  057600  040524  052116  046440
11278  057606  046505  051117  020131
11279  057614  051105  047522  000122
11280  057622  044120  051531  040440  DH13:   .ASCIZ  /PHYS ADDRESS/
11281  057630  042104  042522  051523
11282  057636     000
11283  057637     106  047514  052101  EM14:   .ASCIZ  /FLOATING POINT ERROR/
```

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 11294  057644  047111  020107  047520
 11295  057652  047111  020124  051105
 11296  057660  047522  000122
 11297  057664  042011  052101  030501  DH14:   .ASCIZ  /       DATA1                                   DATA2/
 11298  057672  004411  004411  040504
 11299  057700  040524  000062
 11300                                  .EVEN
 11301  057704  001434  001450  001440  DT14:   .WORD   FTMP4,FREG2,FTMP6,FREG3,0
 11302  057712  001452  000000
 11303  057716     004     000     004  DF14:   .BYTE   4,0,4,0
 11304  057721     000
 11305  057722  042504  044526  042503  EM15:   .ASCIZ  /DEVICE HUNG/
 11306  057730  044040  047125  000107
 11307                                  .EVEN
 11308
 11309  057736  000000                  ENDTAG: .WORD   0
 11310                                  ;;*****************************************************************
 11311                                  ;THE FOLLOWING ASCII GETS OVERLAYED WHEN THE PROGRAM RUNS.
 11312  057740  050117  051105  052101  SWITCH: .ASCII  /OPERATIONAL SWITCH SETTINGS/<CRLF>
 11313  057746  047511  040516  020114
 11314  057754  053523  052111  044103
 11315  057762  051440  052105  044524
 11316  057770  043516  100123
 11317  057774  053523  052111  044103          .ASCII  /SWITCH                 USE/<CRLF>
 11318  060002  004411  052411  042523
 11319  060010     200
 11320  060011     040  030440  020065          .ASCII  /  15  = 100000         HALT ON ERROR/<CRLF>
 11321  060016  036440  030440  030060
 11322  060024  030060  004460  044011
 11323  060032  046101  020124  047117
 11324  060040  042440  051122  051117
 11325  060046     200
 11326  060047     040  030440  020064          .ASCII  /  14  = 040000         LOOP ON TEST/<CRLF>
 11327  060054  036440  030040  030064
 11328  060062  030060  004460  046011
 11329  060070  047517  020120  047117
 11330  060076  052040  051505  100124
 11331  060104  020040  031461  020040          .ASCII  /  13  = 020000         INHIBIT ERROR TYPEOUTS/<CRLF>
 11332  060112  020075  031060  030060
 11333  060120  030060  004411  047111
 11334  060126  044510  044502  020124
 11335  060134  051105  047522  020122
 11336  060142  054524  042520  052517
 11337  060150  051524     200
 11338  060153     040  030440  020062          .ASCII  /  12  = 010000         INHIBIT UBE/<CRLF>
 11339  060160  036440  030040  030061
 11340  060166  030060  004460  044411
 11341  060174  044116  041111  052111
 11342  060202  052440  042502     200
 11343  060207     040  030440  020061          .ASCII  /  11  = 004000         INHIBIT ITTERATIONS/<CRLF>
 11344  060214  036440  030040  032060
 11345  060222  030060  004460  044411
 11346  060230  044116  041111  052111
 11347  060236  044440  052124  051105
 11348  060244  052101  047511  051516
 11349  060252     200
```

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11340  060253     040  030440  020060          .ASCII  /  10  = 002000        BELL ON ERROR/<CRLF>
11341  060260  036440  030040  031060
11342  060266  030060  004460  041011
11343  060274  046105  020114  047117
11344  060302  042440  051122  051117
11345  060310     200
11346  060311     040  020040  020071          .ASCII  /   9  = 001000        LOOP ON ERROR/<CRLF>
11347  060316  036440  030040  030460
11348  060324  030060  004460  046011
11349  060332  047517  020120  047117
11350  060340  042440  051122  051117
11351  060346     200
11352  060347     040  020040  020070          .ASCII  ?   8  = 000400        INHIBIT RELOCATION VIA I/O DEVICE?<CRLF>
11353  060354  036440  030040  030060
11354  060362  030064  004460  044411
11355  060370  044116  041111  052111
11356  060376  051040  046105  041517
11357  060404  052101  047511  020116
11358  060412  044526  020101  027511
11359  060420  020117  042504  044526
11360  060426  042503     200
11361  060431     040  020040  020067          .ASCII  /   7  = 000200        INHIBIT TYPEOUT OF THIS TEXT AND SYS SIZE/<CRLF>
11362  060436  036440  030040  030060
11363  060444  030062  004460  044411
11364  060452  044116  041111  052111
11365  060460  052040  050131  047505
11366  060466  052125  047440  020106
11367  060474  044124  051511  052040
11368  060502  054105  020124  047101
11369  060510  020104  054523  020123
11370  060516  044523  042532     200
11371  060523     040  020040  020066          .ASCII  /   6  = 000100        INHIBIT RELOCATION/<CRLF>
11372  060530  036440  030040  030060
11373  060536  030061  004460  044411
11374  060544  044116  041111  052111
11375  060552  051040  046105  041517
11376  060560  052101  047511  100116
11377  060566  020040  032440  020040          .ASCII  /   5  = 000040        INHIBIT ROUND ROBIN RELOCATION/<CRLF>
11378  060574  020075  030060  030060
11379  060602  030064  004411  047111
11380  060610  044510  044502  020124
11381  060616  047522  047125  020104
11382  060624  047522  044502  020116
11383  060632  042522  047514  040503
11384  060640  044524  047117     200
11385  060645     040  020040  020064          .ASCII  /   4  = 000020        INHIBIT RANDOM DISK ADDRESS/<CRLF>
11386  060652  036440  030040  030060
11387  060660  031060  004460  044411
11388  060666  044116  041111  052111
11389  060674  051040  047101  047504
11390  060702  020115  044504  045523
11391  060710  040440  042104  042522
11392  060716  051523     200
11393  060721     040  020040  020063          .ASCII  /   3  = 000010        INHIBIT MBT/<CRLF>
11394  060726  036440  030040  030060
11395  060734  030460  004460  044411
```

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11396  060742  044116  041111  052111
11397  060750  046440  052102     200
11398  060755     040  020040  004462          .ASCII  /   2           THESE THREE SWITCHES/<CRLF>
11399  060762  052011  042510  043523
11400  060770  052040  051110  042505
11401  060776  051440  044527  041524
11402  061004  042510  100123
11403  061010  020040  030440  004411          .ASCII  /   1           ARE ENCODED TO SELECT RELOCATION/<CRLF>
11404  061016  051101  020105  047105
11405  061024  047503  042504  020104
11406  061032  047524  051440  046105
11407  061040  041505  020124  042522
11408  061046  047514  040503  044524
11409  061054  047117     200
11410  061057     040  020040  004460          .ASCII  /   0           ON THE FOLLOWING DEVICES:/<CRLF>
11411  061064  047411  020116  044124
11412  061072  020105  047506  046114
11413  061100  053517  047111  020107
11414  061106  042504  044526  042503
11415  061114  035123     200
11416  061117     011  027060  027056          .ASCII  ?       0...RP11/RP03?<CRLF>
11417  061124  050122  030461  051057
11418  061132  030120  100063
11419  061136  030411  027056  051056          .ASCII  ?       1...RK11/RK05?<CRLF>
11420  061144  030513  027461  045522
11421  061152  032460     200
11422  061155     011  027062  027056          .ASCII  ?       2...NOT USED?<CRLF>
11423  061162  047516  020124  051525
11424  061170  042105     200
11425  061173     011  027063  027056          .ASCII  ?       3...NOT USED?<CRLF>
11426  061200  047516  020124  051525
11427  061206  042105     200
11428  061211     011  027064  027056          .ASCII  ?       4...RH11/RP04?<CRLF>
11429  061216  044122  030461  051057
11430  061224  030120  100064
11431  061230  032411  027056  051056          .ASCII  ?       5...RH11/RS04 OR RS03?<CRLF>
11432  061236  030510  027461  051522
11433  061244  032060  047440  020122
11434  061252  051522  031460     200
11435  061257     011  027066  027056          .ASCII  ?       6...NOT USED?<CRLF>
11436  061264  047516  020124  051525
11437  061272  042105     200
11438  061275     011  027067  027056          .ASCIZ  ?       7...NOT USED?<CRLF>
11439  061302  047516  020124  051525
11440  061310  042105  000200
11441          000001                          .END
```

```
AA      001547          1565#   2123#
ADC82   011336          3311    3313#
ADC85   012162          3543    3545#
ADC86   012664          3701    3702    3704#
ADC87   013614          3927    3928    3929    3931#
ADC0    007230          2705    2706    2707    2709#
ADC1    010130          2936    2937    2938    2940#
ADC2    011140          3240    3242#
ADC5    011762          3470    3471    3473#
ADC6    012466          3643    3644    3646#
ADC7    013462          3884    3885    3887#
ADD0    014310          4095    4096    4097    4099#
ADD1    014414          4133    4134    4136#
ADD1A   014640          4216    4217    4218    4220#
ADD1B   014656          4225    4226    4228#
ADD2    015300          4372    4373    4375#
ADD3    016056          4566    4568#
ADD6    016434          4669    4670    4672#
ADD7    017114          4788    4789    4790    4792#
ARBEX   035606          8040    8084#
ARBFIN  035574          8025    8047    8069    8071    8082#
ASHCL0  025332          6211#
ASHCR0  025410          6232#
ASHL0   025122          6161#
ASHL1   025720          6345#
ASHR0   025236          6188#
ASHR1   026006          6368#
ASLB1   010500          3071    3072    3074#
ASLB1A  010724          3158    3159    3161#
ASLB3   012152          3537    3538    3540#
ASLB4   011442          3348    3349    3350    3352#
ASLB6   012646          3693    3694    3695    3697#
ASLB7   013712          3959    3960    3962#
ASL0    007352          2749    2750    2751    2752    2754#
ASL1    010304          2999    3000    3001    3003#
ASL3    011676          3439    3440    3442#
ASL4    011232          3272    3273    3274    3276#
ASL6    012436          3631    3632    3634#
ASL7    013310          3831    3832    3834#
ASP1    002502          1850#
ASP2    002574          1880#
ASRB1   010574          3107    3109#
ASRB1A  010610          3113    3114    3116#
ASRB2   011406          3333    3334    3336#
ASRB2A  011424          3341    3342    3344#
ASRB5   012112          3518    3519    3521#
ASRB6   012764          3733    3734    3736#
ASRB7   013730          3966    3967    3969#
ASR0    007400          2763    2764    2765    2767#
ASR1    010172          2956    2957    2958    2960#
ASR2    011154          3246    3247    3249#
ASR3    011662          3433    3435#
ASR6    012320          3593    3594    3596#
ASR7    013344          3845    3846    3848#
BICB1   015040          4289    4290    4292#
BICB1A  015062          4300    4303#   4362    4363
```

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BIC0    014222          4066    4067    4068    4070#
BIC1    014536          4179    4180    4182#
BIC2    015370          4401    4402    4403    4405#
BIC3    016070          4571    4573#
BIC7    017766          4971#   4973
BIN0    015614          4466    4468    4471    4473    4476    4478    4481    4484#
BIN07   017534          4906    4914#
BIN1    015220          4332    4335    4338    4341    4344    4347    4350    4355#
BIS01   015026          4284    4286#
BIS0    014200          4057    4058    4060#
BIS0A   014256          4084    4086#
BIS1    014524          4173    4174    4176#
BIS2    015326          4385    4387#
BIS2A   015430          4419    4420    4422#
BIS7    017726          4961#   4963
BITB1   015016          4278    4279    4281#
BITB2   015700          4506    4507    4509#
BITB3   016246          4626    4629#
BITB6   016646          4719#
BITT1   014452          4150    4151    4153#
BITT2   015414          4412    4413    4415#
BIT0  = 000001          1265#   1437    2425    2433    2435    6601    6687    6736    6956    6998    7084    7127    7164
                        7189    8973    9011    9046
BIT00 = 000001          1255#   1265
BIT01 = 000002          1254#   1264
BIT02 = 000004          1253#   1263
BIT03 = 000010          1252#   1262
BIT04 = 000020          1251#   1261
BIT05 = 000040          1250#   1260
BIT06 = 000100          1249#   1259
BIT07 = 000200          1248#   1258
BIT08 = 000400          1247#   1257
BIT09 = 001000          1246#   1256    9559    9621
BIT1  = 000002          1264#
BIT10 = 002000          1245#   9606
BIT11 = 004000          1244#   9457    9566
BIT12 = 010000          1243#   2389    2409    8874
BIT13 = 020000          1242#   6889    8853    9613
BIT14 = 040000          1241#   9128    9189    9212    9227    9238    9262    9293    9310    9325    9336    9361    9450
                        9541    10530
BIT15 = 100000          1240#   6601    6607    6641    6687    6704    6736    6598    7036    7084    7127    7155    7164
                        7189    8501    8983    8990    9091    9098    9207    9214    9305    9312    10481
BIT2  = 000004          1263#   6704    6918    7155
BIT3  = 000010          1262#   9018
BIT4  = 000020          1261#   2464    6881    7143    7241    8782    8786
BIT5  = 000040          1260#   1441    2397    2417    6963    7036    8510    8513    8858    9193    9232    9267    9297
                        9330    9366
BIT6  = 000100          1259#   1436    1439    6696    6908    7036    7174    8809    9525
BIT7  = 000200          1258#   1438    1440    2335    6889    7036    7064
BIT8  = 000400          1257#   2341    2378    2395    2415    2446    8519    8593    8614    8678    8750    8820    8894
                        8967    9002    9039    9074    9111    9147    9187    9198    9225    9260    9291    9323    9359
BIT9  = 001000          1256#   6602    6659    6889    8526
BKFLAG  055200          6598*   6611    6638*   6647    10999*  11002#
BKROUT  055172          6597    10999#
BPTVEC= 000014          1272#   5424    5427*   5428*   5500*   5501*
BSP1    002576          1883#
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BSP2    002664          1911#
CACHVE= 000114          1340#   2476#   2477#   10720#  10729#
CALLMA= 000010          1431#   8417    8521
CBIT    023174          5689#
CCNSC0  003070          2013#
CCNSC1  003074          2014#
CCNSC2  003100          2015#
CCNST0  003114          2018#
CCNST1  003120          2019#
CCNST2  003110          2017#
CCR   = 177746          1342#   6774#   6776#   6824#   6838#   6840#   6949#   6950    6987#   6992#   6995#   7001#   7016#
CCST20  003104          2016#
CC0     007036          2626    2627    2628    2629    2630    2631    2632    2634#
CC1     007052          2638    2639    2640    2642#
CC2     007066          2646    2647    2648    2650#
CC3     007100          2654    2655    2657#
CC4     007114          2661    2662    2663    2665#
CHKDAT  054026          8283    8462    8541    10720#  10728
CHKSP   022766          5622#
CLCUA   003050          2009#
CLFGIN  003054          2010#
CLJAM   003034          2006#
CLPBA   003044          2008#
CLRTBI  054112          5418    5568    5615    6448    8198    8591    10743#
CLR0    007146          2676    2677    2678    2679    2681#
CLSERV  003040          2007#
CLTAG   003064          2012#
CLWHAM  003060          2011#
CMPB1   014772          4268    4270#
CMPB2   015664          4499    4500    4502#
CMPB3   016260          4632    4635#
CMPN    023230          5703#
CMPO    014102          4020    4021    4022    4024#
CMPOA   014344          4110    4113#
CMP1    014434          4141    4142    4143    4145#
CMP1A   014554          4186    4187    4188    4190#
CMP2    015316          4379    4380    4382#
CMP7    017050          4774    4775    4777#
CNSCOR  002554          1872#
CNSCTL  002740          1954#
CNSCO   002704          1922#
CNSC1   002706          1923#
CNSC2   002710          1924#
CNSSW   002552          1871#
CNSTSW  002544          1868#
CNST0   002714          1926#
CNST1   002732          1945#
CNST2   002730          1944#
CNTRLC= 000003          10773#  10778
CNTRLO= 000017          10774#  10793
CNVADR  053724          6709    8287    9677    9753    10684#
COMB1   010556          3098    3099    3101#
COMB1A  010736          3164    3165    3167#
COMB2   011320          3302    3303    3305#
COMB5   012070          3510    3512#
COMB6   012716          3714    3715    3717#
```

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COMB7   013630          3934    3935    3937#
COMO    007212          2696    2697    2698    2699    2701#
COM1    010316          3006    3007    3009#
COM3    011740          3460    3462#
COM4    011042          3203    3205#
COM6    012304          3588    3589    3591#
COM7    013434          3873    3874    3876#
COUNT   002753          1965#
CPCHK   004132          2229#
CPUERR= 177766          1345#   6696    6881    6908    6956    7143    7174    10984
CR    = 000015          1180#   9962    9972
CRLF  = 000200          1181#   1338#   2318    2452    8362    8371    9808    9931    9972    11036   11048   11059   11070
                       11083   11095   11103   11115   11134   11302   11307   11310   11316   11321   11328   11333   11340
                       11346   11352   11361   11371   11377   11385   11393   11398   11403   11410   11416   11419   11422
                       11425   11428   11431   11435   11438
CSP1    002666          1914#
CSP2    002714          1926#
CST200  002712          1925#
CUR     002745          1959#
DBINB7  017530          4911#   4943*   4944*   4948*   4949*   4950    4954*   4961    4962*   4969*   4971    4972*
DBIN7   016750          4749#   4764*   4768*   4773    4779*   4787*   4794*   4798*   4802
DCSO    002756          1968#
DCS1    002760          1970#
DDATA   016276          4644#   4648*   4650*   4654    4658    4659    4662*   4663    4668*   4675*   4682*   4683    4686*
                        4689    4693
DDATAB  016732          4715#   4716*   4721*   4724    4728*   4729    4733    4738#
DDISP = 177570          1187#   1493    2203
DEC81   010526          3084    3085    3087#
DEC81A  010656          3136    3137    3139#
DEC82   011454          3355    3356    3358#
DEC85   012230          3566    3568#
DEC86A  013016          3745    3746    3747    3749#
DEC87   013676          3953    3954    3956#
DECO    007272          2722    2723    2724    2725    2727#
DEC1    010110          2929    2931#
DEC1A   010360          3027    3029#
DEC2    011210          3263    3264    3266#
DEC5    011714          3446    3447    3448    3450#
DEC6    012452          3637    3638    3640#
DEC7    013326          3838    3839    3841#
DEVICE  001612          1583#
DEVIND  001614          1584#   8319*   8320*   8321*   8325    8327*   8328*   8329
DF1     056475          2040    2045    2050   11157#
DF10    057356          2075   11245#
DF11    057465          2080   11260#
DF12    057556          2085    2090   11272#
DF14    057716          2095   11293#
DF4     057026          2055    2065   11202#
DF5     057125          2060   11215#
DH1     056436          2038   11151#
DH10    057307          2073   11238#
DH11    057374          2078   11250#
DH12    057542          2083   11270#
DH13    057622          2088   11280#
DH14    057664          2093   11287#
DH2     056542          2043   11166#
```

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DH3     056635          2048   11178#
DH4     056747          2053   11192#
DH5     057071          2058   11210#
DH6     057210          2063   11226#
DISPLA  001244          1493#   2203#  2211#  2480#  9583#  9605#
DISPRE  000174          1450#   2211
DIV0    025634          6316#
DIV1    026102          6400#   6413
DPTRP = 000001          1437#   6776   6987   7001   7016
DREG    002750          1962#
DSWR  = 177570          1186#   1492   2202
DT1     056502          2039   11160#
DT10    057362          2074   11248#
DT11    057472          2079   11263#
DT12    057560          2084    2089  11274#
DT14    057704          2094   11291#
DT2     056570          2044   11171#
DT3     056704          2049   11186#
DT4     057014          2054   11200#
DT5     057130          2059   11217#
DT6     057230          2064   11230#
DUMMY   035412          8033#
DWORRY  041772          8775#
ECHO    054332         10814#  10832
EISOPT= 040000          1396#
EMTVEC= 000030          1275#   2186#  2187#  5299#  5301#  5338#  5339#
EMT1    021314          5298    5306#
EMT1B   021374          5306    5310   5311   5314   5315   5319   5320   5323   5324   5325   5330#
EMT1C   021400          5304    5332#
EMT1D   021412          5333    5334   5337#
EM1     056411          2037   11147#
EM10    057236          2072   11231#
EM12    057504          2082   11265#
EM13    057564          2087   11275#
EM14    057637          2077    2092  11283#
EM15    057722          2097   11295#
EM2     056514          2042   11162#
EM3     056600          2047   11173#
EM4     056720          2052   11188#
EM5     057032          2057   11204#
EM6     057140          2062   11219#
END     040640          8588#
ENDCP   031524          7259    7329#
ENDM    040606          8188    8572#
ENDMEM  040604          8227    8571#
ENDTAG  057736          2147    8226#  11299#
END1    040640          8589#
ENTER2  037046          8278    8311#  8363   8498
ERFLG   055066         10973#  10989#
ERPRT   055064          2143    2306   2462   5027   5508   6474   6662   6695   6733   6880   6907   6931   6955
                        7090    7142   7173   7186   7209   7224   7312   7425   8234   8589  10972#
ERRADR  001734          1605#   9417#  9429   9478#  9488
ERRBA   001726          1603#
ERRRTN  001340          1527#
ERRVEC= 000004          1268#   2138#  2143#  2200   2201#  2212#  2229#  2230#  2306#  2329#  2354#  2357#  2363#
                        2383#   2403#  2460   4985#  4986#  4987   5027#  5422#  5423#  5465#  5508#  5509#  5510#
```

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                        6459#   6474#   7303#   7312#   7385#   7386#   7425#   7426#   7427#   8114#   8115#   8227#   8228#
                        8234#   8589#   9546    9547#   9549#   9552#
EXIT    040472          8463    8542    8547#
EXITFL  001600          1578#
EXITRE  036762          8251    8253    8284    8290#   8549
EXPEXT  053210          7947    7958    8003    10492   10514#
EXTINS  023416          5755#
FACTOR  001550          1566#   2498#   2617#   3661    3793#   3907    4364    4365    4646    4707    4823    4824    4828
                        4829    4861#   4932    4986    5112    5127    5135    5151    5176    5213    5408#   5518    5520
                        5531    5748#   5854    6154#   6714    6764    7353#   7605#   8021#   8261    8269#   10703
FAC0.0  002650          1905#
FAC0.1  002652          1906#
FAC0.2  002654          1907#
FAC0.4  002656          1908#
FAC0.5  002660          1909#
FAC1.0  002556          1873#
FAC1.1  002560          1874#
FAC1.2  002562          1875#
FAC1.3  002564          1876#
FAC1.4  002566          1877#
FAC1.5  002570          1878#
FAC2.0  002612          1890#
FAC2.1  002614          1891#
FAC2.2  002616          1892#
FAC2.3  002620          1893#
FAC2.4  002622          1894#
FAC2.5  002624          1895#
FAC3.0  002516          1857#
FAC3.1  002520          1858#
FAC3.2  002522          1859#
FAC3.3  002524          1860#
FAC3.4  002526          1861#
FAC3.5  002530          1862#
FDST0   002664          1911#
FDST1   002574          1880#
FDST2   002630          1897#
FDST3   002534          1864#
FEA     002662          1910#
FLAG    002746          1960#
FLD20 = 104411          9792    10643#
FLTADD  035150          7618    7658    7661    7691    7788    7828    7831    7861    7969#
FLTDBL  053050          7782    10470#
FLTDIV  035122          7751    7921    7955#
FLTMPY  035100          7621    7631    7640    7650    7653    7703    7711    7719    7752    7791    7801    7810    7820
                        7823    7873    7881    7889    7922    7944#
FLTMP0  001464          1552#   7792#   7844    7874#   7905    7923#   11263
FLTMP1  001474          1553#   7832#   7895#   7926#   11263
FLTSGL  053056          7612    10471#
FLTSUB  035144          7676    7699    7724    7737    7759    7846    7869    7894    7907    7929    7968#
FL20  = 104410          9782    10395   10642#
FPOPT = 020000          1397#
FPSHI   002572          1879#
FREG0   001444          1544#   7616    7627    7649    7689    7696    7716    7749    7757    7758    7760    7786    7797
                        7819    7859    7866    7886    7919    7927    7928    7930    10523
FREG1   001446          1545#   7617    7638    7648    7690    7698    7708    7750    7787    7808    7818    7860    7868
                        7878    7920
```

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FREG2   001450            1546#   7623*   7675    7705*   7736    7754*   7793*   7845    7875*   7906    7924*   11263   11291
FREG3   001452            1547#   7663*   7677    7726*   7738    7758*   7833*   7847    7896*   7908    7928*   11263   11291
FREG4   001454            1548#
FREG5   001456            1549#
FREG6   001460            1550#
FREG7   001462            1551#
FRSTAD  001554            1568#   2495*   2614*   3790*   4442    4858*   5405*   5745*   6151*   7350*   7602*   8254
FRSTME  001556            1569#   2147*   8264
FTMP0   001424            1536#   7614    7628    7687    7695    7715    7747    7755    7784    7798    7857    7865    7885
                          7917    7925    10472   10487   10519
FTMP1   001426            1537#
FTMP2   001430            1538#   7615    7636    7645    7688    7697    7707    7748
FTMP3   001432            1539#
FTMP4   001434            1540#   7622*   7674    7704*   7735    7753*   7785    7806    7815    7858    7867    7877    7918
                          11291
FTMP5   001436            1541#
FTMP6   001440            1542#   7662*   7725*   7756*   11291
FTMP7   001442            1543#
GMS   = ******  U         1449    2317    2451    6618    8361    8370    8646    8653    9807    10633   10634   10635   10636
                          10637   10640   10641   10642   10643
GMSHAM  002542            1867#
GSTST   007700            2870#
HALT1   031412            7301#
HI    = 000200            1440#
HITMIS= 177752            1343#
HT    = 000011            1178#   9929    9972
INCB1   010442            3053    3054    3056#
INCB2   011550            3390    3391    3392    3394#
INCB3   012122            3524    3526#
INCB6   012630            3688    3690#
INCB6A  013000            3739    3740    3742#
INCB7   013662            3947    3948    3950#
INC0    007312            2731    2732    2733    2734    2736#
INC1    010224            2971    2972    2973    2975#
INC3    011750            3465    3467#
INC4    011072            3216    3217    3219#
INC6    012414            3622    3623    3624    3626#
INC7    013474            3890    3892#
INIT    002757            1969#
IOMON   036770            8235    8300#   8499
IOTTST  021040            5232#
IOTVEC= 000020            1273#   2184*   2185*   5232    5245*   5294*   5295*   5340*   5341*   7274*   7293*
IOWC    001610            1582#   8277*   8310*   8401
JAM     002742            1956#
JMP1    020254            5043    5044    5045    5047#
JMP3    020324            5063    5067#
JMP4    020362            5079    5083#
JMP5    020426            5097    5101#
JMP6    020446            5109#
JMP7    020504            5120#
JSR1    020516            5127#
JSR3    020602            5137    5151#
JSR4    020670            5163    5176#
JSR6    020746            5185    5199#
JSR7    021000            5203    5213#
KERSTK= 001200            1351#   2105    2150    5499    8562    8592
```

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KIPAR0= 172340          1328#   7517    8103#   8202#   8551#   8558   10693   10887   10912
KIPAR1= 172342          1329#   8104#   8203#   8552#
KIPAR2= 172344          1330#   8105#   8204#   8553#
KIPAR3= 172346          1331#   8113#   8121#   8130    8205#   8206    8208    8302    8551
KIPAR4= 172350          1332#   7532#   8206#   8207#   8552
KIPAR5= 172352          1333#   8208#   8209#   8553
KIPAR6= 172354          1334#
KIPAR7= 172356          1335#   8106#   8210#   8222
KIPDR0= 172300          1317#   7513    8096#
KIPDR1= 172302          1318#   8097#
KIPDR2= 172304          1319#   8098#
KIPDR3= 172306          1320#   8099#
KIPDR4= 172310          1321#   7533#   8100#
KIPDR5= 172312          1322#   8101#
KIPDR6= 172314          1323#
KIPDR7= 172316          1324#   8102#
KM    = 000000          1432#
KTABRT  054662          2478    7292   10924#
KTABT   032364          7530#
KTEX    032570          7531    7574#
KTFLG   054664         10925#  10942#
KTOPT = 100000          1395#
KTPAR   032226          7477#
KTPDR   032110          7438#
LCDTA   002734          1950#
LCUA    002674          1918#
LDKT    054516          9378    9447    9513    9980   10804   10882#
LDRP3   041612          8730    8738#   8997
LDRP4   042514          8866    8873#   9194    9220    9233    9248    9268
LDRS    043044          8927    8936#   9318    9346
LF    = 000012          1179#   9966    9972
LFGIN   002676          1919#
LJAM    002666          1915#
LKOPT = 001000          1399#   2238    8046    8140
LKS   = 177546          1364#   2236    8056#   8058    8144#   9525#
LKSRV   046630          8078    8142    9512#
LKVEC = 000100          1365#   8049#   8050#   8078#   8142#   8143#
LO    = 000100          1439#
LOOP    005530          2437    2439    2441    2443    2445    2447    2458#   8564    8611    8669
LPBA    002672          1917#
LSERV   002670          1916#
LSTMEM  001560          1570#   2145#   2146#   8266
LTAG    002702          1921#
LTICKS  001644          1596#   8426    8443    9514#   9515    9517#   9518#   9519    9521#   9981
LWHAM   002700          1920#
MARKEX  024440          6018    6022    6026#
MARK1   024414          6014    6016#
MBTAS = 160116          1385#
MBTBA = 160104          1380#   1807
MBTBAE= 160174          1389#
MBTCS1= 160100          1378#   1805    1808
MBTCS2= 160110          1382#   1810
MBTCS3= 160176          1390#   1813
MBTDB = 160120          1386#
MBTDT = 160126          1388#   1816
MBTER = 160114          1384#   1812
```

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MBTERR  046470          9458    9478#
MBTMR1= 160124          1387#
MBTMR2= 160106          1381#   1809
MBTN2   002352          1817#   2283
MBTN3   002354          1818#   2287
MBTN4   002356          1819#   2291
MBTOPT= 002000          1398#   2281    2305    8163
MBTPSW= 000776          1392#   1815
MBTSET  036176          8149    8151    8163#
MBTSRV  046304          8176    9446#
MBTST = 160112          1383#   1811
MBTTBL  002322          1805#   2279    2297    2301*   2302*   2303    8173*   8174*   8175*   8176*   8177*   8178*   9449
                        9454*   9489    9503*   11024
MBTVEC= 000774          1391#   1814
MBTWC = 160102          1379#   1806
MBT1    036242          8173#
MD      002736          1952#
MED   = 076600          1339#   2215    6463    6485    6513    6518    6521    6525    6563    6599    6603    6605    6608
                        6623    6639    6642    6645    6657    6660    6685    6688    6702    6711    6719    6734    6737
                        6780    6782    6784    6789    6795    6800    6806    6812    6844    6849    6887    6895    6916
                        6924    6961    6996    6999    7005    7014    7025    7044    7055    7074    7082    7085    7091
                        7125    7128    7153    7162    7166    7187    7190    7210    7225    10580
MEDEX   031134          6766    6769    7239#
MEDHLT  026362          6487    6488    6489    6491#
MEDTP0  002472          1828#   6515*   6524    6713*   6802*   6988*   7003*   7019    7067*
MEDTP1  002474          1829#   6516*   6534    6808*   7068*
MEDTP2  002476          1830#   6508*   6517    6527    6533*   6535    6567*   6723*   6814*
MEDTP3  002500          1831#   6523*   6527
MEDT1   026374          6506#
MEDT10  026550          6557#
MEDT11  026620          6596#
MEDD0   026340          6483#
MEDD1   026166          6447#
MEMERR= 177744          1341#   6852    7036    10733   10866
MEMFLG  001732          1604#   9395*   9416*   9420    9448*   9477*   9481
MEMHOL  046464          9468    9470    9477#
MEMSIZ  003420          2133    2135    2137#
MHOLE   046154          9407    9409    9416#
MMON    001545          1563#   2152*   5564    6767    7266    7443    7483    7530    8156    8171    8225*   8252    8372
                        8418    8449    8469    8496    8516    8547    8581*   10686   10882   10905
MMR0  = 177572          1352#   10935   10941*
MMR2  = 177576          1353#   10936
MMVEC = 000250          1284#   2478*   2479*   7262*   7292*   7536    7537    7540*   7541*   7571*   7572*
MOVB1   014746          4253    4254    4255    4256    4259#
MOV0    014032          3998    3999    4001#
MOV0A   014062          4013    4015#
MOV1    014624          4211    4213#
MOV7    017020          4765    4767#
MPI     031222          7258#
MRKTST  024356          6003#
MSGINX  055236          8355    9773    9801    10053   11026#
MSG1    055262          11036#
MSG10   055517          11030   11066#
MSG11   055525          11031   11068#
MSG12   055533          9812    11070#
MSG13   055646          9819    11083#
```

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MSG14   055756          9892   11095#
MSG15   056014         11034   11100#
MSG16   056035          9835   11103#
MSG17   056144          9840   11115#
MSG2    055274         11038#
MSG20   056220          8618   11123#
MSG21   056320         11028   11029   11032   11033   11134#
MSG22   056340          9854   11137#
MSG23   056350          9858   11139#
MSG24   056357         11035   11141#
MSG25   056401         10040   11145#
MSG3    055306          9665   11040#
MSG4    055366         10044   11048#
MSG5    055503         11026   11062#
MSG6    055511         11027   11064#
MTICKS  001642          1595#   2160*   9522*   9991
MUL0    025504          6264#
MXMMHI  001622          1587#   8136*   9408    9469
MXMML0  001624          1588#   2175*   8109    8137*   9406    9467
NEG81   010512          3077    3078    3080#
NEG84   011500          3367    3368    3370#
NEG86   012734          3721    3722    3724#
NEG87   013744          3972    3973    3975#
NEG0    007332          2741    2742    2743    2745#
NEG1    010350          3021    3022    3024#
NEG2    011114          3228    3230#
NEG5    011726          3453    3454    3456#
NEG6    012340          3600    3601    3602    3604#
NEG7    013402          3860    3861    3863#
NEXEC   001544          1562#   2502    2621    3797    4865    5412    5752    6158    7357    7609    8565
NEXPAR  001562          1571#   2153*   2156*   8205    8217    8550*   8577*   8580*
NOMEM   036764          8267    8289    8291#
NOTYPE  001530          1556#   2225*   9957   10796*  10814
NUA     002754          1966#
NULLS   001570          1574#   8028   10835
NWBASH  001606          1581#   8274*   8306*   8415    8424*
NWBASL  001604          1580#   8273*   8305*   8375    8414    8423*   8455
OAERR   020012          4978#
OLDBAS  001602          1579#   8272*   8301*   8374    8413    8422*   8451
OLDPSW  036324          8196#   8563
OPT.CP  001532          1557#   2308*   2446    8023    8046    8140    8148    8163    8593    8614   10041
OVFLW   021752          5416#
PAGORT= 000200          1438#   6987
PARFLG  054416         10856#  10871#
PARTBL  032346          7477    7517#
PA1500  001540          1560#   6714*   6715    9401*   9404*   9406    9424    9460*   9465*   9467    9485    9680*   9683
                        9754    9766*   9861*   9865*   9867    9876*  10700*
PA1716  001542          1561#   6724    9402*   9403*   9405*   9408    9425    9464*   9466*   9469    9486    9681*   9767*
                        9864*   9866*   9877*   9878*  10699*
PBA     002744          1958#
PDRTBL  032340          7438    7513#
PERET   054444         10866#
PIRQ   = 177772         1185#
PIRQVE= 000240          1279#
PKM    = 000000         1434#
PLKCSB= 172542          1362#
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PLKCSR= 172540          1361#
PLKVEC= 000104          1363#
PROT    003330          2116#   2136*   2146    2154    8578
PR0   = 000000          1202#
PR1   = 000040          1203#
PR2   = 000100          1204#   6109    6114
PR3   = 000140          1205#
PR4   = 000200          1206#   2222    2224    5234    5252    8197
PR5   = 000240          1207#   5241    6108    8177    8410
PR6   = 000300          1208#
PR7   = 000340          1209#   2463    2473    2475    2481    5240    5284    5295    5339    5349    5350    5380    5382
                        5419    5510    6062    6064    6070    6120    6125    7242    7427    8050    8143    10660
PS    = 177776          1182#   1183
PSW   = 177776          1183#   2453*   2461    2481*   2870    2884*   2889*   5285*   5301    5349*   5355    5383*   5416
                        5417*   5419*   5447*   5452*   5509    5566    5567*   5570    5613    5614*   5678*   5724*   6054
                        6062*   6070*   6108*   6113    6120*   6125    6130*   6168    6172    6176*   6178    6194    6200
                        6352    6356    6376    6380    6447    6455*   6483*   6506*   7258    7291*   7314*   7322    7325
                        7328*   7386    7393    7426    7541    7551    8039    8043*   8062*   8107    8195    8197*   8561*
                        8590*   8977    9015    9050    9085    9125    9160    9196    9235    9270    9299    9332    9368
                        10743   10754*  10885   10886*  10916*
PSWCHK  022524          5564#
PSWHOL  002362          1823#   6447*   7239
PSWTAB  055202          8610    11010#
PTRP1   030310          7002    7013#
PUM   = 030000          1435#   5266    6108    6120    6125
PWRVEC= 000024          1274#   2190*   2191*   10558*  10559*  10568*  10574*  10589*  10590*
QV      001546          1564#   2111*   2119*   2132    2436    8364    8612
RDFLAG= 000144          1405#   6606    6640
RDLCUR= 000103          1415#   6624
RDLDAT= 000106          1421#   6807    7075
RDLFGI= 000104          1417#   6925    7092    7211    7226
RDLJAM= 000100          1409#   6703    6888    6917    6962    7154
RDLPBA= 000102          1413#   6712    6801    6896    7045
RDLSER= 000101          1411#   6720    7026
RDLTAG= 000107          1423#   6813    7056
RDLWRA= 000105          1419#
RDWHAM= 000022          1404#   6600    6658    6686    6735    6997    7033    7126    7163    7188
REGINX  055212          9824    9837    9882    11016#
RELE0   006676          2504    2594#
RELE1   013066          2623    3770#
RELE2   017266          3799    4838#
RELE3   021634          4867    5385#
RELE4   023300          5414    5725#
RELE5   025004          5754    6171#
RELE6   031524          6160    7230#
RELE7   032570          7359    7575#
RELE8   035306          7611    7834    7936    8007#
RELMIO  036726          8271    8280#   6282    8379
RELOC   036574          2597    3773    4841    5388    5728    6134    7333    7578    8010    8250#
RELOCP  040434          8309    8383    8537#   8539
RELO    005674          2492#
RELOO   006712          2598#
REL1    006732          2611#
REL11   013102          3774#
REL2    013122          3787#
REL22   017302          4842#
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REL3    017322          4855#
REL33   021650          5389#
REL4    021670          5402#
REL44   023314          5729#
REL5    023334          5742#
REL55   025020          6135#
REL6    025040          6148#
REL66   031540          7334#
REL7    031560          7347#
REL77   032604          7579#
REL8    032624          7599#
REL88   035322          8011#
REPAOR  001742          1608#  10867*  10870   10937*  10940   10961*  10964
REPMR0  001744          1609#  10935*  11186
REPMR2  001746          1610#  10936*  11186
REPPSW  001736          1606#  10863*  10932*  10958*  10980*  10990   11160   11171   11186   11200
REPREG  001740          1607#  10733*  10866*  10984*  10985*  10988   11160   11200   11217
RES     002755          1967#
RESERR  054774          2307    2466    5028    5557    6475    7313    10949#
RESET1  031476          7321#
RESFLG  054776         10951#  10965*
RESKT   054604          9389    9411    9438    9452    9501    9523    10024   10812   10905#
RESPSW  054126         10750#  10756
RESREG= 104407          8680    8728    8752    8802    8822    8864    8896    8926    9390    9412    9439    9453    9502
                        9524    9727   10025   10242   10367   10420   10641#  10701   10813
RESTPS  054136         10754#
RESTRP  022360          5517#
RESVEC= 000010          1269#  2231*   2232*   2307*   4987*   5028*   5519*   5520*   5557*   6460*   6475*   7304*   7313*
                        8410#  8411#   8520*
RETPC   036766          8263#  8292#
RETPSW  054120         10745#  10755
RETRY   036534          8227#  8546
REV     002751          1963#
RKBA    002206          1751#  8805*   9106*   9142*
RKCS    002202          1749#  2334*   2343*   8505*   8811*   9076    9080*   9082    9096    9107*   9113    9120*   9122
                        9128    9143*   9149    9155*   9157    9855
RKDA    002210          1752#  2333*   8803*   9104*   9140*
RKDRV   041644          1687    8748#
RKDS    002176          1747#  2337    8809    11017
RKER    002200          1748#  2335
RKERR   044036          9079    9088#   9118    9153
RKFUN   002136          1710#  8808*   9060*   9061    9066*   9068    9119*   9154*   9231*
RKHAMA  002104          1687#
RKHDA   002122          1699#  8795*   8803    9104    9140
RKHSTA  001754          1618#  8749*   8750    8755*   9074    9088*   9095*   9098*   9111    9147    9163*
RKHWC   001774          1631#  8804    9105    9141
RKLOOP  044064          9075    9095#   9112    9148
RKNEWH  002044          1661#  9134    9136*   9139
RKNEWL  002042          1660#  9142
RKOLD   002012          1643#  8798    8801*   8805    9103    9106
RKPSW   002214          1754#  8807*
RKREAD  044364          9071    9147#
RKRPT   043700          8753    9059#
RKSRV   043730          8806    9066#
RKTRY   002147          1722#  8796*   9078    9084*   9101*   9117    9124*   9132*   9151    9159*
RKUNIT  002070          1676#  8792
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RKVEC   002212          1753#   8806#
RKWC    002204          1750#   8804#   9105#   9141#
RKWRCK  044164          9069    9111#
RKWTRY  042140          8803#   9064    9086
RK1     044110          9062    9077    9101#
RK10    001632          1591#   8797#   8800#   8811    9102#   9103#   9107    9138#   9139#   9143
RK11    001634          1592#   8754#   8774    9090    9115
RK2     044132          9104#   9126
RK3     044332          9065    9140#   9161
RNTBIN  001620          1586#   8312#   8406#   8407    8420    8682    8754    8824    8898
ROLB1   010454          3059    3060    3062#
ROLB2   011372          3325    3326    3327    3329#
ROLB3   012176          3549    3550    3552#
ROLB6   012750          3727    3728    3730#
ROLB6A  013044          3757    3758    3760#
ROLB7   013762          3979    3980    3982#
ROL0    007364          2757    2758    2760#
ROL1    010144          2943    2944    2945    2947#
ROL1A   010156          2950    2951    2953#
ROL3    011776          3477    3478    3480#
ROL4    011170          3253    3254    3256#
ROL6    012270          3581    3582    3583    3585#
ROL7    013512          3896    3897    3899#
RORB1   010542          3091    3092    3094#
RORB1A  010632          3124    3125    3127#
RORB4   011354          3317    3318    3319    3321#
RORB5   012140          3530    3531    3532    3534#
RORB6   012702          3708    3709    3711#
RORB7   013646          3941    3942    3944#
ROR0    007250          2713    2714    2715    2716    2718#
ROR1    010074          2921    2922    2924#
ROR1A   010206          2963    2964    2965    2967#
ROR2    011056          3209    3210    3212#
ROR5    011650          3426    3427    3429#
ROR6    012360          3608    3609    3610    3612#
ROR7    013364          3853    3854    3856#
RPCC    002246          1769#
RP3BA   002164          1740#   8741#   9034#
RP3CS   002160          1738#   2367#   2368    8729#   8736#   8969    8973#   8974    8988    8998#   9004    9011#   9012
                        9035#   9041    9046#   9047    9857
RP3DA   002166          1741#   8717#   8738#   9031#
RP3DC   002170          1742#   8739#   9032#
RP3DRV  041250          1686    8676#
RP3DS   002154          1736#   2374    8734    11016
RP3ER   002156          1737#   9018
RP3ERR  043260          8972    8980#   9009    9044
RP3FUN  002134          1709#   8733#   8954#   8955    8960#   8961    9010#   9045#
RP3HAN  002102          1686#   8411    8520
RP3HDA  002116          1697#   8738    9031
RP3HDC  002120          1698#   8716#   8739    9032
RP3HST  001752          1617#   2164    8384    8389    8435    8501#   8519#   8522    8524    8677#   8678    8967    8980#
                        8987#   8990#   9002    9039    9053#
RP3HWC  001772          1630#   8401#   8740    9033
RP3LOO  043306          8968    8987#   9003    9040
RP3NXH  002040          1659#   8415#   9024    9026#   9029
RP3NXL  002036          1658#   8414#   9034
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RP3OLD  002006          1641#  8413*  8416*  8720   8723*  8741   8995
RP3PSW  002174          1744#  8732*
RP3REA  043606          8964   9039#
RP3RPT  043130          8681   8953#
RP3SRV  043160          8731   8960#
RP3TRY  002146          1721#  8718*  8971   8976*  8993*  9008   9014*  9022*  9043   9049*
RP3UNI  002066          1675#  8409*  8724    727*  8729   8996   9030
RP3VEC  002172          1743#  8731*
RP3WC   002162          1739#  8740*  9033*
RP3WCK  043376          8962   9002#
RP3WTR  041544          8729#  8958   8978
RP31    043332          8956   8970   8993#
RP310   001626          1589#  8719*  8722*  8726*  8736   8994*  8995*  8996*  8998   9028*  9029*  9030*  9035
RP311   001630          1590#  8682*  8697   8982   9006
RP32    043362          8997#  9016
RP33    043546          8959   9031#  9051
RP4BA   002222          1759#  8885*  9255*
RP4BAE  002224          1760#
RP4CS1  002216          1757#  2358   2388*  8870*  8882*  8883*  9200*  9201   9221*  9252*  9253*  9256*  11020
RP4C[illegible]  002230          1762#  2387*  2389   2397*  8513*  8873*  9193*  9232*  9238   9267*
RP4C[illegible]  002232          1763#
RP4DA   002226          1761#  8876*
RP4DC   002240          1766#  8875*
RP4DRV  042[illegible]20          1690   8818#
RP4DS   002234          1764#  2391   9189   9212   9218   9227   9246   9262
RP4ERR  044650          9192   9204#  9230   9265
RP4ER1  002236          1765#
RP4ER2  002242          1767#
RP4ER3  002244          1768#
RP4FUN  002142          1712#  8869*  9176*  9177   9181*  9182   9266*
RP4HAN  002112          1690#
RP4HDA  002126          1701#  8862*  8876
RP4HDC  002130          1702#  8861*  8875
RP4HST  001762          1621#  8819*  8820   8825*  9187   9198   9204*  9211*  9214*  9225   9260   9273*
RP4HWC  002002          1634#  8877
RP4LOO  044676          9188   9211#  9226   9261
RP4NXM  002060          1667#  9250
RP4NXM  002056          1666#  9255
RP4OF   002250          1770#  8874*
RP4OLD  002026          1649#  8879   8885
RP4PSW  002254          1772#  8868*
RP4REA  045142          9184   9260#
RP4RPT  044504          8823   9175#
RP4SRV  044530          8867   9181#
RP4TRY  002151          1724#  8863*  9191   9195*  9217*  9229   9234*  9245*  9264   9269*
RP4UNI  002076          1679#  8873
RP4VEC  002252          1771#  8867*
RP4WC   002220          1758#  8877*
RP4WCK  044754          9183   9225#
RP4WTR  042462          8865#  9180   9197
RP41    044724          9178   9190   9217#
RP411   001636          1593#  8824*  8841   9206   9240
RP42    044732          9218#  9219   9236
RP43    045064          9179   9246#  9247   9271
RSBA    002262          1777#  8946*  9354*
RSBAE   002264          1778#
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RSCS1	002256	1775#	2408*	8933*	8943*	8944*	9319*	9351*	9352*	9355*	11021
RSCS2	002270	1780#	2407*	2409	2417*	8510*	8936*	9297*	9330*	9336	9366*
RSCS3	002272	1781#									
RSDA	002266	1779#	8937*								
RSDRV	042614	1691	8892#								
RSDS	002274	1782#	2411	8931	9293	9310	9316	9325	9344	9361	
RSER	002276	1783#									
RSERR	045350	9296	9302#	9328	9364						
RSFUN	002144	1713#	8930*	9280*	9281	9285*	9286	9329*	9365*		
RSHANA	002114	1691#									
RSHDA	002132	1703#	8924*	8937							
RSHSTA	001764	1622#	8893*	8894	9291	9302*	9309*	9312*	9323	9359	9371*
RSHWC	002004	1635#	8938								
RSLOOP	045376	9292	9309#	9324	9360						
RSNEWH	002064	1669#	9348								
RSNEWL	002062	1668#	9354								
RSOLD	002032	1651#	8940	8946							
RSPSW	002302	1785#	8929*								
RSREAD	045642	9288	9359#								
RSRPT	045234	8897	9279#								
RSSRV	045260	8928	9285#								
RSTRY	002152	1725#	8925*	9295	9298*	9315*	9327	9331*	9343*	9363	9367*
RSUNIT	002100	1680#	8936								
RSVEC	002300	1784#	8928*								
RSWC	002260	1776#	8938*								
RSWCK	045454	9287	9323#								
RSWTRY	043004	8927#	9284	9300							
RS11	001640	1594#	8898*	8913	9304	9338					
RS41	045424	9282	9234	9315#							
RS42	045432	9316#	9317	9333							
RS43	045560	9283	9344#	9345	9369						
RTI1	041034	8613	8615	8620#							
RTT1	024452	6054#									
RTT1EX	024642	6090#									
RTT2A	024656	6097	6099#								
RTT2EX	024776	6056	6105	6115	6117	6126	6128	6130#			
RT1	054510	10874#									
RT1A	002546	1869#									
RT1B	002642	1902#									
RT2A	002550	1870#									
RT2B	002644	1903#									
RUNTBL	001666	1599#	8408*	8476	8698	8701*	8775	8778*	8842	8845*	8915*
RUNTRA	001702	1600#	8532	8715*	8789*	8860*	8921*	8983*	9091*	9207*	9305*
RVECT	002646	1904#									
RZERO	002640	1901#									
R0A	002720	1940#									
R0B	002724	1942#									
R1A	002502	1851#									
R1B	002576	1884#									
R2A	002504	1852#									
R2B	002600	1885#									
R3A	002506	1853#									
R3B	002602	1886#									
R4A	002510	1854#									
R4B	002604	1887#									
R5A	002512	1855#									

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R5B     002606          1888#
R6A     002514          1856#
R6B     002610          1889#
R7A     002722          1941#
R7B     002726          1943#
SAVPSW  024654          6054#   6055    6060    6085    6098#   6099    6130
SAVREG= 104406          8676    8748    8818    8892    9377    9446    9512    9662    9979    10224   10317   10392   10640#
                        10684   10802
SBC81   010466          3065    3066    3068#
SBC83   012216          3560    3562#
SBC84   011466          3361    3362    3364#
SBC86   012604          3678    3679    3681#
SBC87   013574          3919    3920    3921    3923#
SBC0    007414          2771    2772    2774#
SBC1    010240          2978    2979    2980    2982#
SBC1A   010256          2986    2987    2988    2990#
SBC5    012010          3484    3486#
SBC6    012374          3615    3616    3618#
SBC7    013270          3823    3824    3826#
SBIN87  017520          4907#   4938#   4939    4943    4950    4954    4958#   4961#   4964    4968#   4971#   4974
SBIN7   016746          4748#   4763#   4764    4773    4779    4786#   4787    4794    4798    4802
SDATA   016274          4643#   4649#   4650    4651#   4652#   4657#   4658#   4659    4663    4668    4674#   4675    4681#
                        4686    4687#   4688#   4689    4692#   4693    4696
SDATA8  016730          4713#   4714#   4715    4717    4721    4724    4728    4729    4737#
SECT2   033302          7682    7685#
SECT20  034406          7852    7855#
SECT3   033646          7743    7747#
SECT30  034752          7913    7917#
SERV    002743          1957#
SIZE    004634          2329#   2455
SOBOBL  053206          10470#  10471   10477   10489   10493#  10495#
SOBO    024150          5915    5926#
SOB1    024156          5928#   5932
SOB10   024132          5917#   5980
SOB2    024204          5928    5929    5930    5931    5933    5934    5935    5936    5939#
SOB3    024216          5943#   5951
SOB4    024250          5943    5944    5945    5946    5949    5952    5953    5956#
SOB5    024252          5958#
SOB5A   024272          5967#
SOB6    024316          5978#
SOB7    024324          5981#
SOB8    024326          5924    5983#
SOB9    024142          5922#   5993
SPARE0  001756          1619#
SPARE1  001760          1620#
SPCHK   023016          5636#
SRCADR  001750          1611#   10735#  11217
SREG    002752          1964#
SR0   = 177572          1288#   1352    7556    7573#   8111#   8138#   8224#   8572#
SR1   = 177574          1289#
SR2   = 177576          1290#   1353    7559
SR3   = 172516          1291#
STACK = 001200          1173#   1337    1351    2182
START   003276          1453    2105#   10594
STGBLK  002370          1826#
STKLMT= 177774          1184#   7361
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STMM    036304          8153    8155    8157    8164    8166    8168    8170    8172    8186#   8567
SUPFLG  035304          7968#   7997    8004#   8006#
SU PAS  001574          1576#   2167#   8152    8167    8597#   8598    8602#   8608    9697
SUB0    014050          4006    4007    4009#
SUB1    014472          4159    4160    4162#
SUB1A   014600          4198    4199    4201#
SUB1B   014614          4205    4206    4208#
SUB2    015344          4391    4392    4394#
SUB2A   015464          4433    4434    4436#
SUB3    016002          4543    4544    4546#
SUB3A   016024          4551    4552    4554#
SUB6    016454          4676    4678#
SUB7    017070          4780    4781    4782    4784#
SWR80   007432          2778    2779    2780    2782#
SWR81   010672          3143    3144    3146#
SWR82   011104          3223    3225#
SWR84   011532          3384    3386#
SWR86   013030          3752    3754#
SWR87   013416          3867    3869#
SWB01 = 000071          1426#   6596
SWB1A = 000710          1427#   6626
SWITCH  057740         10039   11302#
SWR     001242          1492#   2180    2202#   2204    2210#   2444    8020#   8092#   8150    8165    8186    8250    3270
                        8307    8315    8319    8526    8683    8756    8826    8899    9541    9559    9566    9606    9613
                        9618    9621   10566   10582#
SWREG   000176          1451#   2210
SW0   = 000001          1237#
SW00  = 000001          1227#   1237
SW01  = 000002          1226#   1236
SW02  = 000004          1225#   1235
SW03  = 000010          1224#   1234
SW04  = 000020          1223#   1233
SW05  = 000040          1222#   1232
SW06  = 000100          1221#   1231
SW07  = 000200          1220#   1230
SW08  = 000400          1219#   1229
SW09  = 001000          1218#   1228
SW1   = 000002          1236#
SW10  = 002000          1217#
SW11  = 004000          1216#
SW12  = 010000          1215#   8150
SW13  = 020000          1214#
SW14  = 040000          1213#
SW15  = 100000          1212#
SW2   = 000004          1235#
SW3   = 000010          1234#   8165
SW4   = 000020          1233#   8683    8756    8826    8899
SW5   = 000040          1232#   8315
SW6   = 000100          1231#   8186    8250
SW7   = 000200          1230#   2444
SW8   = 000400          1229#   8270    8307
SW9   = 001000          1228#
SXRA    023772          5864#   5873#
SXRB    023774          5865#   5891
SXT0    023440          5758    5759    5760    5761    5764#
SXT1    023524          5791#
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SXT2    024010          5871#
SXT3    024024          5877#
SXT4    023572          5809    5811#
SXT5    024034          5882#
SXT6    023734          5846    5847    5848    5849    5851#
SXT6A   023764          5857    5860#
SXT7    024100          5899#
SYSSIZ  001646          1598#   2346*   2380*   2400*   2420*   2425*   2433*   2435*   8332    8335    8345    8352*   8394*
                       10047   10058
TABBEG  002364          1824#
TABEND  002366          1825#
TAG   = 000040          1441#
TBITVE= 000014          1270#   5350*   5382*   5569    5580*   5583*   5607*   6059*   6061*   6088*   6089*   8607*
TBL2    002502          1847#   6507
TBL4    002720          1939#
TBL5    002734          1948#   6632
TBL6    002762          1976#   6633
TBL7    003034          2004#   6559
TEST1   010334          3013    3014    3015    3017#
TEST2   011032          3197    3198    3200#
TEST6   013060          3763    3764    3766#
TIMEBU  051236          2168    2173*   2174*   9985*   9990*   9995*   10000*  10007*  10014*  10021*  10022   10027#
TIMER   044466          9081    9121    9156    9165#
TKBFR   001506          1554    1555#  10808   10810
TKBFRP  001504          1554#  10805   10811*
TKISR   054152          2221   10776#
TKVEC = 000060          1277#   2221*   2222*
TLOC1   002360          1822#   6772    6786    6836    6842    6989    7003    7046    7059
TLOC2   002470          1827#
TPISR   054364          2223    8082   10830#
TPVEC = 000064          1278#   2223*   2224*   8048*   8082*
TRAPVE= 000034          1276#   2188*   2189*   5353*   5355*   5361*   5364*   5368*   5373*   5379
TRAP1   021546          5352    5367#
TRAP1C  021606          5366    5379#
TRTVEC= 000014          1271#
TSTB1   010704          3149    3150    3152#
TSTB2   011510          3373    3375#
TSTB2A  011520          3378    3380#
TSTB6   012556          3666    3667    3668    3670#
TSTO    007170          2686    2687    2688    2689    2691#
TST1    005656          2485#
TST10   011252          3287#
TST100  032100          7434#
TST101  032216          7474#
TST102  032354          7511    7527#
TST103  032606          7592#
TST104  033774          7765    7778#
TST105  035324          8017#
TST106  035606          8089#
TST11   011570          3405#
TST12   012012          3490#
TST13   012232          3572#
TST14   012512          3657#
TST15   013104          3780#
TST16   013514          3903#
TST17   014010          3993#
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TST2    006714          2604#
TST20   014346          4117#
TST21   014672          4237#
TST22   015222          4359#
TST23   015506          4447#
TST24   015712          4518#
TST25   016102          4582#
TST26   016262          4639#
TST27   016560          4701#
TST3    007116          2669#
TST30   016734          4736    4744#
TST31   017154          4809#
TST32   017304          4848#
TST33   017506          4903#
TST34   020214          5032#
TST35   020506          5124#
TST36   021030          5229#
TST37   021234          5247    5290#
TST4    007434          2786#
TST40   021442          5346#
TST41   021652          5395#
TST42   022350          5514#
TST43   022514          5561#
TST44   022756          5619#
TST45   023164          5686#
TST46   023316          5735#
TST47   024116          5910#
TST5    010030          2909#
TST50   024346          6000#
TST51   024442          6051#
TST52   024642          6094#
TST53   025022          6141#
TST54   025474          6261#
TST55   025624          6313#
TST56   026072          6397#
TST57   026150          6443#
TST6    010362          3033#
TST60   026330          6479#
TST61   026364          6503#
TST62   026540          6553#
TST63   026610          6593#
TST64   027076          6677#
TST65   027324          6759#
TST66   027564          6833#
TST67   027702          6872#
TST7    010770          3184#
TST70   030074          6945#
TST71   030164          6983#
TST72   030550          7121#
TST73   030762          7197#
TST74   031212          7255#
TST75   031402          7298#
TST76   031466          7318#
TST77   031542          7340#
TTOPT = 000400          1400#   2242    8023
TTYCHK  035342          8021#
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TYPDS = 104405          8650    8657    9703   10637#
TYPE  = 104401          2315    2449    6616    8357    8359    8368    8644    8651    8658    9608    9616    9663    9665
                        9667    9670    9687    9689    9692    9696    9700    9704    9717    9719    9722    9724    9728
                        9748    9758    9775    9785    9795    9803    9805    9812    9819    9835    9840    9845    9854
                        9858    9871    9873    9887    9889    9890    9892    9895    9934   10022   10023   10039   10040
                       10043   10044   10055   10062   10065   10129   10204   10591   10633#
TYPOC = 104402          9669    9691    9695    9699    9745    9844    9886    9894   10042   10634#
TYPON = 104404         10636#
TYPOS = 104403         10635#
TYPSIZ  051250          2448   10039#
TYPTIM  051010          8633    9664    9979#
UBEADR  001722          1602#   9384*   9385*   9386    9387    9433    9435   10663   10664
UBEBA = 170004          1370#   1793
UBECC = 170002          1369#   1792
UBECLR= 170010          1372#   1796
UBECR1= 170006          1371#   1795    2247*   2248
UBECR2= 170016          1374#   1794
UBEDB = 170000          1368#   2245    2253    2258    2263
UBEERR  046160          9400    9417#
UBEGO = 170014          1373#
UBEINI  053646          8158    9410   10649#
UBEOPT= 000200          1401#   2250
UBESAV  001716          1601#   9382*   9383*   9384    9385   10649
UBESET  036122          8141    8148#
UBESRV  045730          9377#  10659
UBETBL  002304          1792#   2269    9379    9391*   9413*   9431    9875   10657   11025
UBEVEC= 000510          1375#   1797    1798
UBE2    046030          9381    9395#
UBE3    046230          9418    9423    9429#
UBM6    013064          3660    3662*   3665    3673    3677*   3684*   3686*   3692*   3700*   3707*   3713*   3720*   3726*
                        3732*   3738*   3744*   3751*   3756*   3762    3769#
UBREAK= 177770          1347#   6596*   6637*
UB7     016756          4747    4753#
UCNSCT  002772          1982#
UCOUNT  003020          1993#
UCUA    003004          1987#
UDCS0   003026          1996#
UDCS1   003032          1998#
UDREG   003012          1990#
UFLAG   003006          1988#
UINIT   003030          1997#
UIPAR0= 177640          1306#   7268    7518    8217*   8218    8220
UIPAR1= 177642          1307#   8218*   8219*
UIPAR2= 177644          1308#   8220*   8221*
UIPAR3= 177646          1309#
UIPAR4= 177650          1310#   7534*
UIPAR5= 177652          1311#
UIPAR6= 177654          1312#   7268*
UIPAR7= 177656          1313#   8222*
UIPDR0= 177600          1295#   7514    8213*
UIPDR1= 177602          1296#   8214*
UIPDR2= 177604          1297#   8215*
UIPDR3= 177606          1298#
UIPDR4= 177610          1299#   7535*
UIPDR5= 177612          1300#
UIPDR6= 177614          1301#   7269*
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UIPDR7= 177616          1302#  8216*
UJAM    002776          1984#
ULCDTA  002762          1978#
UM    = 140000          1433#  5259   5433   6101   6104   6125   7258   7393   7402
UMD     002766          1980#
UNITNO  001616          1585#  8400*  8404   8409
UMUA    003022          1994#
UPBA    003002          1986#
URES    003024          1995#
UREV    003014          1991#
UR6A    002532          1863#
UR6B    002626          1896#
USERV   003000          1985#
USESTK= 000700          1337#  2458   5026   5286   5458   5493   5507   6265   6456   7251   7294   7399   7419
                        7423   10983
USREG   003016          1992#
UWM6    012244          3576#  3580*  3587*  3592*  3599*  3607*  3614*  3621*  3628*  3630*  3636*  3642*  3648*
UWM7    013210          3802#  3906   3909*  3914*
UW7     013214          3800   3805#
VADR    001536          1559#  6708*  8286*  8466*  8544*  9671   9672*  9678*  9680   9682*  10685  10734*  10864*
                        10865*  10933*  10934*  10959*  10960*  10981*  10982*  11160  11171  11186  11200  11217  11230
                        11248
WCNSSW= 000226          1407#  10581
WCSADR  002636          1900#
WCSA.0  002536          1865#
WCSA.1  002540          1866#
WCSB.0  002632          1898#
WCSB.1  002634          1899#
WRFLAG= 000344          1408#  6609   6643
WRINIT= 000352          1425#  2216
WRLCUR= 000303          1416#
WRLDAT= 000306          1422#  6783
WRLFGI= 000304          1418#
WRLJAM= 000300          1410#
WRLPBA= 000302          1414#  6781
WRLSER= 000301          1412#
WRLTAG= 000307          1424#  6785
WRLWRA= 000305          1420#
WRWRAM= 000222          1406#  6604   6661   6689   6738   7000   7086   7129   7167   7191
WWP   = 000100          1436#  6774   6838   6840   6992   6995
X       054512          10872  10875#
XOR0    023472          5772   5773   5774   5777#
XOR1    023560          5797   5798   5799   5800   5802   5805#
XOR24   023614          5819#
XOR35   024064          5888   5889   5893#
XOR6    023702          5824   5827   5829   5836#
XOR6A   023706          5822*  5823*  5828*  5830*  5834   5840#  5845*  5856*  5858*
XOR6B   023710          5831*  5832*  5833*  5834   5841#
XOR7    024114          5904#
XXDP    003324          2113#  2126*  2134
XXDPC   003325          2114#  2129*  2438
$AC0    001410          1530#  7617*  7620*  7627*  7629   7638*  7639   7648*  7652*  7656*  7660*  7675*  7690*
                        7698*  7702*  7708*  7710   7716*  7718   7723*  7736*  7750*  7757*  7787*  7790*  7797*
                        7799   7808*  7809   7818*  7822*  7826*  7830*  7845*  7860*  7868*  7872*  7878*  7880
                        7886*  7888   7893*  7906*  7920*  7927*  7944   7955   7969   7974   7985   7987   10543
$AC1    001412          1531#  7616*  7620   7623   7629*  7633   7639*  7642   7649*  7663   7671   7677*  7680*
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                        7681    7689*   7693    7696*   7705    7710*   7713    7718*   7720    7726    7732    7738*   7741*
                        7742    7749*   7754    7760*   7762*   7763    7786*   7790    7793    7799*   7803    7809*   7812
                        7819*   7833    7841    7847*   7850*   7851    7859*   7863    7866*   7875    7880*   7883    7888*
                        7890    7896    7902    7908*   7911*   7912    7919*   7924    7930*   7932*   7933    7944*   7955*
                        7969    7973    7986    7987*
$AC2    001414          1532*   7633*   7660    7668    7670*   7671*   7672*   7673*   7681    7693*   7702    7713*   7723
                        7729    7731*   7732*   7733*   7734*   7742    7803*   7830    7838    7840*   7841*   7842*   7843*
                        7851    7863*   7872    7883*   7893    7899    7901*   7902*   7903*   7904*   7912
$AC3    001416          1533*   7642*   7656    7668    7670    7720*   7729    7731    7812*   7826    7838    7840    7890*
                        7899    7901
$AC4    001420          1534*
$AC5    001422          1535*
$AUTOB  001236          1489*
$BDAOR  001224          1484*
$BDDAT  001230          1486*   9425*   9486*
$BELL   001330          1522*   9608    9633
$BUFF   001406          1529*   10398*  10423
$CHARC  051004          9936*   9946*   9953    9964*   9969*
$CKSWR= ******  U       10640
$CMTAG  001200          1471*   2177    2178    2186    2192    2193    2194
$CM1  = 000010          1504*   1505*   1506*   1507*   1508*   1509*   1510*   1511*   1512*
$CM2  = 000020          1504*   1505*   1506*   1507*   1508*   1509*   1510*   1511*   1512*
$CM3  = 000010          1502*   1504
$CM4  = 000010          1512*   1513*   1514*   1515*   1516*   1517*   1518*   1519*   1520*
$CRLF   001335          1524*   8658    9616    9633    9663    9666    9704    9719    9724    9728    9873    9889    9890
                        9935    9972    10023   10043   10065   10780   10788   10798
$DBLK   052050          10170   10204   10212*
$DB20   052060          9684    9755    9868    10224*
$DDAGN  041240          8640    8661    8667*
$DTBL   052040          10173   10208*
$ENDAD  041230          1460    2117    2313    8663*   9628
$ENDCT  041074          2192    8642*
$ENULL  041244          8670*
$EOP    041036          8604    8632*
$EOPCT  041066          2192*   8639*   8643
$ERFLG  001204          1474*   9533    9555    9557    9563*   9580    9582    9587    9602    9603*   9633
$ERMAX  001217          1481*   2195*   9557    9579*   9587
$ERPSW  001576          1577*
$ERROR  047160          2186    5294    5338    7205    9601*
$ERRPC  001220          1482*   9610*   9611*   9612    9633    9667    9672
$F  RTB 003126          2035*   9714
$  RTY  047334          9615    9662*
$ERTTL  001214          1479*   8655    8659*   9609*   9633
$ESCAP  001326          1521*   2194*   9578*   9624    9626    9633
$FACTO  001552          1567*   8260*   8376    8453    8456
$FILLC  001260          1500*   9939    9972
$FILLS  001257          1499*   9972
$FLBUF  001342          1528*   10022   10370
$FLD20  002600          10392*  10643
$FL20   052312          10317*  10642
$GDAOR  001222          1483*
$GDDAT  001226          1485*   9424*   9485*   11274
$GET42  041220          8660*
$GTSWR= ******  U       10639
$HD   = 000000          1113
$HINUM  001566          1573*   2106*   8689    8762    8832    8905    10443   10451   10456*  10479   10483
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$ICNT   001206          1476#  9570*  9571   9573*  9586
$ILLUP  053550         10558  10574  10596#
$INTAG  001237          1490#
$ITEMB  001216          1480#  9612*  9633   9673   9675   9706
$LF     001336          1525#  9633   9972
$LONUM  001564          1572#  2107*  8690   8763   8833  10442  10449  10455*  10484
$LPADR  001210          1477#  2196*  2501*  2620*  3796*  4864*  5411*  5751*  6157*  7356*  7608*  9561*  9576*
                        9584   9586
$LPERR  001212          1478#  2197*  2499*  2500*  2501   2618*  2619*  2620   3794*  3795*  3796   4862*  4863*
                        4864   5409*  5410*  5411   5749*  5750*  5751   6155*  6156*  6157   7354*  7355*  7356
                        7606*  7607*  7608   8300*  8446   8492*  9417   9418*  9429*  9478   9479*  9488*  9561
                        9577*  9586   9623  10067  10868*  10870*  10875  10937  10938*  10940*  10943  10961  10962*
                       10964*  10966  10985  10986*  10988*  10991
$MAIL = ****** U        2214   9576   9618   9923
$MXCNT  047156          9574   9586#
$NULL   001256          1498#  9941   9972
$NWTST= 000001          2482#  2601#  2666#  2783#  2906#  3030#  3181#  3284#  3402#  3487#  3569#  3654#  3777#
                        3900#  3990#  4114#  4234#  4356#  4444#  4515#  4579#  4636#  4698#  4740#  4742   4805#
                        4807   4845#  4900#  5029#  5121#  5224#  5226   5287#  5343#  5392#  5511#  5558#  5616#
                        5683#  5732#  5905#  5907   5997#  6027#  6029   6091#  6138#  6255#  6257   6306#  6308
                        6391#  6393   6436#  6438   6476#  6493#  6495   6543#  6545   6576#  6578   6669#  6671
                        6749#  6751   6826#  6828   6861#  6863   6935#  6937   6971#  6973   7106#  7108   7194#
                        7252#  7295#  7315#  7337#  7429#  7431   7470#  7472   7521#  7523   7582#  7584   7768#
                        7770   8014#  8085#  8087
$OCNT   051630         10101*  10130*  10143#
$OCTVL  052200         10226   10254#
$OMODE  051632         10096#  10100*  10105   10108*  10119*  10145#
$OVER   047126          9542   9562    9572    9580#
$PASS   001200          1472#  2151*  2440    8154    8169    8636*  8637*  8648   8670   9568   9587   9701
$POWER  053556         10592   10599#
$PWRAD  053544         10594#
$PWRON  053376          2190   10558#  10589
$PWRMG  053540         10592#
$PWRUP  053450         10568   10574#
$QUES   001334          1523#  9633   9972
$RAND   052752          8688   8761   8831   8904   10438#  10474
$RDCHR= ****** U       10640
$RDDEC= ****** U       10640
$RDLIN= ****** U       10640
$RDOCT= ****** U       10640
$REGAD  001262          1502#
$REG0   001264          1504#
$REG1   001266          1505#
$REG2   001270          1506#
$REG3   001272          1507#
$REG4   001274          1508#
$REG5   001276          1509#  8028*  8608*  8618*  10780*  10788*  10798*  10830*  10831  10835*
$REG6   001300          1510#
$REG7   001302          1511#
$RESRE  052254         10288#  10641
$RTNAD  041242          8669#
$RTRN   001534          1558#  2468   6088   8607
$R2A  = ****** U       10642
$SAVPA  054652         10894   10908  10919#
$SAVPS  054660         10885*  10916  10920#
$SAVRE  052216         10272#  10640
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$SAVR6  053554  10567* 10575  10576* 10577* 10598*
$SCOPE  046720  2184   5245   5251   5340   7220   7293   9540*
$SETUP= 000037  2158*  2183   2184   2186   2188   2190   2192   2193   2194   2196   2313   2316   8634
                9541   9602   9621   9628
$STUP = 177777  2158*
$SVLAD  047104  9550   9575*
$SVPC = 000204  1458*  1463
$SWR  = 167377  1104*  1113   1127   1128   1129   1130   1131   1132   1133   1134   1520   1521   1522
                2193   2194   2196   2197   2489   2608   2672   2789   2912   3036   3187   3290   3408
                3493   3575   3660   3784   3906   3996   4120   4240   4362   4450   4521   4585   4642
                4704   4747   4812   4852   4906   5035   5127   5232   5293   5349   5399   5517   5564
                5622   5689   5739   5913   6003   6054   6097   6145   6264   6316   6400   6446   6482
                6506   6556   6596   6680   6762   6836   6875   6948   6986   7124   7200   7258   7301
                7321   7344   7437   7477   7530   7596   7781   8020   8092   8629   8635   8662   8668
                8670   9533   9534   9535   9536   9537   9541   9553   9555   9556   9557   9564   9565
                9566   9577   9580   9586   9593   9594   9595   9596   9597   9606   9613   9618   9621
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. ABS.  061314     000

 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0

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 RUN-TIME: 27 31 3 SECONDS
 RUN-TIME RATIO: 680/63=10.7
 CORE USED:  31K  (62 PAGES)
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