PDP11

INSTRUCTION EXERCISER

MD-11-DDQAA-A

EP-DDQAA-A-DL-A

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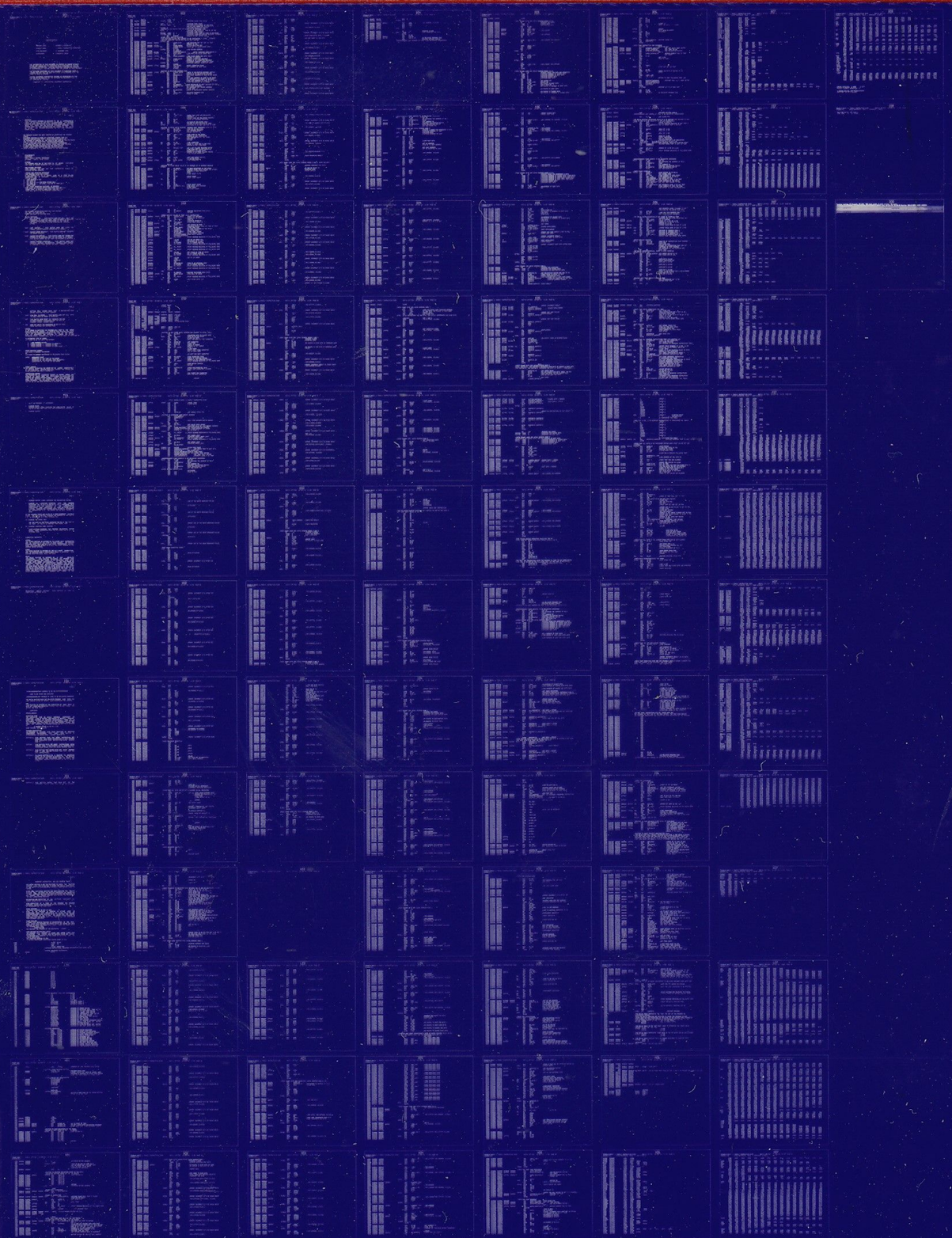
MADE IN USA



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IDENTIFICATION

PRODUCT CODE:	MAINDEC-11-DDQAA-A-D
PRODUCT NAME:	11 FAMILY INSTRUCTION EXERCISER
DATE RELEASED:	21 DECEMBER 1975
MAINTAINER:	DIAGNOSTIC GROUP

1.0 ABSTRACT

THIS DIAGNOSTIC PROGRAM IS DESIGNED TO BE A COMPREHENSIVE CHECK OF THE PDP11/05 AND PDP11/10 PROCESSORS. THE PROGRAM EXECUTES EACH INSTRUCTION IN ALL ADDRESS MODES AND INCLUDES TESTS FOR TRAPS AND THE TELETYPE INTERRUPT SEQUENCE. THE PROGRAM DOES NOT TEST INSTRUCTIONS NOT COMMON TO THE 11/10 OR 11/05. THE PROGRAM RELOCATES THE TEST CODE THROUGHOUT MEMORY 0-28K.

THE PROGRAM DDQAAA HAS BEEN CREATED BY MODIFYING THE PROGRAM DZQKCE.
FOLLOWING SECTION 2 THERE IS A ROUTINE -"CHECK THAT ALL RESERVED INSTRUCTIONS TRAP"- WHICH ASCERTAIN WHICH CP THE PROGRAM IS RUNNING ON. THE RESULTS ARE USED BY THE FOLLOWING CODE TO CHECK THE ADDITIONAL INSTRUCTIONS/FEATURES OF THE 11/40 AND 11/45.------ THIS ROUTINE, EVENTHOUGH QUITE HARMLESS FOR THE SEDM SYSTEM, COULD HAVE BEEN DELETED TO MAKE THE PROGRAM EXCLUSIVE FOR THE SEDM SYSTEM.
PLEASE IGNORE THIS ROUTINE AND ANY DEFINITION ETC. WHICH IS RELATED TO IT, WHEN RUNNING ON THE SEDM SYSTEM.

2.0 REQUIREMENTS

2.1 EQUIPMENT

PDP11 FAMILY CENTRAL PROCESSOR
OPTIONAL - KW11-L (LINE CLOCK)

2.2 STORAGE

THE PROGRAM USES ALL OF THE FIRST 4K OF MEMORY (EXCLUDING THAT AREA OF MEMORY RESERVED FOR THE LOADERS).

2.3 PRELIMINARY PROGRAMS

NONE, HOWEVER, THE EMT AND TRAP INSTRUCTION SHOULD BE VERIFIED BEFORE RUNNING.

3.0 LOADING AND STARTING PROCEDURE

LOAD PROGRAM USING ABS LOADER
IF THE CONSOLE TTY IS A SERIAL LA30 OR A VT05 FILLER CHARACTERS MAY BE REQUIRED. DEPOSIT INTO LOCATION 1002 (FILLS) A 4400.

1. LOAD ADDRESS = 200
2. SET SW15 UP
3. SET SW12 UP --- FOR SEDM SYSTEM ONLY
4. SET SW06 UP --- OPTIONAL, FOR END OF PASS HALT
5. PRESS START
6. SET OTHER OPERATING SWITCHES, AS DESIRED

PASS COUNT IS PRINTED AFTER EACH PASS (SEE SEC 6.4).
"DDQAA DONE" IS PRINTED WHEN DONE (SEE SEC 7.1).
THERE WILL BE A 5 ON THE DISPLAY LIGHTS FOR A

FEW SECONDS AFTER EATCH PASS AND THEN PROGRAM
WILL HALT IF SW06 WAS UP.
PRESS CONTINUE FOR ANOTHER PASS.

4.0 SWITCH SETTINGS

SW15 HALT ON ERROR... THIS SWITCH WHEN SET WILL HALT THE PROCESSOR, AT LOCATION 1664, WHEN AN ERROR IS DETECTED. THE PC, THE CURRENT STATUS,AND THE PASS COUNT AT THE TIME OF THE ERROR, IS STORED IN CORE STARTING AT LOCATION 017400.

SW14 LOOP SUBTEST... THIS SWITCH WHEN SET LOOPS THE CURRENT SUBTEST RUNNING REGARDLESS OF ERROR.

SW13 INHIBIT ERROR PRINTOUT - THIS SWITCH WHEN SET INHIBITS THE ERROR PRINTOUT.

SW12 INHIBIT RELOCATION... THIS SWITCH WHEN SET CAUSES THE PROGRAM TO BE EXECUTED ONLY IN THE FIRST 4K OF MEMORY. THIS SWITCH CANNOT BE SET WHEN THE PROGRAM IS RUNNING.

SW11 INHIBIT SUBTEST ITERATION... THIS SWITCH WHEN SET INHIBITS SUBTEST REITERATION. NORMALLY EACH SUBTEST IS EXECUTED 8 TIMES BEFORE THE NEXT SUBTEST IS RUN.

SETTING SW11 CAUSES EACH TEST TO BE EXECUTED ONCE BEFORE STARTING THE NEXT SUBTEST.

SW10 RING BELL ON ERROR... THIS SWITCH WHEN SET WILL RING THE BELL WHEN AN ERROR IS DETECTED.

SW7 THIS SWITCH WHEN RESET (0) INHIBITS THE END OF PASS TYPEOUT (ICNT=XXXX) AND THE END OF PROGRAM TYPEOUT (DDQAAA DONE).

SW6 WHEN SET HALTS THE PROCESSOR ON END OF PASS. PRESS CONTINUE FOR ANOTHER PASS.

5.0 ERRORS

IF AN ERROR IS DETECTED THE PROGRAM WILL TRAP TO THE ERROR HANDLING ROUTINE (ERROR). IF ENABLED THIS ROUTINE WILL BYTE THE PC AND THE PROCESSER STATUS AT THE TIME OF THE ERROR. ALSO (IF REQUIRED) THE ORIGINAL PC (WHERE THE PC WAS RELOCATED FROM). PROGRAM WILL HALT AT LOCATION 1664, IF SW15 WAS UP.

TO DETERMINE TYPE OF ERROR:
(IF THERE IS NO TTY WITH THE SYSTEM)

1. LOAD ADDRESS 017400.
2. PRESS EXAMINE --- CONTENT IS ERROR PC.
3. PRESS EXAMINE --- CONTENT IS PSW.
4. PRESS EXAMINE --- CONTENT IS PASS COUNT.

5.0.1 ERROR PRINTOUT FORMAT

ICNT=AAAA PC=BBBBBB PSW=DDDDDD
OR
ICNT=AAAA PC=BBBBBB PSW=DDDDDD PC RELOCATED FROM CCCCCC

WHERE: AAAA=PASS COUNT
BBBBBB=PC AT THE TIME OF THE ERROR
CCCCCC=PC OF THE ORIGINAL CODE RELOCATED
DDDDDD=PSW AT THE TIME OF THE ERROR.

5.1 ERROR LOOPING

THE SUBTEST DETECTING THE ERROR MAY BE LOOPED INDEFINITELY BY SETTING SW14. SETTING SW13 WILL INHIBIT THE TYPEOUT AND ALLOW SCOPING THE FAULTY SIGNAL(S).

5.2 UNPREDICTED ERRORS

THE PROGRAM MAY ON OCCASSION DETECT A MEMORY ERROR THE RESULTS OF WHICH WERE NOT PREDICTABLE IN WHICH CASE THE PROGRAM MAY BEHAVE UNPREDICTABLY. WHEN THIS HAPPENS THE USER MUST RETRACE THE PROGRAM STEPS TO RESOLVE WHERE THE ERROR OCCURRED. THE FOLLOWING ITEMS SHOULD BE CONSIDERED AND MAY BE OF USE WHEN RETRACING A FAILURE OF THIS NATURE.

1. HALT THE PROGRAM (IF NECESSARY)

2. EXAMINE RELR1
   ADDRESS RELR1 (1006) CONTAINS THE UNRELOCATED VALUE OF
   THE PC OF THE LAST TEST THAT WAS SUCCESSFULLY EXECUTED.

3. EXAMINE FACTOR

ADDRESS FACTOR (1004) CONTAINS THE RELOCATION FACTOR.

4. EXAMINE ALL LOCATIONS STARTING WITH THE ADDRESS SPECIFIED IN R1/R11(IF PSW BIT11 =0/1) COMPARING THEIR CONTENTS WITH THE CONTENTS OF THE CORRESPONDING UNRELOCATED CODE (SPECIFIED IN 1006) AS SHOWN IN THE LISTING. EXAMINE AND COMPARE UNTIL EITHER A DIFFERENCE IN INSTRUCTION (I.E., THE ERROR) OR THE NEXT 'SCOPE' IS SEEN.

IF THE PROGRAM TRAPS AND HALTS AT A TRAP/INTERRUPT VECTOR+2 (NOTE: THE PDP-11/45 WILL DISPLAY THE ADDRESS OF THE HALT+2 I.E., A FALSE TRAP TO 4 WILL DISPLAY 10).

1A. EXAMINE THE STACK (R6)

THE TOP WORD ON THE STACK CONTAINS THE PC AT THE TIME OF THE TRAP. IF THE PC IS GREATER THAN 20000, THEN

2A. EXAMINE LOCATION 1002 (FACTOR)

THIS LOCATION CONTAINS THE PROGRAM RELOCATION FACTOR WHICH, WHEN SUBTRACTED FROM THE PC GIVES THE PC OF THE ORIGINAL CODE.

6.0 SUBROUTINE ABSTRACTS

6.1 SCOPEA

THE SCOPEA ROUTINE IS ENTERED BY THE SCOPE (EMT) INSTRUCTION AND IS EXECUTED AT THE START OF EACH SUBTEST. THE ROUTINE MONITORS SW14, SW11 AND SW 8 AND TAKES APPROPRIATE ACTION. ALSO, THIS ROUTINE STORES IN R1/R11 THE FIRST ADDRESS OF THE SUBTEST BEING ENTERED.

6.2 ERROR

THE ERROR ROUTINE IS ENTERED BY THE HLT (TRAP) INSTRUCTION, AND IS EXECUTED WHEN A PREDICTABLE ERROR IS DETECTED. THIS ROUTINE MONITORS SW15, SW13, AND SW10.

6.3 RELOC

THE RELOC ROUTINE IS ENTERED BY A MOV RELOC,PC INSTRUCTION. THIS ROUTINE RELOCATES THE PROGRAM CODE THROUGHOUT MEMORY, AND 'JUMPS' TO THE RELOCATED CODE AFTER IT HAS BEEN MOVED SUCCESSFULLY. IF THE CODE CANNOT BE RELOCATED (BECUASE OF INSUFFICIENT MEMORY) THE ROUTINE 'JUMPS' TO THE NEXT SECTION OF UNRELOCATED PROGRAM CODE. THE CODE MOVED IS LESS THAN 1K (4000) BYTES). AT THE START AND END OF EACH SECTION OF CODE TO BE MOVED ARE A SECTION OF CODE WHICH ESTABLISHES THE FIRST ADDRESS OF THE CODE TO BE MOVED, AND SETS A SCOPE POINTER (R1/R11) AND, ALSO A SECTION WHICH ESTABLISHES THE LAST ADDRESS AND 'JUMPS' TO THE

RELOCATION (RELOC) ROUTINE. EACH SECTION OF CODE IS
IDENTIFIED AS SHOWN BELOW:

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```
                ;OOOOOOOOOOOOOFIRST ADDRESS TO BE RELOCATEDOOOOOOOOO

                     CODE TO BE MOVED AND EXECUTED

                ;OOOOOOOOOOOOOLAST ADDRESS OF CODE TO BE RELOCATED OOOOOOOO

                THE RELOC ROUTINE DOES NOT RELOCATE PROGRAM  CODE  INTO  THE
                LAST 1000(8) BYTES OF MEMORY, THUS PRESERVING THE LOADERS.

6.4             END
                THIS ROUTINE IS ENTERED AT THE COMPLETION OF  EACH  PASS  IT
                SETS UP (LOADS NEW PROCESSOR STATUS) FOR THE NEXT PASS;  AND
                PRINTS THE PASS COUNT:

                     ICNT=XXXX

7.0             MISCELLANEOUS

7.1             EXECUTION TIME
                THE  EXECUTION  TIME  IS  HIGHLY  VARIABLE  (DEPENDENT  ON
                PROCESSOR,  TYPE OF MEMORY, AND AMOUNT OF MEMORY).  HOWEVER,
                WHEN  THE  PROGRAM  IS  RUNNING  SUCCESSFULLY  THERE  IS  A
                NOTICEABLE  'FLICKER' DISPLAYED IN THE CONSOLE LIGHT PATTERN
                THE 'FLICKER' WILL DIM WHEN 'T' BIT TRAP PASSES  (EVERY  ODD
                PASS)  ARE  RUNNING, THE PROGRAM SHOULD BE RUN FOR A MINIMUM
                OF:
                          2 PASSES ICNT=2 11/05 OR 11/20
                SOME TYPICAL TIMES FOLLOW:

8.0             PROGRAM DESCRIPTION
                THE PROGRAM  IS  DIVIDED  INTO  FOUR  SECTIONS  OF  POSITION
                INDEPENDENT   RELOCATABLE   TEST   CODE.   EACH  SECTION  IS
                APPROXIMATELY 1K WORDS LONG.  (EXCEPT SECTION A).

                SECTION 0  THIS  SECTION  TEST  THE  UNARY  INSTRUCTION  SET
                           EXECUTING  EACH UNARY INSTRUCTION IN EACH ADDRESS
                           MODE (EXCLUDING UNARY INSTRUCTIONS USING  ADDRESS
                           MODE 7).

                SECTION 1  THIS SECTION TESTS THE UNARY  INSTRUCTIONS  USING
                           ADDRESS  MODE  7 AND BINARYS IN ALL ADDRESS MODES
                           (EXCLUDING BINARY BYTE OPS USING ADDRESS MODE 7).

                SECTION 2  THIS SECTION TEST BINARY BYTE OPS  USING  ADDRESS
                           MODE  7, JMP, JSR AND PROGRAM TRAP (IOT, TRAP AND
                           EMT) INSTRUCTIONS.

                SECTION A  FOLLOWING SECTION 2 IS  A  ROUTINE  TO  ASCERTAIN
                           WHICH  CP THE PROGRAM IS RUNNING ON.  THE RESULTS
                           ARE USED BY  THE  FOLLOWING  CODE  TO  CHECK  THE
                           ADDITIONAL INSTRUCTIONS/FEATURES OF THE 11/40 AND
                           11/45.
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SECTION 3 THIS SECTION CHECKS THAT EACH BIT IN THE
PROCESSOR STATUS WORD (PSW) CAN BE SET CLEARED,

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RESERVED INSTRUCTION, AND ODD ADDRESS TRAPS.

FOLLOWING SECTION 3 ARE TWO ROUTINES TO CHECK THE TELETYPE PRINTER LOGIC AND A ROUTINE TO START THE KW11-L LINE CLOCK. IF THE KW11-L IS AVAILABLE THE PRIORITY ARBITRATION LOGIC IS TESTED.

AFTER EACH INDIVIDUAL SECTION HAS BEEN EXECUTED THE "RELOC" ROUTINE WILL RELOCATE THE SECTION THROUGHOUT ALL MEMORY UP TO 28K. WHEN THE SECTION HAS BEEN RELOCATED AND EXECUTED IN ALL MEMORY THE "RELOC" ROUTINE WILL RETURN THE PROGRAM TO THE NEXT UNRELOCATED SECTION.

RELOCATION AND EXECUTION OF ALL SECTIONS THROUGHOUT ALL MEMORY CONSTITUTES A SINGLE PASS.

UPON COMPLETION OF A PASS OF THE PROGRAM THE PROGRAM RESTARTS USING A NEW PROCESSOR STATUS DEPENDING ON THE TYPE OF PROCESSOR AND THE PASS COUNT.

8.1 STACK POINTER
THE STACK POINTER IS SET AT 500.
NOTE: IF THE PROGRAM IS RUNNING IN EITHER USER OR SUPERVISOR MODE (NOT APPLICABLE IF 11/20 OR 11/05) THE USER/SUPERVISOR STACK POINTER IS SET TO 500 AND THE KERNEL STACK POINTER IS SET TO 600. THE KERNEL STACK POINTER IS USED ONLY FOR THE SCOPE, HLT, TTY, AND KW11-L (IF AVAILABLE TRAP/INTERUPT ROUTINES.

8.2 POWER FAILURE
A POWER FAIL SERVICE ROUTINE IS INCORPORATED IN THE TEST. WHEN USING THIS PROGRAM THE POWER SHOULD BE TURNED OFF WHEN RUNNING TO CHECK THE POWER FAIL LOGIC. WHEN THE POWER FAILS THE PROGRAM WILL TYPE:
POWER FAILED
AND RESTART THE PROGRAM AT THE BEGINNING. (START)

9.0 USER DEFINED RELOCATION LIMITS
THE PROGRAM WILL REQUEST A LOWER AND UPPER LIMIT FOR RELOCATION. THE LIMITS MUST BE BETWEEN 20000 AND 157776. THE PROGRAM WILL EXECUTE IN THE LOWER 4K (0-17776) AND THE LIMITS SPECIFIED.
THE STARTING ADDRESS IS 204.
TO RETAIN PREVIOUSLY SPECIFIED LIMITS START AT 210.

```
359                                     .NLIST  MD,MC
360                                     .LIST   ME
361                                     .ABS
362                                     .TITLE  FRONT END
363                             ;CONTAINS DEFINITIONS, REGISTER ASSIGNMENTS AND MACRO CALLS
364
365                             ;GENERAL REGISTER ASSIGNMENTS
366             000000                  R0=%0
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```
                        R1=%1
000001                  R2=%2
000002                  R3=%3
000003                  R4=%4
000004                  R5=%5
000005                  SP=%6
000006                  PC=%7
000007                  R10=%0
000000                  R11=%1
000001                  R12=%2
000002                  R13=%3
000003                  R14=%4
000004                  R15=%5
000005
                ;STATUS REGISTER (PSW) BIT ASSIGNMENTS
                        C=1                     ;C BIT
000001                  V=2                     ;V BIT
000002                  Z=4                     ;Z BIT
000004                  N=10                    ;N BIT
000010                  T=20                    ;'T' BIT
000020                  PRTY7=340               ;PRIORITY LEVEL 7
000340                  PRTY6=300               ;PRIORITY LEVEL 6
000300                  PRTY4=200               ;PRIORITY LEVEL 4
000200
                ;VECTOR ADDRESSES
                        ERRVEC=4                ;ADDRESS OF ERROR VECTOR
000004                  RESVEC=10               ;ADDRESS OF RESERVED INST. TRAP VECTOR
000010                  TBITVEC=14              ;ADDRESS OF 'T' BIT TRAP VECTOR
000014                  TRTVEC=14               ;ADDRESS OF 'TRACE' TRAP VECTOR
000014                  BPTVEC=14               ;ADDRESS OF 'BREAKPOINT' TRAP VECTOR
000014                  IOTVEC=20               ;ADDRESS OF IOT TRAP VECTOR
000020                  PFVEC=24                ;ADDRESS OF POWER FAIL TRAP VECTOR
000024                  EMTVEC=30               ;ADDRESS OF EMT VECTOR
000030                  TRAPVEC=34              ;ADDRESS OF TRAP VECTOR
000034                  TPVEC=64                ;ADDRESS OF TTY PRINTER INTERRUPT VECTOR
000064                  LKVEC=100               ;ADDRESS KW11-L LINE CLOCK INT. VECTOR
000100                  PIRVEC=240              ;ADDRESS OF PIRQ VECTOR
000240                  FPEVEC=244              ;ADDRESS OF FLOATING POINT INT. VECTOR
000244                  MMVEC=250               ;ADDRESS OF MEM MGMT ERROR TRAP VECTOR
000250
                ;REGISTER ADDRESSES
                        PSW=    177776          ;ADDRESS OF STATUS REGISTER
177776                  SLR=    177774          ;ADDRESS OF STACK LIMIT REGISTER
177774                  PIRQ=   177772          ;ADDRESS OF PROGRAM INTERRUPT REQUEST
177772                  UBREAK= 177770          ;ADDRESS OF MICRO BREAK REGISTER
177770                  LKS=    177546          ;ADDRESS OF KW11-L STATUS REG.
177546                  TKS=    177560          ;ADDRESS OF KEYBOARD CSR
177560                  TKB=    177562          ;ADDRESS OF KEYBOARD BUFFER
177562                  TPS=    177564          ;ADDRESS OF TELEPRINTER CSR
177564                  TPB=    177566          ;ADDRESS OF TELEPRINTER BUFFER
177566                  SR0=    177572          ;ADDRESS OF MEM MGMT REGISTER SR0
177572                  SWR=    177570          ;ADDRESS OF CONSOL SWITCH REGISTER
177570                  DISPLAY=177570          ;ADDRESS OF CONSOL DISPLAY REGISTER
177570                  LPS=    177514          ;ADDRESS OF LINE PRINTER STATUS REG
177514
```

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                                        LPB=    177516          ;ADDRESS OF LINE PRINTER DATA DUFFER

                                ;INITIAL STACK POINTER SETTING
                                        STKPTR= 500             ;PROGRAM STACK PTR
                                        KPTR=600                ;KERNEL STACK PTR (USED BY KERNEL WHEN
                                                                ;PROGRAM IS RUNNING IN OTHER THAN KERNEL
                                                                ;MODE (NOT APPLICABLE TO 11/05,11/20)

                                ;MISCELLANEOUS BIT ASSIGNMENTS
                                        BIT15=100000
                                        BIT14=40000
                                        BIT13=20000
                                        BIT8=400
                                        BIT6=100

                                        ;SWITCHES

                                        SW06=100
                                ;INSTRUCTION EQUATES
                                        HLT=TRAP                ;HLT IS A TRAP INST TO THE ERROR ROUTINE
                                        SCOPE=EMT               ;SCOPE IS AN EMT TRAP

                                        .=46
000046  016612                          LOGICAL
                                        .=52
000052  040000                          BIT14
                                        .=200
000200  012707  002102                  MOV     #START,PC       ;GO TO START OF TEST
000204  012707  002174                  MOV     #START1,PC      ;GO GET LOWER/UPPER RELOCATION BOUNDARY
000210  012707  002240                  MOV     #START3,PC      ;START WITH LAST TYPED BOUNDARY LIMITS

                                ;ROUTINE TO SAVE REGISTERS ON THE STACK
                                ;CALLED BY SAVE MACRO OR JSR    PC,$SAVR
000214  012667  000016          $SAVR:  MOV     (SP)+,1$        ;SAVE RETURN PC
000220  010546                          MOV     %5,-(SP)
000222  010446                          MOV     %4,-(SP)
000224  010346                          MOV     %3,-(SP)
000226  010246                          MOV     %2,-(SP)
000230  010146                          MOV     %1,-(SP)
000232  010046                          MOV     %0,-(SP)
000234  012707                          MOV     (PC)+,PC        ;RETURN
```

```
                                1$:     0                       ;CONTAINS RETURN ADDRESS
                                        .=250
                                EOPHLT: HALT                    ;THIS IS AN END OF PASS HALT;
                                                                ;NOT AN ERROR HALT.YOU GET HERE
                                                                ;ONLY IF SW06 IS UP.PRESS
                                                                ;CONTINUE TO CONTINUE.
                                        RTS     PC

                                ;ROUTINE TO RESTORE REGISTERS SAVED ON THE STACK
                                ;CALLED BY RESTORE MACRO OR JSR  PC,$RESTR
                                $RESTR: MOV     (SP)+,1$        ;SAVE RETURN PC
                                        MOV     (SP)+,%0
                                        MOV     (SP)+,%1
                                        MOV     (SP)+,%2
                                        MOV     (SP)+,%3
                                        MOV     (SP)+,%4
                                        MOV     (SP)+,%5
                                        MOV     (PC)+,PC        ;RETURN
                                1$:     0                       ;CONTAINS RETURN ADDRESS

                                        .=610
                                ;POWER FAIL SUBROUTINE
                                PDWN:   MOV     #PUP,@#PFVEC
                                        HALT

                                ;POWER UP SUBROUTINE
                                PUP:    MOV     #PDWN,@#PFVEC   ;RESTORE POWER FAIL TRAP TO POWER
                                                                ;DOWN ROUINE ABOVE
                                        MOV     #KPTR,SP        ;SET STACK PTR
                                        CLR     (PC)+
                                1$:     .WORD   0               ;KILL TIME
                                2$:     INC     1$
                                        BNE     2$
                                        JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
                                        PFAIL
                                        JMP     @#START                 ;RESTART TEST

                                PFAIL:  .ASCIZ  <15><12>'POWER FAILED'<15><12>


                                        .=740
                                ;NOTE: THIS CODE USED ONLY BY THE XOR TESTER.
                                ;TO USE CODE PLACE 776 (BR  .-2) IN SCOPEA
                                FORXOR: MOV     #RTI,@#ERRVEC+2 ;SET TIME OUT TRAP TO RETURN
                                        SEC                     ;SET C
                                        TST     @#177060        ;IF A TIME OUT OCCURS.THEN WHEN NEXT
                                                                ;INSTRUCTION IS EXECUTED 'C' WILL BE SET
                                                                ;AND IF NO TIME OUT 'C' WILL BE CLEARED
                                        BCS     1$              ;BRANCH IF 'C' SET (TIMED OUT)
                                        MOV     (SP),R1         ;ADDRESS OF NEXT SUBTEST TO R1
                                1$:     CLR     @#ERRVEC+2      ;RESTORE TIME OUT TRAP
                                        MOV     R1,(SP)         ;GET RETURN ADDRESS BACK TO SUBTESTS
                                        NOP
                                        RTI                     ;RETURN EITHER TO LAST OR NEXT SUBTEST
```

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                000776                          .=776
000776  000000  000000          TICKS:  .WORD   0               ;CONTAINS CLOCK TICK COUNT
                001000                          .=1000
001000  000000  000000          ICNT:   0                       ;CONTAINS PASS COUNT
001002  000000  000000          $FILLS: .WORD   0               ;CONTAINS FILLS COUNT IN ODD BYTE
                                                                ;AND FILLER CHARACTER IN EVEN BYTE
001004  000000  000000          FACTOR: 0                       ;CONTAINS RELOCATION FACTOR
                                ;SUBTRACT # IN FACTOR FROM PC TO GET PC OF ORIGINAL CODE
001006  000000  000000          RELR1:  0                       ;CONTAINS RELOCATED R1 (THE R1 OF THE
                                                                ;ORIGINAL CODE MOVED)
001010  000000  000000          FRSTAD: .WORD   0               ;CONTAINS FIRST ADRS OF CODE TO BE MOVED
001012  000000  000000          FRSTMEM:.WORD   0               ;CONTAINS LOWER RELOCATION BOUNDARY ADDRESS
001014  000751  000751                  BR      FORXOR          ;BRANCH TO XOR TESTER CODE
                                ;SCOPE (EMT) SERVICE ROUTINE
                                ;THIS ROUTINE ALLOWS THE SUBTEST TO BE CONTINUOUSLY LOOPED, ITERATED
                                ;(OR NOT ITERATED) BEFORE BEGINNING NEXT SUBTEST
001016  000240  000240          SCOPEA: NOP
001020  032766  004000  000002          BIT     #4000,2(SP)     ;WAS REGISTER SET BIT SET ON TRAP
001026  001403  001403          2$:     BEQ     2$              ;BRANCH IF NOT
001030  052737  004000  177776          BIS     #4000,@#PSW     ;RETAIN REGISTER SET
001036  032737  040000  177570          BIT     #40000,@#SWR    ;CHECK BIT 14 (CONTINUOUS LOOP)
001044  001416  001416          SCOPEB: BEQ     SCOPEC
001046  010116  010116                  MOV     R1,(SP)         ;LOAD RETURN ADDRESS
001050  010137  001006                  MOV     R1,@#RELR1
001054  163737  001004  001006          SUB     @#FACTOR,@#RELR1        ;RELR1 CONTAINS UNRELOCATED R1
001062  032737  000400  177570          BIT     #400,@#SWR      ;LOAD PDP11/45 MICRO BREAK REG?
001070  001403  001403                  BEQ     1$
001072  113737  177570  177770          MOVB    @#SWR,@#UBREAK  ;LOAD MICRO BREAK REG WITH SR0-7
001100  000002  000002          1$:     RTI                     ;RETURN TO SUBTEST
001102  032737  004000  177570  SCOPEC: BIT     #4000,@#SWR     ;SUBTEST ITERATION DESIRED?
001110  001006  001006                  BNE     SCOPEE          ;BRANCH IF NO ITERATION DESIRED?
001112  005327  005327                  DEC     (PC)+           ;DECREMENT SUBTEST ITERATION COUNT
001114  000040  000040          SCOPED: 40                      ;CONTAINS SUBTEST ITERATION COUNT
001116  001353  001353                  BNE     SCOPEB
001120  012767  000040  177766  SCOPEF: MOV     #40,SCOPED      ;RESET ITERATION COUNT
001126  011601  011601          SCOPEE: MOV     (SP),R1         ;GET ADDRESS OF NEXT TEST
001130  000746  000746                  BR      SCOPEB

                                ;ROUTINE TO RELOCATE PROGRAM CODE
001132  032737  010000  177570  RELOC:  BIT     #10000,@#SWR    ;CHECK IF RELOCATION DESIRED (BIT12)
001140  001031  001031                  BNE     3$              ;BRANCH IF NO RELOCATION DESIRED
001142  013700  001010                  MOV     @#FRSTAD,R0     ;GET FIRST ADDRESS OF CODE TO BE MOVED
001146  010005  010005                  MOV     R0,R5           ;SAVE
001150  010204  010204                  MOV     R2,R4           ;GET LAST ADDRESS OF CODE TO BE MOVED
001152  160504  160504                  SUB     R5,R4           ;R4 CONTAINS # OF WORDS TO RELOCATE
001154  010203  010203                  MOV     R2,R3           ;SAVE LAST ADDRESS OF CODE TO BE MOVED
001156  005737  001004                  TST     @#FACTOR        ;FIRST RELOCATION IS TO 20000
001162  001004  001004                  BNE     10$
001164  010237  001230                  MOV     R2,@#RETPC      ;SAVE RETURN PC TO NEXT SECTION OF CODE
001170  013702  001012                  MOV     @#FRSTMEM,R2    ;SET FIRST ADDDRESS
001174  060204  060204          10$:    ADD     R2,R4           ;R4 CONTAINS LAST MEMORY ADDRESS
                                                                ;TO BE USED
001176  020437  002154                  CMP     R4,@#LSTMEM     ;CHECK IF SUFFICIENT MEMORY REMAINS
001202  101011  101011                  BHI     4$
001204  012022  012022          1$:     MOV     (R0)+,(R2)+     ;RELOCATE PROGRAM CODE
001206  020003  020003                  CMP     R0,R3           ;CHECK IF DONE
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 591  001210  001375                        BNE     1$
 592  001212  024042                2$:     CMP     -(R0),-(R2)     ;CHECK THAT CODE WAS RELOCATED
 593  001214  001401                        BEQ     .+4             ;PROPERLY
 594  001216  104400                        HLT                     ;ERROR! CODE NOT RELOCATED PROPERLY
 595  001220  020005                        CMP     R0,R5           ;CHECK IF FINISHED CHECKING
 596  001222  001373                        BNE     2$
 597  001224  010207                3$:     MOV     R2,PC           ;GO EXECUTE RELOCATED CODE
 598  001226  011707                4$:     MOV     (PC),PC         ;RETURN TO NEXT SECTION OF CODE
 599  001230  000000                RETPC:  0                       ;CONTAINS PC OF NEXT SECTION OF CODE
 600
 601                                ;ROUTINE TO PRINT ASCII MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
 602  001232  010046                .PRINT: MOV     R0,-(SP)        ;SAVE R0 ON THE STACK
 603  001234  017600  000002               MOV     @2(SP),R0       ;GET MESSAGE ADDRESS
 604  001240  062766  000002  000002       ADD     #2,2(SP)        ;ADJUST RETURN PC
 605
 606  001246  112046                1$:     MOVB    (R0)+,-(SP)     ;PUSH CHAR ON THE STACK
 607  001250  001003                        BNE     2$              ;BRANCH IF NOT TERMINATOR
 608  001252  005726                        TST     (SP)+           ;POP TERMINATOR OFF THE STACK
 609  001254  012600                        MOV     (SP)+,R0        ;RESTORE R0
 610  001256  000207                        RTS     PC              ;RETURN
 611
 612  001260  004767  000026        2$:     JSR     PC,5$           ;TYPE CHARACTER
 613  001264  122726  000012        3$:     CMPB    #12,(SP)+       ;CHECK IF CHAR WAS A LINE FEED
 614  001270  001366                        BNE     1$              ;BRANCH IF NOT LINE FEED
 615
 616  001272  016746  177504               MOV     $FILLS,-(SP)    ;GET # OF FILLERS REQUIRED AFTER
 617                                                                ;LINE FEED AND FILLER CHARACTER
 618  001276  105366  000001        4$:     DECB    1(SP)           ;DECREMENT FILLERS COUNT
 619  001302  002770                        BLT     3$              ;BRANCH IF NO MORE FILLERS NEEDED
 620  001304  004767  000002               JSR     PC,5$           ;TYPE FILLER CHARACTER
 621  001310  000772                        BR      4$
 622
 623  001312  105737  177564        5$:     TSTB    @#TPS           ;WAIT FOR OUTPUT DEVICE
 624  001316  100375                        BPL     .-4             ;TO BECOME READY
 625  001320  116637  000002  177566       MOVB    2(SP),@#TPB     ;TYPE CHARACTER
 626  001326  000207                        RTS     PC
 627
 628          000000                        NULL=0
 629                                ;ROUTINE TO PLACE ASCII VALUE OF AN ADDRESS IN TO ADDRESS MESSAGE
 630  001330                        $FORMD:
 631  001330  004767  176660               JSR     PC,$SAVR        ;GO SAVE REGISTERS ON THE STACK
 632  001334  012704  001676               MOV     #DIGITS,R4      ;ADDRESS WHERE ASCII VALUES ARE STORED
 633  001340  005003                        CLR     R3              ;WORKING & INDEX REGISTER
 634  001342  010201                        MOV     R2,R1           ;SAVE
 635  001344  006302                1$:     ASL     R2              ;FIRST DIGIT TO R3
 636  001346  006103                        ROL     R3
 637  001350  012700  000006               MOV     #6,R0           ;DIGIT COUNT
 638  001354  000404                        BR      3$              ;PRINT FIRST DIGIT
 639  001356  006302                2$:     ASL     R2
 640  001360  006103                        ROL     R3
 641  001362  005301                        DEC     R1
 642  001364  001374                        BNE     2$
 643  001366  012701  000003        3$:     MOV     #3,R1           ;DIGIT SHIFT COUNT
 644  001372  116324  001666               MOVB    DIGTAB(3),(4)+  ;LOAD DIGIT INTO MESSAGE
 645  001376  005003                        CLR     R3              ;CLEAR INDEX
 646  001400  005300                        DEC     R0              ;DEC DIGIT COUNT
```

```
  647  001402  001365                        BNE     2$
  648  001404  004767  176644                JSR     PC,$RESTR       ;RESTORE REGISTERS FROM STACK
  649  001410  000207                        RTS     PC              ;RETURN
  650
  651                                ;ERROR SERVICE CALLED BY TRAP (HLT) INSTRUCTION
  652  001412  032737  020000  177570 ERROR: BIT     #20000,@#SWR    ;PRINT OUT DESIRED?
  653  001420  001106                        BNE     1$              ;BRANCH IF NO PRINTOUT
  654  001422  011627                        MOV     (SP),(PC)+      ;SAVE PC
  655  001424  000000                 11$:   .WORD   0               ;CONTAINS SAVED PC
  656  001426  011667  015746                MOV     (SP),SAVPC      ;STORE AWAY ERROR PC
  657  001432  162767  000002  015740        SUB     #2,SAVPC
  658  001440  016627  000002                MOV     2(SP),(PC)+     ;GET STATUS ON TRAP
  659  001444  000000                 12$:   .WORD   0               ;CONTAINS STATUS (PSW) AT TIME OF TRAP
  660  001446  016667  000002  015726        MOV     2(SP),SAVPS     ;STORE AWAY PSW
  661  001454  004767  176534                JSR     PC,$SAVR        ;GO SAVE REGISTERS ON THE STACK
  662  001460  013702  001000                MOV     @#ICNT,R2       ;GET PASS COUNT
  663  001464  013767  001000  015712        MOV     @#ICNT,SAVIC    ;STORE AWAY ICOUNT
  664  001472  004767  177632                JSR     PC,$FORMO       ;GO TO FORMAT ROUTINE
  665  001476  016767  000176  000212        MOV     DIGITS+2,PASSES ;LOAD ASCII VALUES
  666  001504  016767  000172  000206        MOV     DIGITS+4,PASSES+2
  667  001512  004767  177514                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  668  001516  001706                        PASCNT
  669  001520  016702  177700                MOV     11$,R2          ;GET PC OF ERROR CALL
  670  001524  005742                        TST     -(R2)           ;DECREMENT PC TO HLT
  671  001526  004767  177576                JSR     PC,$FORMO       ;GO TO FORMAT ROUTINE
  672  001532  004767  177474                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  673  001536  001723                        ERRPC
  674  001540  004767  177466                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  675  001544  001676                        DIGITS
  676  001546  004767  177460                JSR.    PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  677  001552  001730                        STATUS
  678  001554  016702  177664                MOV     12$,R2          ;GET STAUS AT TIME OF ERROR
  679  001560  004767  177544                JSR     PC,$FORMO       ;GO TO FORMAT ROUTINE
  680  001564  004767  177442                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  681  001570  001676                        DIGITS
  682  001572  016702  177626                MOV     11$,R2          ;GET PC OF ERROR
  683  001576  005742                        TST     -(R2)
  684  001600  005737  001004                TST     @#FACTOR
  685  001604  001412                        BEQ     10$
  686  001606  163702  001004                SUB     @#FACTOR,R2     ;FORM PC OF ORIGINAL CODE
  687  001612  004767  177512                JSR     PC,$FORMO       ;GO TO FORMAT ROUTINE
  688  001616  004767  177410                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  689  001622  001735                        ERRPCO
  690  001624  004767  177402                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  691  001630  001676                        DIGITS
  692  001632                          10$:
  693  001632  004767  176416                JSR     PC,$RESTR       ;RESTORE REGISTERS FROM STACK
  694  001636  032737  002000  177570  1$:   BIT     #2000,@#SWR     ;RING BELL ON ERROR
  695  001644  001403                        BEQ     2$
  696  001646  004767  177360                JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
  697  001652  001763                        BELL
  698  001654  005737  177570          2$:   TST     @#SWR           ;HALT AFTER PRINT OUT
  699  001660  100001                        BPL     .+4
  700  001662  000000                        HALT
  701  001664  000002                        RTI
  702
```

```
                                        ;DIGIT TABLE
001666  030460                  DIGTAB: "01
001670  031462                          "23
001672  032464                          "45
001674  033466                          "67
001676  030060  030060  030060  DIGITS: .ASCIZ  '000000 '
001704  000040
001706  005015                  PASCNT: .ASCII  <15><12>
001710  044440  047103  036524          .ASCII  '  ICNT='
001716  030060  030060    000   PASSES: .ASCIZ  '0000'
001723    040   041520  000075  ERRPC:  .ASCIZ  ' PC='
001730  051520  036527    000   STATUS: .ASCIZ  'PSW='
001735    120   020103  042522  ERRPCO: .ASCIZ  'PC RELOCATED FROM '
001742  047514  040503  042524
001750  020104  051106  046517
001756  000040
001760  005015    000           $CRLF:  .ASCIZ  <15><12>
001763    007     000           BELL:   .ASCIZ  <7>
        001766                          .EVEN

                                        ;ROUTINE TO GET TYPED OCTAL ADDRESS AND CONVERT TO OCTAL. CALL:
                                        ;       JSR     R5,RECD
                                        ;       .WORD   0               ;CONVERTED DATA IS PLACED HERE
001766  010046                  RECD:   MOV     R0,-(SP)        ;SAVE R0 ON THE STACK
001770  005015                          CLR     (R5)            ;CLEAR OLD DATA
001772  105737  177560          1$:     TSTB    @#TKS           ;WAIT FOR USER TO TYPE CHARACTER
001776  100375                          BPL     1$
002000  113700  177562                  MOVB    @#TKB,R0        ;GET CHARACTER
002004  042700  000200                  BIC     #200,R0         ;STRIP MSB
002010  122700  000177                  CMPB    #177,R0         ;CHECK IF RUBOUT
002014  001010                          BNE     2$              ;BRANCH IF NOT RUBOUT
002016  112737  000134  177566          MOVB    #'\,@#TPB       ;TYPE \
002024  000241                          CLC                     ;CLEAR CARRY
002026  006015                          ROR     (R5)            ;SHIFT LAST TYPED CHARACTER
002030  006215                          ASR     (R5)            ;OUT OF DATA WORD
002032  006215                          ASR     (R5)
002034  000756                          BR      1$              ;GO WAIT FOR NEXT CHARACTER

002036  110037  177566          2$:     MOVB    R0,@#TPB        ;ECHO CHARACTER TYPED
002042  122700  000015                  CMPB    #15,R0          ;CHECK IF CARRIAGE RETURN
002046  001005                          BNE     3$              ;BRANCH IF NOT CARRIAGE RETURN
002050  004767  177156                  JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
002054  001760                          $CRLF
002056  005725                          TST     (R5)+           ;STEP RETURN ADDRESS
002060  000205                          RTS     R5              ;RETURN

002062  042700  177770          3$:     BIC     #177770,R0      ;STRIP NON-ESSENTIAL BITS
002066  006315                          ASL     (R5)            ;SHIFT LAST CHARACTER 3 PLACES
002070  006315                          ASL     (R5)            ;LEFT
002072  006315                          ASL     (R5)
002074  050015                          BIS     R0,(R5)         ;AND INSERT NEW CHARACTER
002076  000735                          BR      1$              ;WAIT FOR NEXT CHARACTER


002100  000002                          RTI                             ;RETURN
```

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                                                .TITLE  DDQAA-A BASIC 11 FAMILY INSTRUCTION EXER.

002102  005037  177776          START:  CLR     @#PSW           ;KERNEL MODE
002106  005000                          CLR     R0              ;CLEAR R0-R5
002110  005001                          CLR     R1
002112  005002                          CLR     R2
002114  005003                          CLR     R3
002116  005004                          CLR     R4
002120  005005                          CLR     R5
002122  012706  000600                  MOV     #KPTR,SP        ;SET KERNEL STACK PTR

                                ;ROUTINE TO DETERMINE LAST MEMORY ADDRESS
002126  012737  002146  000004          MOV     #1$,@#ERRVEC
002134  005037  000006                  CLR     @#ERRVEC+2
002140  005000                          CLR     R0
002142  005720                          TST     (R0)+           ;WILL TIME OUTWHEN END OF MEMORY
002144  000776                          BR      .-2
002146  162700  000002          1$:     SUB     #2,R0
002152  010027                          MOV     R0,(PC)+        ;SET VALUE INTO LSTMEM
002154  000000                  LSTMEM: .WORD   0               ;CONTAINS VALUE OF LAST MEMORY ADDRESS
002156  162737  004000  002154          SUB     #4000,@#LSTMEM  ;SET PROTECTION FOR LOADERS
002164  012737  020000  001012          MOV     #20000,@#FRSTMEM;SET LOWER BOUNDARY AT 20000
002172  000422                          BR      START3          ;GO TO START 3
002174                          START1:
002174  004767  177032                  JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
002200  016646                          MSG1
002202  004567  177560                  JSR     R5,RECD         ;GET LOWER LIMIT
002206  000000                  1$:     .WORD   0               ;CONTAINS TYPED LOWER LIMIT
002210  016737  177772  001012          MOV     1$,@#FRSTMEM    ;SET IN LOWER LIMIT
002216  004767  177010                  JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
002222  016663                          MSG2
002224  004567  177536                  JSR     R5,RECD         ;GET UPPER LIMIT
002230  000000                  2$:     .WORD   0               ;CONTAINS UPPER LIMIT
002232  016737  177772  002154          MOV     2$,@#LSTMEM

002240  005037  001000          START3: CLR     @#ICNT          ;CLEAR PASS COUNT
002244  012737  000006  000004  START2: MOV     #ERRVEC+2,@#ERRVEC      ;SET ERROR TRAP TO HALT AT 6
002252  012706  000500                  MOV     #STKPTR,SP      ;SET STACK PTR
002256  013737  001000  177570          MOV     @#ICNT,@#DISPLAY;DISPLAY PASS COUNT
002264  012737  001016  000030          MOV     #SCOPEA,@#EMTVEC;SET EMT(SCOPE) TRAP VECTOR
002272  012737  001412  000034          MOV     #ERROR,@#TRAPVEC        ;SET TRAP (HLT) VECTOR
002300  012737  000200  000036          MOV     #200,@#TRAPVEC+2        ;PRIORITY LEVEL 4 ON TRAP

                                ;000000000000 FIRST ADDRESS TO BE RELOCATED 000000000
002306  010700                  RELO:   MOV     PC,R0           ;GET PC
002310  005740                          TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF RELO
002312  010037  001010                  MOV     R0,@#FRSTAD     ;SAVE
002316  010700                          MOV     PC,R0           ;GET CURRENT PC
002320  162700  002320                  SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
002324  010037  001004                  MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
002330  010701                          MOV     PC,R1           ;SET NEW SCOPE PTR
                                ;CHECK BRANCH INSTRUCTIONS
002332  000257                          CCC                     ;CC'S=0000
002334  103407                          BCS     CC0             ;SAME AS BLO
002336  102406                          BVS     CC0
002340  001405                          BEQ     CC0
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  814  002342  100404                    BMI     CC0
  815  002344  002403                    BLT     CC0
  816  002346  003402                    BLE     CC0
  817  002350  101401                    BLOS    CC0
  818  002352  101001                    BHI     .+4
  819  002354  104400            CC0:    HLT                     ;ONE OF THE ABOVE BRANCHES FAILED
  820
  821                             ;CONTINUE
  822  002356  000270                    SEN                     ;CC'S=1000
  823  002360  100003                    BPL     CC1
  824  002362  002002                    BGE     CC1
  825  002364  003001                    BGT     CC1
  826  002366  002401                    BLT     .+4
  827  002370  104400            CC1:    HLT                     ;ONE OF THE ABOVE BRANCHES FAILED
  828
  829                             ;CONTINUE
  830  002372  000262                    SEV                     ;CC'S=1010
  831  002374  102003                    BVC     CC2
  832  002376  002402                    BLT     CC2
  833  002400  003401                    BLE     CC2
  834  002402  002001                    BGE     .+4
  835  002404  104400            CC2:    HLT                     ;ERROR! ONE OF THE ABOVE BRANCHES FAILED
  836
  837                             ;CONTINUE
  838  002406  000261                    SEC                     ;CC'S=1011
  839  002410  103002                    BCC     CC3
  840  002412  101001                    BHI     CC3
  841  002414  003001                    BGT     .+4
  842  002416  104400            CC3:    HLT                     ;ERROR! ONE OF THE ABOVE BRANCHES FAILED
  843
  844                             ;CONTINUE
  845  002420  000264                    SEZ                     ;CC'S=1111
  846  002422  001003                    BNE     CC4
  847  002424  003002                    BGT     CC4
  848  002426  101001                    BHI     CC4
  849  002430  003401                    BLE     .+4
  850  002432  104400            CC4:    HLT                     ;ERROR! ONE OF THE ABOVE BRANCHES FAILED
  851  002434  104000                    SCOPE
  852
  853                             ;TEST UNARY CONDITION CODES
  854                             ;CLR    R0
  855  002436  000277                    SCC
  856  002440  000244                    CLZ
  857  002442  005000                    CLR     R0              ;R0=0,CC'S=0100
  858  002444  103404                    BCS     CLR0
  859  002446  102403                    BVS     CLR0
  860  002450  001002                    BNE     CLR0
  861  002452  100401                    BMI     CLR0
  862  002454  003401                    BLE     .+4
  863  002456  104400            CLR0:   HLT                     ;ERROR! INCORRECT CC'S AFTER CLR
  864
  865  002460  000277                    SCC
  866  002462  000244                    CLZ
  867  002464  005700                    TST     R0              ;R0=0,CC'S=0100
  868  002466  103404                    BCS     TST0
  869  002470  102403                    BVS     TST0
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  870  002472  001002                    BNE     TSTO
  871  002474  100401                    BMI     TSTO
  872  002476  101401                    BLOS    .+4
  873  002500  104400            TSTO:   HLT                     ;ERROR! INCORRECT CC'S AFTER TST
  874
  875  002502  000257                    CCC
  876  002504  000266                    +SEZ!SEV
  877  002506  005100                    COM     R0              ;R0=-1,CC'S=1001
  878  002510  103004                    BCC     COM0
  879  002512  102403                    BVS     COM0
  880  002514  001402                    BEQ     COM0
  881  002516  100001                    BPL     COM0
  882  002520  002401                    BLT     .+4
  883  002522  104400            COM0:   HLT                     ;ERROR! INCORRECT CC'S AFTER COM
  884
  885  002524  000261                    SEC
  886  002526  005500                    ADC     R0              ;R0=000000,CC'S=0101
  887  002530  103003                    BCC     ADC0
  888  002532  102402                    BVS     ADC0
  889  002534  001001                    BNE     ADC0
  890  002536  002001                    BGE     .+4
  891  002540  104400            ADC0:   HLT                     ;ERROR! INCORRECT CC'S AFTER ADC
  892
  893  002542  000261                    SEC
  894  002544  006000                    ROR     R0              ;R0=100000,CC'S=1010
  895  002546  103404                    BCS     ROR0
  896  002550  102003                    BVC     ROR0
  897  002552  001402                    BEQ     ROR0
  898  002554  100001                    BPL     ROR0
  899  002556  003001                    BGT     .+4
  900  002560  104400            ROR0:   HLT                     ;ERROR! INCORRECT CC'S AFTER ROR
  901  002562  000277                    SCC
  902  002564  000242                    CLV
  903  002566  005300                    DEC     R0                      ;R0=077777,CC'S=0011
  904  002570  103004                    BCC     DEC0
  905  002572  102003                    BVC     DEC0
  906  002574  001402                    BEQ     DEC0
  907  002576  100401                    BMI     DEC0
  908  002600  003401                    BLE     .+4
  909  002602  104400            DEC0:   HLT                     ;ERROR! INCORRECT CC'S AFTER DEC
  910
  911  002604  000257                    CCC
  912  002606  005200                    INC     R0              ;R0=100000,CC'S=1010
  913  002610  103404                    BCS     INC0
  914  002612  102003                    BVC     INC0
  915  002614  001402                    BEQ     INC0
  916  002616  100001                    BPL     INC0
  917  002620  003001                    BGT     .+4
  918  002622  104400            INC0:   HLT                     ;ERROR! INCORRECT CC'S AFTER INC
  919
  920  002624  000277                    SCC
  921  002626  000242                    CLV
  922  002630  005400                    NEG     R0              ;R0=100000,CC'S=1011
  923  002632  103003                    BCC     NEG0
  924  002634  102002                    BVC     NEG0
  925  002636  001401                    BEQ     NEG0
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926  002640  002001                    BGE     .+4
927  002642  104400          NEGO:     HLT                     ;ERROR! INCORRECT CC'S AFTER NEG
928
929  002644  000261                    SEC
930  002646  006300                    ASL     R0              ;R0=000000,CC'S=0111
931  002650  103004                    BCC     ASLO
932  002652  102003                    BVC     ASLO
933  002654  001002                    BNE     ASLO
934  002656  100401                    BMI     ASLO
935  002660  101401                    BLOS    .+4
936  002662  104400          ASLO:     HLT                     ;ERROR! INCORRECT CC'S AFTER ASL
937
938  002664  006100                    ROL     R0              ;R0=000001,CC'S=0000
939  002666  103402                    BCS     ROLO
940  002670  003401                    BLE     ROLO
941  002672  002001                    BGE     .+4
942  002674  104400          ROLO:     HLT                     ;ERROR! INCORRECT CC'S AFTER ROL
943
944  002676  006200                    ASR     R0              ;R0=000000,CC'S=0111
945  002700  103003                    BCC     ASRO
946  002702  102002                    BVC     ASRO
947  002704  001001                    BNE     ASRO
948  002706  002401                    BLT     .+4
949  002710  104400          ASRO:     HLT                     ;ERROR! INCORRECT CC'S AFTER ASR
950
951  002712  000277                    SCC
952  002714  005600                    SBC     R0              ;R0=-1,CC'S=1001
953  002716  103002                    BCC     SBCO
954  002720  102401                    BVS     SBCO
955  002722  003401                    BLE     .+4
956  002724  104400          SBCO:     HLT                     ;ERROR! INCORRECT CC'S AFTER SBC
957
958  002726  005400                    NEG     R0              ;R0=000001,CC'S=00001
959  002730  000300                    SWAB    R0              ;R0=000400',CC'S=0100
960  002732  103403                    BCS     SWABO
961  002734  102402                    BVS     SWABO
962  002736  001001                    BNE     SWABO
963  002740  002001                    BGE     .+4
964  002742  104400          SWABO:    HLT                     ;ERROR! INCORRECT CC'S AFTER SWAB
965  002744  104000                    SCOPE
966
967                            ;CHECK REGISTER SELECTION
968  002746  005000                    CLR     R0
969  002750  000277                    SCC
970  002752  006100                    ROL     R0              ;R0=1
971  002754  010002                    MOV     R0,R2
972  002756  006302                    ASL     R2              ;R2=2
973  002760  010203                    MOV     R2,R3
974  002762  006303                    ASL     R3              ;R3=4
975  002764  010304                    MOV     R3,R4
976  002766  006304                    ASL     R4              ;R4=10
977  002770  010405                    MOV     R4,R5
978  002772  006305                    ASL     R5              ;R5=20
979  002774  010546                    MOV     R5,-(SP)        ;SET BITS SET IN REGISTERS
980  002776  050416                    BIS     R4,(SP)         ;INTO STACK ADDRESS
981  003000  050316                    BIS     R3,(SP)
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```
                                        BIS     R2,(SP)
                                        BIS     R0,(SP)
003006  022726  000037                 CMP     #37,(SP)+
003012  001401                         BEQ     .+4                     ;WERE SET
003014  104400                         HLT                             ;MISSING BIT(S) REPRESENT
                                                                        ;INCORRECT REGISTER SELECTION

                                ;CHECK THAT ALL BITS CAN BE SET & CLEARED IN ALL REGISTERS
003016  000257                         CCC
003020  112700  000377                 MOVB    #377,R0         ;SET ALL BITS (MOVB EXTENDS SIGN)
003024  006100                 1$:     ROL     R0                      ;ROTATE A 0 THROUGH ALL BIT
003026  103776                         BCS     1$                      ;POSITIONS
003030  005200                         INC     R0                      ;FINAL RESULT IS -1
003032  001401                         BEQ     .+4
003034  104400                         HLT                             ;ERROR!

003036  012700  000020                 MOV     #16.,R0         ;SET SHIFT COUNT
003042  005002                         CLR     R2
003044  000261                 2$:     SEC
003046  006002                         ROR     R2              ;ROTATE 1 THROUGH ALL BIT POSITS
003050  005300                         DEC     R0              ;DECREMENT SHIFT COUNT
003052  001374                         BNE     2$
003054  005102                         COM     R2              ;R2 SHOULD CONTAIN -1
003056  001401                         BEQ     .+4
003060  104400                         HLT                     ;ERROR! CHECK R2 SHOULD = 0

003062  012703  100000                 MOV     #100000,R3
003066  006203                 3$:     ASR     R3              ;EXTEND 1 BIT THROUGH ALL POSITIONS
003070  103376                         BCC     3$
003072  005203                         INC     R3
003074  001401                         BEQ     .+4
003076  104400                         HLT                             ;ERROR!

003100  112704  177401                 MOVB    #177401,R4      ;R4=1
003104  060404                 4$:     ADD     R4,R4           ;HAS THE AFFECT OF SHIFTING A BIT
003106  103376                         BCC     4$              ;THROUGH ALL POSITIONS
003110  005704                         TST     R4              ;RESULT SHOULD BE 0
003112  001401                         BEQ     .+4
003114  104400                         HLT

003116  012705  000001                 MOV     #1,R5
003122  006305                 5$:     ASL     R5
003124  102376                         BVC     5$
003126  006305                         ASL     R5
003130  103002                         BCC     6$
003132  005705                         TST     R5
003134  001401                         BEQ     .+4
003136  104400                 6$:     HLT     .

                                ;CHECK REGISTER VOLITILITY
003140  005002                         CLR     R2
003142  005102                         COM     R2              ;R2=-1
003144  010203                         MOV     R2,R3
003146  000257                         CCC
003150  006002                         ROR     R2              ;R2=LOOP COUNT
003152  006202                         ASR     R2
```

```
 1038  003154  010304                    7$:     MOV     R3,R4
 1039  003156  005302                            DEC     R2              ;DECREMENT LOOP COUNT
 1040  003160  001375                            BNE     7$
 1041  003162  005203                            INC     R3              ;CHECK R3
 1042  003164  001002                            BNE     8$
 1043  003166  005204                            INC     R4              ;CHECK R4
 1044  003170  001401                            BEQ     .+4
 1045  003172  104400                    8$:     HLT
 1046
 1047                                    ;CHECK TRANSFER OF REGISTER DATA BETWEEN THE GS AND GD REGISTERS (11/45)
 1048  003174  032737  000020  177776    GSTST:  BIT     #20,@#PSW       ;CHECK IF 'T' BIT IS SET
 1049  003202  001052                            BNE     7$              ;SKIP TEST IF 'T' BIT SET
 1050  003204  010146                            MOV     R1,-(SP)        ;SAVE SCOPE PTR
 1051  003206  010627                            MOV     SP,(PC)+        ;SAVE STACK PTR
 1052  003210  000000                    1$:     .WORD   0               ;CONTAINS SAVED STACK PTR
Z 1053  003212  010727                            MOV     PC,(PC)+        ;LOAD DATA. THE CURRENT PC IS USED AS
 1054  003214  000000                    2$:     .WORD   0               ;DATA. IF THIS TEST FAILS 2$ CON-
 1055                                                                    ;TAINS THE DATA BEING USED.
 1056  003216  005267  177772                    INC     2$              ;MAKE ODD TO CHECK BIT 0
 1057  003222  016700  177766            3$:     MOV     2$,R0           ;LOAD GD REGISTER 0
 1058  003226  010001                            MOV     R0,R1           ;TRANSFER GS REG 0 TO GD REG 1
 1059  003230  010102                            MOV     R1,R2           ;AND GS REG 1 TO GD REG 2
 1060  003232  010203                            MOV     R2,R3           ;ETC...
 1061  003234  010304                            MOV     R3,R4
 1062  003236  010405                            MOV     R4,R5
 1063  003240  152737  000340  177776            BISB    #340,@#PSW      ;SET PRIORITY LEVEL 7
 1064  003246  010506                            MOV     R5,SP           ;TRANSFER GS REG 5 TO GD STK PTR
 1065  003250  010627                            MOV     SP,(PC)+        ;TRANSFER GS STK PTR TO MEMORY
 1066  003252  000000                    4$:     .WORD   0               ;CONTAINS GS STACK PTR
 1067  003254  016706  177730                    MOV     1$,SP           ;RESTORE STK PTR NEEDED FOR HLT/SCOPE
 1068  003260  142737  000340  177776            BICB    #340,@#PSW      ;SET PRIORITY LEVEL 0
 1069  003266  026700  177760                    CMP     4$,R0           ;COMPARE GS/GD STKPTR WITH GS REG 0
 1070  003272  001004                            BNE     5$              ;BRANCH IF THEY WERE NOT =
 1071  003274  006367  177714                    ASL     2$              ;SHIFT TEST DATA UNTIL = 000000
 1072  003300  001350                            BNE     3$
 1073  003302  000411                            BR      6$
 1074  003304  010046                    5$:     MOV     R0,-(SP)        ;GET GS REG 0
 1075  003306  010146                            MOV     R1,-(SP)        ;ETC...
 1076  003310  010246                            MOV     R2,-(SP)
 1077  003312  010346                            MOV     R3,-(SP)
 1078  003314  010446                            MOV     R4,-(SP)
 1079  003316  010546                            MOV     R5,-(SP)
 1080  003320  104400                            HLT                     ;ERROR! DATA IN GS STK PTR NOT = GS REG 0
 1081                                                                    ;GS REG 0-GS REG 5 ARE ON THE STACK
 1082  003322  016706  177662                    MOV     1$,SP           ;RESTORE STACK PTR
 1083  003326  012601                    6$:     MOV     (SP)+,R1        ;RESTORE SCOPE PTR
 1084  003330  104000                    7$:     SCOPE
 1085
 1086                                    ;TEST UNARY WORD INSTRUCTIONS USING ADDRESS MODE 1
 1087  003332  000401                            BR      .+4
 1088  003334  000000                            .WORD   0               ;RESERVE ADDRESS FOR TESTS
 1089  003336  010702                            MOV     PC,R2
 1090  003340  162702  000004                    SUB     #4,R2           ;R2 POINTS TO RESERVED WORD
 1091  003344  005012                            CLR     (R2)            ;PRESET (R2)
 1092
 1093  003346  000261                            SEC
```

```
1094  003350  006012                    ROR     (R2)            ;(R2)=100000,CC=1010
1095  003352  101402                    BLOS    ROR1
1096  003354  100001                    BPL     ROR1
1097  003356  002001                    BGE     .+4
1098  003360  104400            ROR1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1099
1100  003362  000257                    CCC
1101  003364  000261                    SEC
1102  003366  005312                    DEC     (R2)            ;(R2)=077777,CC=0011
1103  003370  103001                    BCC     DEC1
1104  003372  003401                    BLE     .+4
1105  003374  104400            DEC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1106
1107  003376  000257                    CCC
1108  003400  000261                    SEC
1109  003402  005512                    ADC     (R2)            ;(R2)=100000,CC=1010
1110  003404  103403                    BCS     ADC1
1111  003406  102002                    BVC     ADC1
1112  003410  100001                    BPL     ADC1
1113  003412  001001                    BNE     .+4
1114  003414  104400            ADC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1115
1116  003416  006112                    ROL     (R2)            ;(R2)=000000,CC=0111
1117  003420  103003                    BCC     ROL1
1118  003422  102002                    BVC     ROL1
1119  003424  001001                    BNE     ROL1
1120  003426  100001                    BPL     .+4
1121  003430  104400            ROL1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1122
1123  003432  006112                    ROL     (R2)            ;(R2)=000001,CC=0000
1124  003434  101402                    BLOS    ROL1A           ;BRANCH IF C OR Z IS SET
1125  003436  102401                    BVS     ROL1A
1126  003440  100001                    BPL     .+4
1127  003442  104400            ROL1A:  HLT
1128
1129  003444  006212                    ASR     (R2)            ;(R2)=000000,CC=0111
1130  003446  103003                    BCC     ASR1
1131  003450  102002                    BVC     ASR1
1132  003452  001001                    BNE     ASR1
1133  003454  100001                    BPL     .+4
1134  003456  104400            ASR1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1135
1136  003460  006012                    ROR     (R2)            ;(R2)=100000,CC=1010
1137  003462  103403                    BCS     ROR1A
1138  003464  102002                    BVC     ROR1A
1139  003466  001401                    BEQ     ROR1A
1140  003470  100401                    BMI     .+4
1141  003472  104400            ROR1A:  HLT
1142
1143  003474  000261                    SEC
1144  003476  005212                    INC     (R2)            ;(R2)=100001,CC=1001
1145  003500  103003                    BCC     INC1
1146  003502  102402                    BVS     INC1
1147  003504  001401                    BEQ     INC1
1148  003506  100401                    BMI     .+4
1149  003510  104400            INC1:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
```

```
1150
1151  003512  005612                    SBC     (R2)            ;(R2)=100000,CC=1000
1152  003514  103403                    BCS     SBC1
1153  003516  102402                    BVS     SBC1
1154  003520  001401                    BEQ     SBC1
1155  003522  100401                    BMI     .+4
1156  003524  104400          SBC1:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1157
1158  003526  000261                    SEC
1159  003530  005612                    SBC     (R2)            ;(R2)=077777,CC=0010
1160  003532  103403                    BCS     SBC1A
1161  003534  102002                    BVC     SBC1A
1162  003536  001401                    BEQ     SBC1A
1163  003540  100001                    BPL     .+4
1164  003542  104400          SBC1A:    HLT                     ;ERROR! INCORRECT CC'S AS SHOEN ABOVE
1165
1166  003544  000261                    SEC
1167  003546  005512                    ADC     (R2)            ;(R2)=100000,CC=1010
1168  003550  100401                    BMI     .+4
1169  003552  104400                    HLT
1170
1171  003554  000261                    SEC
1172  003556  006312                    ASL     (R2)            ;(R2)=000000,CC=0111
1173  003560  103003                    BCC     ASL1
1174  003562  102002                    BVC     ASL1
1175  003564  001001                    BNE     ASL1
1176  003566  100001                    BPL     .+4
1177  003570  104400          ASL1:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1178
1179  003572  005112                    COM     (R2)            ;(R2)=177777,CC=1001
1180  003574  103002                    BCC     COM1
1181  003576  102401                    BVS     COM1
1182  003600  100401                    BMI     .+4
1183  003602  104400          COM1:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1184
1185  003604  000250                    CLN
1186  003606  005712                    TST     (R2)            ;(R2)=177777,CC=1000
1187  003610  103403                    BCS     TST1
1188  003612  102402                    BVS     TST1
1189  003614  100001                    BPL     TST1
1190  003616  001001                    BNE     .+4
1191  003620  104400          TST1:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1192
1193  003622  000262                    SEV
1194  003624  005412                    NEG     (R2)            ;(R2)=000001,CC=0000
1195  003626  103002                    BCC     NEG1
1196  003630  102401                    BVS     NEG1
1197  003632  001001                    BNE     .+4
1198  003634  104400          NEG1:     HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1199
1200  003636  005312                    DEC     (R2)            ;(R2)=000000,CC=0101
1201  003640  103001                    BCC     DEC1A
1202  003642  001401                    BEQ     .+4
1203  003644  104400          DEC1A:    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1204  003646  104000                    SCOPE
1205
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```
1206                                    ;CHECK UNARY BYTE INSTRUCTIONS USING ADDRESS MODE 1
1207  003650  000401                            BR      .+4             ;RESERVE A WORD
1208  003652  000000                            .WORD   0               ;ADDRESS RESERVED FOR TESTS
1209  003654  010703                            MOV     PC,R3
1210  003656  162703  000004                    SUB     #4,R3           ;R3 POINTS TO EVEN BYTE OF WORD
1211  003662  010304                            MOV     R3,R4           ;R4 POINTS TO ODD BYTE OF WORD
1212  003664  005204                            INC     R4
1213  003666  005013                            CLR     (R3)            ;PRESET DATA
1214
1215  003670  000261                    1$:     SEC
1216  003672  105513                            ADCB    (R3)            ;ADD CARRY TO EVEN BYTE
1217  003674  100402                            BMI     2$              ;UNTIL EVEN BYTE BECOMES NEGATIVE
1218  003676  105214                            INCB    (R4)            ;INCREMENT ODD BYTE
1219  003700  000773                            BR      1$
1220  003702  102401                    2$:     BVS     .+4             ;(R3)=077600=[0774][200],CC=1010
1221  003704  104400                            HLT
1222  003706  000242                            CLV
1223  003710  105214                            INCB    (R4)            ;(R3)=100200=[1000][200],CC=1010
1224  003712  103402                            BCS     INCB1
1225  003714  102001                            BVC     INCB1
1226  003716  100401                            BMI     .+4
1227  003720  104400                    INCB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1228
1229  003722  106114                            ROLB    (R4)            ;(R3)=000200=[0000][200],CC=0111
1230  003724  103002                            BCC     ROLB1
1231  003726  102001                            BVC     ROLB1
1232  003730  001401                            BEQ     .+4
1233  003732  104400                    ROLB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1234
1235  003734  105614                            SBCB    (R4)            ;(R3)=177600=[1774][200], CC=1001
1236  003736  103002                            BCC     SBCB1
1237  003740  102401                            BVS     SBCB1
1238  003742  100401                            BMI     .+4
1239  003744  104400                    SBCB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1240
1241  003746  106313                            ASLB    (R3)            ;(R3)=177400,CC=0111
1242  003750  103002                            BCC     ASLB1
1243  003752  102001                            BVC     ASLB1
1244  003754  001401                            BEQ     .+4
1245  003756  104400                    ASLB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1246
1247  003760  105413                            NEGB    (R3)            ;(R3)=177400,CC=0100
1248  003762  103402                            BCS     NEGB1
1249  003764  102401                            BVS     NEGB1
1250  003766  001401                            BEQ     .+4
1251  003770  104400                    NEGB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1252
1253  003772  000277                            SCC
1254  003774  105313                            DECB    (R3)            ;(R3)=177777,CC=1001
1255  003776  103002                            BCC     DECB1
1256  004000  102401                            BVS     DECB1
1257  004002  001001                            BNE     .+4
1258  004004  104400                    DECB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1259
1260  004006  000241                            CLC
1261  004010  106013                            RORB    (R3)            ;(R3)=177577,CC=0011
```

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1262  004012  103002                    BCC     RORB1
1263  004014  102001                    BVC     RORB1
1264  004016  100001                    BPL     .+4
1265  004020  104400            RORB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1266
1267  004022  000241                    CLC
1268  004024  105114                    COMB    (R4)            ;(R3)=000177,CC=0101
1269  004026  103002                    BCC     COMB1
1270  004030  102401                    BVS     COMB1
1271  004032  001401                    BEQ     .+4
1272  004034  104400            COMB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1273
1274  004036  106213            1$:     ASRB    (R3)            ;SHIFT EVEN BYTE UNTIL V CLEARS
1275  004040  102002                    BVC     2$
1276  004042  105514                    ADCB    (R4)            ;AND ADD CARRY TO ODD BYTE
1277  004044  000774                    BR      1$
1278  004046  103401            2$:     BCS     ASRB1
1279  004050  001401                    BEQ     .+4
1280  004052  104400            ASRB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1281
1282  004054  106214                    ASRB    (R4)
1283  004056  106214                    ASRB    (R4)            ;(R3)=000400,CC=0011
1284  004060  103002                    BCC     ASRB1A
1285  004062  102001                    BVC     ASRB1A
1286  004064  001001                    BNE     .+4
1287  004066  104400            ASRB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1288
1289  004070  105314                    DECB    (R4)            ;(R3)=000000,CC=0100
1290  004072  001401                    BEQ     .+4
1291  004074  104400                    HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1292
1293  004076  000261                    SEC
1294  004100  106014                    RORB    (R4)            ;(R3)=100000,CC=1010
1295  004102  103402                    BCS     RORB1A
1296  004104  102001                    BVC     RORB1A
1297  004106  100401                    BMI     .+4
1298  004110  104400            RORB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1299
1300  004112  000242                    CLV
1301  004114  105314                    DECB    (R4)            ;(R3)=077400,CC=0100
1302  004116  102401                    BVS     .+4
1303  004120  104400                    HLT
1304
1305  004122  000261                    SEC
1306  004124  105313                    DECB    (R3)            ;(R3)=077777,CC=1001
1307  004126  103002                    BCC     DECB1A
1308  004130  102401                    BVS     DECB1A
1309  004132  100401                    BMI     .+4
1310  004134  104400            DECB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1311
1312  004136  000277                    SCC
1313  004140  000313                    SWAB    (R3)            ;(R3)=177577=[1774][177],CC=0000
1314  004142  103402                    BCS     SWAB1
1315  004144  102401                    BVS     SWAB1
1316  004146  100001                    BPL     .+4
1317  004150  104400            SWAB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
```

```
1318
1319  004152  105714                    TSTB    (R4)            ;(R3)=177577=[1774][177],CC=1000
1320  004154  103402                    BCS     TSTB1
1321  004156  102401                    BVS     TSTB1
1322  004160  100401                    BMI     .+4
1323  004162  104400            TSTB1:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1324
1325  004164  105014                    CLRB    (R4)            ;(R3)=000177=[0000][177],CC=0100
1326  004166  001401                    BEQ     .+4
1327  004170  104400                    HLT
1328  004172  106313                    ASLB    (R3)            ;(R3)=000376 ,CC=1010
1329  004174  103402                    BCS     ASLB1A
1330  004176  102001                    BVC     ASLB1A
1331  004200  100401                    BMI     .+4
1332  004202  104400            ASLB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1333
1334  004204  105113                    COMB    (R3)            ;(R3)=000001,CC=0001
1335  004206  103002                    BCC     COMB1A
1336  004210  102401                    BVS     COMB1A
1337  004212  100001                    BPL     .+4
1338  004214  104400            COMB1A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1339
1340  004216  000313                    SWAB    (R3)            ;(R3)=000400, CC=0100
1341  004220  001401                    BEQ     .+4
1342  004222  104400                    HLT
1343
1344  004224  105213                    INCB    (R3)
1345  004226  000261                    SEC
1346  004230  105613                    SBCB    (R3)            ;(R3)=000400,CC=0100
1347  004232  001401                    BEQ     .+4
1348  004234  104400                    HLT
1349  004236  022713  000400            CMP     #400,(R3)       ;CHECK REMAINING RESULT
1350  004242  001401                    BEQ     .+4
1351  004244  104400                    HLT
1352  004246  104000                    SCOPE
1353
1354                          ;CHECK UNARY WORD OPS USING ADDRESS MODES 2 AND 4 (AUTO INC/DEC)
1355  004250  000401                    BR      .+4
1356  004252  000000                    .WORD   0               ;ADDRESS RESERVED FOR TESTS
1357  004254  010704                    MOV     PC,R4
1358  004256  162704  000004            SUB     #4,R4           ;R4 AND R5 POINT TO
1359  004262  010405                    MOV     R4,R5           ;RESERVED WORD
1360  004264  005015                    CLR     (R5)            ;PRESET DATA=0
1361
1362  004266  000277                    SCC
1363  004270  000244                    CLZ
1364  004272  005725                    TST     (R5)+           ;(R5)=000000,CC=0100
1365  004274  103402                    BCS     TST2
1366  004276  102401                    BVS     TST2
1367  004300  001401                    BEQ     .+4
1368  004302  104400            TST2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1369
1370  004304  005145                    COM     -(R5)           ;(R5)=177777,CC=1001
1371  004306  103001                    BCC     COM4
1372  004310  100401                    BMI     .+4
1373  004312  104400            COM4:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
```

```
1374
1375  004314  000241                    CLC
1376  004316  006024                    ROR     (R4)+           ;(R4)=077777,CC=0011
1377  004320  103002                    BCC     ROR2
1378  004322  102001                    BVC     ROR2
1379  004324  100001                    BPL     .+4
1380  004326  104400            ROR2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1381
1382  004330  000257                    CCC
1383  004332  005244                    INC     -(R4)           ;(R4)=100000,CC=1010
1384  004334  102002                    BVC     INC4
1385  004336  001401                    BEQ     INC4
1386  004340  100401                    BMI     .+4
1387  004342  104400            INC4:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1388
1389  004344  000261                    SEC
1390  004346  000324                    SWAB    (R4)+           ;(R4)=000200,CC=1000
1391  004350  103401                    BCS     SWAB2
1392  004352  100401                    BMI     .+4
1393  004354  104400            SWAB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1394
1395  004356  005425                    NEG     (R5)+           ;(R5)=177600,CC=1001
1396  004360  103001                    BCC     NEG2
1397  004362  100401                    BMI     .+4
1398  004364  104400            NEG2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1399
1400  004366  005044                    CLR     -(R4)           ;(R4)=000000,CC=0100
1401  004370  001401                    BEQ     .+4
1402  004372  104400                    HLT
1403
1404  004374  000261                    SEC
1405  004376  006045                    ROR     -(R5)           ;(R5)=100000,CC=1010
1406  004400  000261                    SEC
1407  004402  005525                    ADC     (R5)+           ;(R5)=100001,CC=1000
1408  004404  102401                    BVS     ADC2
1409  004406  100401                    BMI     .+4
1410  004410  104400            ADC2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1411
1412  004412  000262                    SEV
1413  004414  006224                    ASR     (R4)+           ;(R4)=140000,CC=1001
1414  004416  103002                    BCC     ASR2
1415  004420  102401                    BVS     ASR2
1416  004422  100401                    BMI     .+4
1417  004424  104400            ASR2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1418
1419  004426  000262                    SEV
1420  004430  006144                    ROL     -(R4)           ;(R4)=100001, CC=1001
1421  004432  103002                    BCC     ROL4
1422  004434  102401                    BVS     ROL4
1423  004436  100401                    BMI     .+4
1424  004440  104400            ROL4:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1425
1426  004442  005645                    SBC     -(R5)           ;(R5)=100000,CC=1000
1427  004444  103001                    BCC     .+4
1428  004446  104400                    HLT                     ;ERROR! 'C' BIT FAILED TO CLEAR
1429
```

```
1430  004450  005325                        DEC     (R5)+           ;(R5)=077777,CC=0010
1431  004452  103402                        BCS     DEC2
1432  004454  102001                        BVC     DEC2
1433  004456  100001                        BPL     .+4
1434  004460  104400                DEC2:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1435
1436  004462  006324                        ASL     (R4)+           ;(R4)=177776,CC=1010
1437  004464  102401                        BVS     .+4
1438  004466  104400                        HLT
1439  004470  006344                        ASL     -(R4)           ;(R4)=177774,CC=1001
1440  004472  103003                        BCC     ASL4
1441  004474  102402                        BVS     ASL4
1442  004476  001401                        BEQ     ASL4
1443  004500  100401                        BMI     .+4
1444  004502  104400                ASL4:   HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1445
1446  004504  022724  177774              CMP     #177774,(R4)+
1447  004510  001401                        BEQ     .+4
1448  004512  104400                        HLT
1449  004514  020405                        CMP     R4,R5
1450  004516  001401                        BEQ     .+4
1451  004520  104400                        HLT
1452  004522  104000                        SCOPE
1453
1454                                ;CHECK UNARY BYTE OPS USING ADDRESS MODES 2 AND 4
1455  004524  000401                        BR      .+4             ;RESERVE A WORD
1456  004526  000000                        .WORD   0               ;RESERVED WORD
1457  004530  010705                        MOV     PC,R5
1458  004532  162705  000004              SUB     #4,R5           ;R5 POINTS TO EVEN BYTE OF RESERVED WORD
1459  004536  010500                        MOV     R5,R0
1460  004540  010002                        MOV     R0,R2
1461  004542  005202                        INC     R2              ;R2 POINTS TO ODD BYTE OF RESERVED WORD
1462  004544  005010                        CLR     (R0)            ;PRESET
1463
1464  004546  000277                        SCC
1465  004550  000241                        CLC
1466  004552  105125                        COMB    (R5)+           ;(R0)=000377,CC=1001
1467  004554  103002                        BCC     COMB2
1468  004556  102401                        BVS     COMB2
1469  004560  100401                        BMI     .+4
1470  004562  104400                COMB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1471
1472  004564  105542                        ADCB    -(R2)           ;(R0)=000000,CC=0101
1473  004566  001401                        BEQ     .+4
1474  004570  104400                        HLT                     ;ERROR! INCORRECT RESULT AS SHOWN ABOVE
1475  004572  105525                        ADCB    (R5)+           ;(R0)=000400,CC=0000
1476  004574  103401                        BCS     ADCB2
1477  004576  001001                        BNE     .+4
1478  004600  104400                ADCB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1479
1480  004602  000263                        +SEC!SEV
1481  004604  106045                        RORB    -(R5)           ;(R0)=100000,CC=1001
1482  004606  103003                        BCC     RORB4
1483  004610  102402                        BVS     RORB4
1484  004612  001401                        BEQ     RORB4
1485  004614  100401                        BMI     .+4
```

```
1486  004616  104400                RORB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1487
1488  004620  000277                        SCC
1489  004622  106122                        ROLB    (R2)+           ;(R0)=100001,CC=0000
1490  004624  103403                        BCS     ROLB2
1491  004626  102402                        BVS     ROLB2
1492  004630  001401                        BEQ     ROLB2
1493  004632  100001                        BPL     .+4
1494  004634  104400                ROLB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1495
1496  004636  000257                        CCC
1497  004640  106225                        ASRB    (R5)+           ;(R0)=140001, CC=1010
1498  004642  103402                        BCS     ASRB2
1499  004644  102001                        BVC     ASRB2
1500  004646  100401                        BMI     .+4
1501  004650  104400                ASRB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1502
1503  004652  105242                        INCB    -(R2)           ;(R0)=140002,CC=0000
1504  004654  000277                        SCC
1505  004656  106222                        ASRB    (R2)+           ;(R0)=140001,CC=0000
1506  004660  103402                        BCS     ASRB2A
1507  004662  102401                        BVS     ASRB2A
1508  004664  100001                        BPL     .+4
1509  004666  104400                ASRB2A: HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1510
1511  004670  000266                        +SEZ!SEV                ;SET Z,V
1512  004672  106345                        ASLB    -(R5)           ;(R0)=100001,CC=1001
1513  004674  103003                        BCC     ASLB4
1514  004676  102402                        BVS     ASLB4
1515  004700  001401                        BEQ     ASLB4
1516  004702  100401                        BMI     .+4
1517  004704  104400                ASLB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1518
1519  004706  105322                        DECB    (R2)+           ;(R0)=077401=[0774][001] ,CC=0010
1520  004710  103002                        BCC     DECB2
1521  004712  102001                        BVC     DECB2
1522  004714  100001                        BPL     .+4
1523  004716  104400                DECB2:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWNABOVE
1524
1525  004720  105645                        SBCB    -(R5)           ;(R0)=077400, CC=0100
1526  004722  103402                        BCS     SBCB4
1527  004724  102401                        BVS     SBCB4
1528  004726  001401                        BEQ     .+4
1529  004730  104400                SBCB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1530
1531  004732  105442                        NEGB    -(R2)           ;(R0)=10400,CC=1001
1532  004734  103002                        BCC     NEGB4
1533  004736  102401                        BVS     NEGB4
1534  004740  100401                        BMI     .+4
1535  004742  104400                NEGB4:  HLT                     ;ERROR! INCORRECT CC'S AS SHOWN ABOVE
1536
1537  004744  105725                        TSTB    (R5)+           ;(R0)=100400,CC=0100
1538  004746  103401                        BCS     TSTB2
1539  004750  001401                        BEQ     .+4
1540  004752  104400                TSTB2:  HLT
1541
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1542  004754  105722                        TSTB    (R2)+           ;(R0)=100400,CC=1000
1543  004756  001401                        BEQ     TSTB2A
1544  004760  100401                        BMI     .+4
1545  004762  104400              TSTB2A:   HLT
1546
1547  004764  000261                        SEC
1548  004766  000342                        SWAB    -(R2)           ;(R0)=000201,CC=1000
1549  004770  103401                        BCS     SWAB4
1550  004772  100401                        BMI     .+4
1551  004774  104400              SWAB4:    HLT
1552
1553  004776  000277                        SCC
1554  005000  105225                        INCB    (R5)+           ;(R0)=000601=[0004][201],CC=0000
1555  005002  103003                        BCC     INCB2
1556  005004  102402                        BVS     INCB2
1557  005006  001401                        BEQ     INCB2
1558  005010  100001                        BPL     .+4
1559  005012  104400              INCB2:    HLT
1560
1561  005014  022227  000601                CMP     (R2)+,#000601   ;CHECK END RESULT
1562  005020  001401                        BEQ     .+4
1563  005022  104400                        HLT
1564  005024  020205                        CMP     R2,R5           ;CHECK REGISTERS
1565  005026  001401                        BEQ     .+4
1566  005030  104400                        HLT
1567  005032  104000                        SCOPE
1568
1569                          ;CHECK UNARY WORD OPS USING ADDRESS MODES 3 AND 5
1570  005034  000402                        BR      .+6             ;RESERVE 2 WORDS
1571  005036  000000                        .WORD   0               ;1 FOR THE ADDRESS
1572  005040  000000                        .WORD   0               ;AND 1 FOR DATA
1573  005042  010703                        MOV     PC,R3
1574  005044  162703  000004                SUB     #4,R3
1575  005050  005013                        CLR     (R3)            ;PRESET DATA
1576  005052  010300                        MOV     R3,R0           ;R0 POINTS TO DATA WORD
1577  005054  005743                        TST     -(R3)
1578  005056  010013                        MOV     R0,(R3)
1579  005060  010304                        MOV     R3,R4
1580
1581  005062  000257                        CCC
1582  005064  005733                        TST     @(R3)+          ;(R0)=000000,CC=0100
1583  005066  001401                        BEQ     .+4
1584  005070  104400                        HLT
1585
1586  005072  000261                        SEC
1587  005074  006053                        ROR     @-(R3)          ;(R0)=100000,CC=1010
1588  005076  103402                        BCS     ROR5
1589  005100  102001                        BVC     ROR5
1590  005102  100401                        BMI     .+4
1591  005104  104400              ROR5:     HLT
1592
1593  005106  000257                        CCC
1594  005110  006234                        ASR     @(R4)+          ;(R0)=140000,CC=1010
1595  005112  102001                        BVC     ASR3
1596  005114  100401                        BMI     .+4
1597  005116  104400              ASR3:     HLT
```

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1598
1599  005120  000250                    CLN
1600  005122  006333                    ASL     @(R3)+          ;(R0)=100000,CC=1001
1601  005124  103002                    BCC     ASL3
1602  005126  102401                    BVS     ASL3
1603  005130  100401                    BMI     .+4
1604  005132  104400            ASL3:   HLT
1605
1606  005134  000277                    SCC
1607  005136  005354                    DEC     @-(R4)          ;(R0)=077777, CC=0010
1608  005140  103003                    BCC     DEC5
1609  005142  102002                    BVC     DEC5
1610  005144  001401                    BEQ     DEC5
1611  005146  100001                    BPL     .+4
1612  005150  104400            DEC5:   HLT
1613
1614  005152  005453                    NEG     @-(R3)          ;(R0)=100001, CC=1001
1615  005154  103002                    BCC     NEG5
1616  005156  102401                    BVS     NEG5
1617  005160  100401                    BMI     .+4
1618  005162  104400            NEG5:   HLT
1619
1620  005164  000262                    SEV
1621  005166  005134                    COM     @(R4)+          ;(R0)=077776, CC=0001
1622  005170  103001                    BCC     COM3
1623  005172  102001                    BVC     .+4
1624  005174  104400            COM3:   HLT
1625
1626  005176  005233                    INC     @(R3)+          ;(R0)=077777, CC=0001
1627  005200  103001                    BCC     INC3
1628  005202  100001                    BPL     .+4
1629  005204  104400            INC3:   HLT
1630
1631  005206  005554                    ADC     @-(R4)          ;(R0)=100000, CC=1010
1632  005210  103402                    BCS     ADC5
1633  005212  102001                    BVC     ADC5
1634  005214  100401                    BMI     .+4
1635  005216  104400            ADC5:   HLT
1636
1637  005220  000257                    CCC
1638  005222  006134                    ROL     @(R4)+          ;(R0)=000000,CC=0111
1639  005224  103002                    BCC     ROL3
1640  005226  102001                    BVC     ROL3
1641  005230  001401                    BEQ     .+4
1642  005232  104400            ROL3:   HLT
1643
1644  005234  005253                    INC     @-(R3)          ;(R0)=000001, CC=0001
1645  005236  005654                    SBC     @-(R4)          ;(R0)=000000, CC=0100
1646  005240  103401                    BCS     SBC5
1647  005242  001401                    BEQ     .+4
1648  005244  104400            SBC5:   HLT
1649  005246  104000                    SCOPE
1650
1651                            ;CHECK UNARY BYTE OPS USING ADDRESS MODES 3 AND 5
1652  005250  000403                    BR      .+10            ;RESERVE 3 WORDS
1653  005252  000000                    .WORD   0               ;1 FOR EVEN BYTE ADDRESS
```

```
1654  005254  000000                  .WORD   0               ;1 FOR ODD BYTE ADDRESS
1655  005256  000000                  .WORD   0               ;AND 1 FOR DATA
1656  005260  010702                  MOV     PC,R2
1657  005262  005742                  TST     -(R2)           ;BACK R2 UP TO
1658  005264  005742                  TST     -(R2)           ;DATA WORD
1659  005266  010200                  MOV     R2,R0           ;R0 POINTS TO THE DATA WORD
1660  005270  005010                  CLR     (R0)            ;PRESET DATA
1661  005272  005742                  TST     -(R2)           ;BACK R2 UP TO
1662  005274  005742                  TST     -(R2)           ;EVEN BYTE ADDRESS WORD
1663  005276  010022                  MOV     R0,(R2)+        ;LOAD ADDRESS
1664  005300  005200                  INC     R0              ;ODD BYTE ADDRESS
1665  005302  010022                  MOV     R0,(R2)+        ;LOAD ODD BYTE ADDRESS
1666  005304  010200                  MOV     R2,R0           ;RESET R0
1667  005306  010205                  MOV     R2,R5
1668
1669  005310  105152                  COMB    @-(R2)          ;(R0)=177400,CC=1001
1670  005312  103001                  BCC     COMB5
1671  005314  100401                  BMI     .+4
1672  005316  104400          COMB5:  HLT
1673
1674  005320  105752                  TSTB    @-(R2)          ;(R0)=177400, CC=0100
1675  005322  001401                  BEQ     .+4
1676  005324  104400                  HLT
1677
1678  005326  000262                  SEV
1679  005330  106255                  ASRB    @-(R5)          ;(R0)=177400, CC=1001
1680  005332  103002                  BCC     ASRB5
1681  005334  102401                  BVS     ASRB5
1682  005336  100401                  BMI     .+4
1683  005340  104400          ASRB5:  HLT
1684
1685  005342  105232                  INCB    @(R2)+          ;(R0)=177401, CC=000
1686  005344  103001                  BCC     INCB3
1687  005346  100001                  BPL     .+4
1688  005350  104400          INCB3:  HLT
1689
1690  005352  000241                  CLC
1691  005354  106055                  RORB    @-(R5)          ;(R0)=177400, CC=0111
1692  005356  103003                  BCC     RORB5
1693  005360  102002                  BVC     RORB5
1694  005362  001001                  BNE     RORB5
1695  005364  100001                  BPL     .+4
1696  005366  104400          RORB5:  HLT
1697
1698  005370  106332                  ASLB    @(R2)+          ;(R0)=177000, CC=1001
1699  005372  103002                  BCC     ASLB3
1700  005374  102401                  BVS     ASLB3
1701  005376  100401                  BMI     .+4
1702  005400  104400          ASLB3:  HLT
1703
1704  005402  105552                  ADCB    @-(R2)          ;(R0)=177400, CC=1000
1705  005404  103401                  BCS     ADCB5
1706  005406  100401                  BMI     .+4
1707  005410  104400          ADCB5:  HLT
1708
1709  005412  000277                  SCC
```

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1710  005414  106135                          ROLB    @(R5)+          ;(R0)=177401, CC=0000
1711  005416  101402                          BLOS    ROLB3           ;BRANCH IF C OR Z IS SET
1712  005420  102401                          BVS     ROLB3
1713  005422  100001                          BPL     .+4
1714  005424  104400                ROLB3:    HLT
1715
1716  005426  000352                          SWAB    @-(R2)          ;(R0)=000777, CC=1000
1717  005430  100401                          BMI     .+4
1718  005432  104400                          HLT
1719
1720  005434  000261                          SEC
1721  005436  105635                          SBCB    @(R5)+          ;(R0)=000377, CC=0100
1722  005440  103401                          BCS     SBCB3
1723  005442  001401                          BEQ     .+4
1724  005444  104400                SBCB3:    HLT
1725
1726  005446  105432                          NEGB    @(R2)+          ;(R0)=000001
1727  005450  105352                          DECB    @-(R2)          ;(R0)=000000, CC=0101
1728  005452  103001                          BCC     DECB5
1729  005454  001401                          BEQ     .+4
1730  005456  104400                DECB5:    HLT
1731  005460  104000                          SCOPE
1732
1733                                ;CHECK UNARY WORD OPS USING ADDRESS MODE 6 (PC)
1734  005462  005027                          CLR     (PC)+           ;PRESET DATA = 0
1735  005464  000000                UWM6:     .WORD   0               ;RESERVED FOR DATA
1736  005466  010700                          MOV     PC,R0
1737  005470  024040                          CMP     -(R0),-(R0)     ;R0 POINTS TO DATA WORD
1738  005472  000277                          SCC
1739  005474  006167  177764                 ROL     UWM6            ;(R0)=000001,CC=0000
1740  005500  103403                          BCS     ROL6
1741  005502  102402                          BVS     ROL6
1742  005504  001401                          BEQ     ROL6
1743  005506  100001                          BPL     .+4
1744  005510  104400                ROL6:     HLT
1745
1746  005512  005167  177746                 COM     UWM6            ;(R0)=177776, CC=1001
1747  005516  103002                          BCC     COM6
1748  005520  102401                          BVS     COM6
1749  005522  100401                          BMI     .+4
1750  005524  104400                COM6:     HLT
```

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1751
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1752  005526  006267  177732          ASR     UWM6            ;(R0)=177777, CC=1010
1753  005532  103402                  BCS     ASR6
1754  005534  102001                  BVC     ASR6
1755  005536  100401                  BMI     .+4
1756  005540  104400          ASR6:   HLT
1757
1758  005542  000277                  SCC
1759  005544  005467  177714          NEG     UWM6            ;(R0)=000001, CC=0001
1760  005550  103003                  BCC     NEG6
1761  005552  102402                  BVS     NEG6
1762  005554  001401                  BEQ     NEG6
1763  005556  100001                  BPL     .+4
1764  005560  104400          NEG6:   HLT
1765
1766  005562  000277                  SCC
1767  005564  006067  177674          ROR     UWM6            ;(R0)=100000, CC=1001
1768  005570  103003                  BCC     ROR6
1769  005572  102402                  BVS     ROR6
1770  005574  001401                  BEQ     ROR6
1771  005576  100401                  BMI     .+4
1772  005600  104400          ROR6:   HLT
1773
1774  005602  005667  177656          SBC     UWM6            ;(R0)=077777, CC=0010
1775  005606  103402                  BCS     SBC6
1776  005610  102001                  BVC     SBC6
1777  005612  100001                  BPL     .+4
1778  005614  104400          SBC6:   HLT
1779
1780  005616  000242                  CLV
1781  005620  005267  177640          INC     UWM6            ;(R0)=100000, CC=1011
1782  005624  103403                  BCS     INC6
1783  005626  102002                  BVC     INC6
1784  005630  001401                  BEQ     INC6
1785  005632  100401                  BMI     .+4
1786  005634  104400          INC6:   HLT
1787
1788  005636  006267  177622          ASR     UWM6            ;(R0)=140000, CC=1010
1789  005642  000261                  SEC
1790  005644  006367  177614          ASL     UWM6            ;(R0)=100000, CC=1001
1791  005650  103002                  BCC     ASL6
1792  005652  102401                  BVS     ASL6
1793  005654  100401                  BMI     .+4
1794  005656  104400          ASL6:   HLT
1795
1796  005660  005367  177600          DEC     UWM6            ;(R0)=077777, CC=0011
1797  005664  103002                  BCC     DEC6
1798  005666  102001                  BVC     DEC6
1799  005670  100001                  BPL     .+4
1800  005672  104400          DEC6:   HLT
1801
1802  005674  005567  177564          ADC     UWM6            ;(R0)=100000, CC=1010
1803  005700  103402                  BCS     ADC6
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1804  005702  102001                        BVC     ADC6
1805  005704  100401                        BMI     .+4
1806  005706  104400                ADC6:   HLT
1807  005710  000242                        CLV
1808  005712  000367  177546                SWAB    UWM6
1809  005716  100401                        BMI     .+4
1810  005720  104400                        HLT
1811  005722  022710  000200                CMP     #200,(R0)
1812  005726  001401                        BEQ     .+4
1813  005730  104400                        HLT
1814  005732  104000                        SCOPE
1815
1816                          ;CHECK UNARY BYTE OPS (EVEN/ODD) USING ADDRESS MODE 6 (PC)
1817  005734  012700  006276                MOV     #UBM6,R0
1818  005740  063700  001004                ADD     @#FACTOR,R0     ;R0 POINTS TO ADDRESS OF DATA
1819  005744  005067  000326                CLR     UBM6            ;CLEAR DATA
1820  005750  000277                        SCC
1821  005752  000244                        CLZ
1822  005754  105767  000316                TSTB    UBM6
1823  005760  103403                        BCS     TSTB6
1824  005762  102402                        BVS     TSTB6
1825  005764  001001                        BNE     TSTB6
1826  005766  100001                        BPL     .+4
1827  005770  104400                TSTB6:  HLT
1828
1829  005772  000257                        CCC
1830  005774  105767  000277                TSTB    UBM6+1          ;TEST ODD BYTE
1831  006000  001401                        BEQ     .+4
1832  006002  104400                        HLT
1833
1834  006004  105667  000266                SBCB    UBM6            ;(R0)=000000, CC=0100
1835  006010  103402                        BCS     SBCB6
1836  006012  102401                        BVS     SBCB6
1837  006014  001401                        BEQ     .+4
1838  006016  104400                SBCB6:  HLT
1839
1840  006020  000261                1$:     SEC
1841  006022  105267  000250                INCB    UBM6            ;LOOP UNTIL (R0)=077600, CC=1011
1842  006026  100403                        BMI     2$
1843  006030  105567  000243                ADCB    UBM6+1          ;INCB INST INCREMENTS EVEN BYTE
1844  006034  000771                        BR      1$              ;ADCB INCREMENTS ODD BYTE
1845  006036  103001                2$:     BCC     INCB6
1846  006040  102401                        BVS     .+4
1847  006042  104400                INCB6:  HLT
1848
1849  006044  106367  000226                ASLB    UBM6            ;(R0)=077400, CC=0111
1850  006050  103003                        BCC     ASLB6
1851  006052  102002                        BVC     ASLB6
1852  006054  001001                        BNE     ASLB6
1853  006056  100001                        BPL     .+4
1854  006060  104400                ASLB6:  HLT
1855
1856  006062  000242                        CLV
1857  006064  105567  000207                ADCB    UBM6+1          ;(R0)=100000, CC=1010
1858  006070  103402                        BCS     ADCB6
1859  006072  102001                        BVC     ADCB6
```

```
1860  006074  100401                        BMI     .+4
1861  006076  104400              ADCB6:    HLT
1862
1863  006100  000261                        SEC
1864  006102  106067  000171                RORB    UBM6+1          ;(R0)=140000, CC=1010
1865  006106  103402                        BCS     RORB6
1866  006110  102001                        BVC     RORB6
1867  006112  100401                        BMI     .+4
1868  006114  104400              RORB6:    HLT
1869
1870  006116  105167  000154                COMB    UBM6            ;(R0)=140377 CC=1001
1871  006122  103002                        BCC     COMB6
1872  006124  102401                        BVS     COMB6
1873  006126  100401                        BMI     .+4
1874  006130  104400              COMB6:    HLT
1875
1876  006132  000262                        SEV
1877  006134  105467  000137                NEGB    UBM6+1          ;(R0)=040377, CC=0001
1878  006140  103002                        BCC     NEGB6
1879  006142  102401                        BVS     NEGB6
1880  006144  100001                        BPL     .+4
1881  006146  104400              NEGB6:    HLT
1882
1883  006150  106167  000123                ROLB    UBM6+1          ;(R0)=100777, CC=1010
1884  006154  103402                        BCS     ROLB6
1885  006156  102001                        BVC     ROLB6
1886  006160  100401                        BMI     .+4
1887  006162  104400              ROLB6:    HLT
1888
1889  006164  106267  000106                ASRB    UBM6            ;(R0)=100777, CC=1001
1890  006170  103002                        BCC     ASRB6
1891  006172  102401                        BVS     ASRB6
1892  006174  100401                        BMI     .+4
1893  006176  104400              ASRB6:    HLT
1894
1895  006200  105267  000072                INCB    UBM6            ;(R0)=100400, CC=0101
1896  006204  103002                        BCC     INCB6A
1897  006206  102401                        BVS     INCB6A
1898  006210  001401                        BEQ     .+4
1899  006212  104400              INCB6A:   HLT
1900
1901  006214  105367  000057                DECB    UBM6+1          ;(R0)=100000, CC=1001
1902  006220  103003                        BCC     DECB6A
1903  006222  102402                        BVS     DECB6A
1904  006224  001401                        BEQ     DECB6A
1905  006226  100401                        BMI     .+4
1906  006230  104400              DECB6A:   HLT
1907
1908  006232  000367  000040                SWAB    UBM6            ;(R0)=000200, CC=1000
1909  006236  103401                        BCS     SWAB6
1910  006240  100401                        BMI     .+4
1911  006242  104400              SWAB6:    HLT
1912
1913  006244  106167  000026                ROLB    UBM6            ;(R0)=000000, CC=0111
1914  006250  103002                        BCC     ROLB6A
1915  006252  102001                        BVC     ROLB6A
```

```
1916  006254  001401                    BEQ     .+4
1917  006256  104400           ROLB6A:  HLT
1918
1919  006260  005767  000012            TST     UBM6            ;(R0)=000000, CC=0100
1920  006264  103402                    BCS     TST6
1921  006266  102401                    BVS     TST6
1922  006270  001401                    BEQ     .+4
1923  006272  104400           TST6:    HLT
1924
1925  006274  000401                    BR      .+4             ;RESERVE A WORD
1926  006276  000000           UBM6:    .WORD   0               ;WORD RESERVED FOR DATA
1927  006300  104000                    SCOPE
1928  006302  010702                    MOV     PC,R2
1929  006304  062702  000012            ADD     #12,R2
1930  006310  012707  001132            MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
1931  006314  000240                    NOP                     ;PROGRAM RETURNS HERE+2
1932                    ;000000000000 LAST ADDRESS OF CODE TO BE RELOCATED 000000000
1933
```

```
1934
1935
1936                                    ;111111111111 FIRST ADDRESS TO BE RELOCATED 111111111
1937  006316  010700                    REL1:   MOV     PC,R0           ;GET PC
1938  006320  005740                            TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL1
1939  006322  010037  001010                    MOV     R0,@#FRSTAD     ;SAVE
1940  006326  010700                            MOV     PC,R0           ;GET CURRENT PC
1941  006330  162700  006330                    SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
1942  006334  010037  001004                    MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
1943  006340  010701                            MOV     PC,R1           ;SET NEW SCOPE PTR
1944
1945                                    ;CHECK UNARY WORD OPS USING ADDRESS MODE 7
1946  006342  000403                            BR      UW7             ;RESERVE 3 WORDS FOR ADDRESSES & DATA
1947  006344  000000                            .WORD   0               ;CONTAINS ADDRESS OF UWM7
1948  006346  000000                    UWM7:   .WORD   0               ;CONTAINS DATA
1949  006350  000000                            .WORD   0               ;CONTAINS ADDRESS OF UWM7
1950
1951  006352  010700                    UW7:    MOV     PC,R0
1952  006354  005740                            TST     -(R0)
1953  006356  005740                            TST     -(R0)
1954  006360  005040                            CLR     -(R0)           ;CLEAR TEST DATA
1955  006362  010002                            MOV     R0,R2
1956  006364  010240                            MOV     R2,-(R0)        ;SET UP ADDRESS
1957  006366  005720                            TST     (R0)+           ;MOVE R0 TO NEXT ADDRESS
1958  006370  005720                            TST     (R0)+
1959  006372  010210                            MOV     R2,(R0)         ;SET NEXT ADDRESS
1960  006374  010200                            MOV     R2,R0           ;SET R0 POINTING TO DATA
1961  006376  000277                            SCC
1962  006400  000244                            CLZ
1963  006402  005772  000002                    TST     @2(2)           ;(R0)=000000, CC=0100
1964  006406  001401                            BEQ     .+4
1965  006410  104400                            HLT
1966
1967  006412  000277                            SCC
1968  006414  005672  177776                    SBC     @-2(2)          ;(R0)=177777, CC=1001
1969  006420  103002                            BCC     SBC7
1970  006422  102401                            BVS     SBC7
1971  006424  100401                            BMI     .+4
1972  006426  104400                    SBC7:   HLT
1973
1974  006430  000277                            SCC
1975  006432  000241                            CLC
1976  006434  006372  000002                    ASL     @2(2)           ;(R0)=177776, CC=1001
1977  006440  103002                            BCC     ASL7
1978  006442  102401                            BVS     ASL7
1979  006444  100401                            BMI     .+4
1980  006446  104400                    ASL7:   HLT
1981
1982  006450  000257                            CCC
1983  006452  005372  000002                    DEC     @2(2)           ;(R0)=177775, CC=1000
1984  006456  103402                            BCS     DEC7
1985  006460  102401                            BVS     DEC7
1986  006462  100401                            BMI     .+4
1987  006464  104400                    DEC7:   HLT
1988
1989  006466  000262                            SEV
```

```
 1990  006470  006272  177776                ASR     @-2(2)          ;(R0)=177776, CC=1001
 1991  006474  103002                        BCC     ASR7
 1992  006476  102401                        BVS     ASR7
 1993  006500  100401                        BMI     .+4
 1994  006502  104400              ASR7:     HLT
 1995
 1996  006504  000241                        CLC
 1997  006506  000262                        SEV
 1998  006510  006072  177776                ROR     @-2(2)          ;(R0)=077777, CC=0000
 1999  006514  101402                        BLOS    ROR7            ;BRANCH IF C OR Z IS SET
 2000  006516  102401                        BVS     ROR7
 2001  006520  100001                        BPL     .+4
 2002  006522  104400              ROR7:     HLT
 2003
 2004  006524  000262                        SEV
 2005  006526  005472  000002                NEG     @2(2)           ;(R0)=100001, CC=1001
 2006  006532  103002                        BCC     NEG7
 2007  006534  102401                        BVS     NEG7
 2008  006536  100401                        BMI     .+4
 2009  006540  104400              NEG7:     HLT
 2010
 2011  006542  000250                        CLN
 2012  006544  000372  177776                SWAB    @-2(2)          ;(R0)=000600, CC=1000
 2013  006550  103401                        BCS     SWAB7
 2014  006552  100401                        BMI     .+4
 2015  006554  104400              SWAB7:    HLT
 2016
 2017  006556  000262                        SEV
 2018  006560  005172  000002                COM     @2(2)           ;(R0)=177177, CC=1001
 2019  006564  103002                        BCC     COM7
 2020  006566  102401                        BVS     COM7
 2021  006570  100401                        BMI     .+4
 2022  006572  104400              COM7:     HLT
 2023
 2024  006574  000372  000002                SWAB    @2(2)           ;(R0)=077776, CC=1000
 2025  006600  100401                        BMI     .+4
 2026  006602  104400                        HLT
 2027
 2028  006604  000277                        SCC
 2029  006606  005572  177776                ADC     @-2(2)          ;(R0)=077777, CC=0000
 2030  006612  103402                        BCS     ADC7
 2031  006614  102401                        BVS     ADC7
 2032  006616  100001                        BPL     .+4
 2033  006620  104400              ADC7:     HLT
 2034
 2035  006622  005272  000002                INC     @2(2)           ;(R0)=100000, CC=1010
 2036  006626  102001                        BVC     INC7
 2037  006630  100401                        BMI     .+4
 2038  006632  104400              INC7:     HLT
 2039
 2040  006634  000257                        CCC
 2041  006636  006172  177776                ROL     @-2(2)          ;(R0)=000000, CC=0111
 2042  006642  103002                        BCC     ROL7
 2043  006644  102001                        BVC     ROL7
 2044  006646  001401                        BEQ     .+4
 2045  006650  104400              ROL7:     HLT
```

```
                                        SCOPE

                                ;CHECK UNARY BYTE OPS USING ADDRESS MODE 7
006654  005720                        TST     (R0)+
006656  005210                        INC     (R0)            ;WORD FOLLOWING UWM7 CONTAINS ADDRESS
006660  005740                        TST     -(R0)           ;OF ODD BYTE, R0 POINTS TO DATA WORD
006662  005010                        CLR     (R0)            ;PRESET DATA
006664  010701                        MOV     PC,R1           ;SET SCOPE PTR
                                ;NOTE:  @2(2) REFERENCES THE ODD BYTE, AND @-2(2) REFERENCES THE EVEN BYTE.

006666  000263                        +SEC!SEV                ;SET C AND V
006670  105672  000002                SBCB    @2(2)           ;(R0)=177400, CC=1001
006674  103003                        BCC     SBCB7
006676  102402                        BVS     SBCB7
006700  001401                        BEQ     SBCB7
006702  100401                        BMI     .+4
006704  104400                SBCB7:  HLT

006706  000277                        SCC                     ;SET CONDITION CODES
006710  105572  177776                ADCB    @-2(2)          ;(R0)=177401, CC=0000
006714  103403                        BCS     ADCB7
006716  102402                        BVS     ADCB7
006720  001401                        BEQ     ADCB7
006722  100001                        BPL     .+4
006724  104400                ADCB7:  HLT

006726  105172  177776                COMB    @-2(2)          ;(R0)=177776, CC=1001
006732  103002                        BCC     COMB7
006734  102401                        BVS     COMB7
006736  100401                        BMI     .+4
006740  104400                COMB7:  HLT

006742  000241                        CLC                     ;CLEAR CARRY
006744  106072  000002                RORB    @2(2)           ;(R0)=077776, CC=0011
006750  103002                        BCC     RORB7
006752  102001                        BVC     RORB7
006754  100001                        BPL     .+4
006756  104400                RORB7:  HLT

006760  105272  000002                INCB    @2(2)           ;(R0)=100376, CC=1011
006764  103002                        BCC     INCB7
006766  102001                        BVC     INCB7
006770  100401                        BMI     .+4
006772  104400                INCB7:  HLT

006774  105372  177776                DECB    @-2(2)          ;(R0)=100375, CC=1001
007000  103002                        BCC     DECB7
007002  102401                        BVS     DECB7
007004  100401                        BMI     .+4
007006  104400                DECB7:  HLT

007010  106372  000002                ASLB    @2(2)           ;(R0)=000375, CC=0111
007014  103002                        BCC     ASLB7
007016  102001                        BVC     ASLB7
007020  001401                        BEQ     .+4
007022  104400                ASLB7:  HLT
```

```
2102
2103  007024  000241                        CLC                     ;CLEAR CARRY
2104  007026  106272  177776                ASRB    @-2(2)          ;(R0)=000376, CC=1001
2105  007032  103002                        BCC     ASRB7
2106  007034  102401                        BVS     ASRB7
2107  007036  100401                        BMI     .+4
2108  007040  104400              ASRB7:    HLT
2109
2110  007042  105472  000002                NEGB    @2(2)           ;(R0)=000376, CC=0100
2111  007046  103402                        BCS     NEGB7
2112  007050  102401                        BVS     NEGB7
2113  007052  001401                        BEQ     .+4
2114  007054  104400              NEGB7:    HLT
2115
2116  007056  000262                        SEV
2117  007060  106172  177776                ROLB    @-2(2)          ;(R0)=00374, CC=1001
2118  007064  103002                        BCC     ROLB7
2119  007066  102401                        BVS     ROLB7
2120  007070  100401                        BMI     .+4
2121  007072  104400              ROLB7:    HLT
2122
2123  007074  105272  177776                INCB    @-2(2)          ;(R0)=000375, CC=1001
2124  007100  105272  177776                INCB    @-2(2)          ;(R0)=000376, CC=1001
2125  007104  105572  177776                ADCB    @-2(2)          ;(R0)=000377, CC=1000
2126  007110  105172  177776                COMB    @-2(2)          ;(R0)=000000, CC=0100
2127  007114  001401                        BEQ     .+4
2128  007116  104400                        HLT
2129  007120  104000                        SCOPE
2130
2131                          ;CHECK BINARY OPS  USING ADDRESS MODE 0
2132  007122  000277                        SCC                     ;SET CONDITION CODES
2133  007124  010700                        MOV     PC,R0           ;R0=PC, CC=X001
2134  007126  103002                        BCC     MOV0
2135  007130  102401                        BVS     MOV0
2136  007132  001001                        BNE     .+4
2137  007134  104400              MOV0:     HLT
2138
2139  007136  010002                        MOV     R0,R2           ;R2=R0
2140  007140  000262                        SEV                     ;SET V
2141  007142  160002                        SUB     R0,R2           ;R2=000000, CC=0100
2142  007144  103402                        BCS     SUB0
2143  007146  102401                        BVS     SUB0
2144  007150  001401                        BEQ     .+4
2145  007152  104400              SUB0:     HLT
2146
2147  007154  000244                        CLZ
2148  007156  010203                        MOV     R2,R3           ;R2=R3=000000, CC=0100
2149  007160  103401                        BCS     MOVOA
2150  007162  001401                        BEQ     .+4
2151  007164  104400              MOVOA:    HLT
2152
2153  007166  000257                        CCC
2154  007170  000272                        +SEV!SEN                ;SET V & N
2155  007172  020203                        CMP     R2,R3           ;R2=R3=000000, CC=0100
2156  007174  103403                        BCS     CMP0
2157  007176  102402                        BVS     CMP0
```

```
2158  007200  001001                    BNE     CMPO
2159  007202  100001                    BPL     .+4
2160  007204  104400            CMPO:   HLT
2161
2162  007206  010002                    MOV     R0,R2           ;R0=R2
2163  007210  010203                    MOV     R2,R3           ;R0=R2=R3
2164  007212  060203                    ADD     R2,R3           ;R3=2*R0
2165  007214  006302                    ASL     R2              ;R2=2*R0
2166  007216  020203                    CMP     R2,R3           ;R2=R3=2*R0
2167  007220  001401                    BEQ     .+4
2168  007222  104400                    HLT                     ;ERROR! CHECK ADD INSTRUCTION
2169
2170                            ;THE FOLLOWING SUBTEST SHIFTS A BIT THROUGH R2 AND R5 AND DOES A
2171                            ;BIT TEST (BIT) USING R2 AND R5.
2172  007224  005002                    CLR     R2
2173  007226  005202                    INC     R2
2174  007230  000402                    BR      2$
2175  007232  006302            1$:     ASL     R2
2176  007234  100407                    BMI     4$
2177  007236  010205            2$:     MOV     R2,R5
2178  007240  000277                    SCC
2179  007242  030205                    BIT     R2,R5           ;R2=R5
2180  007244  103002                    BCC     3$
2181  007246  102401                    BVS     3$
2182  007250  001370                    BNE     1$
2183  007252  104400            3$:     HLT
2184  007254  010205            4$:     MOV     R2,R5
2185  007256  000257                    CCC
2186  007260  030205                    BIT     R2,R5
2187  007262  100401                    BMI     .+4
2188  007264  104400                    HLT
2189
2190  007266  005002                    CLR     R2
2191  007270  000277                    SCC
2192  007272  050002                    BIS     R0,R2
2193  007274  103002                    BCC     BISO
2194  007276  102401                    BVS     BISO
2195  007300  001001                    BNE     .+4
2196  007302  104400            BISO:   HLT
2197
2198  007304  010003                    MOV     R0,R3
2199  007306  000277                    SCC
2200  007310  000244                    CLZ
2201  007312  040003                    BIC     R0,R3
2202  007314  103003                    BCC     BICO
2203  007316  102402                    BVS     BICO
2204  007320  001001                    BNE     BICO
2205  007322  100001                    BPL     .+4
2206  007324  104400            BICO:   HLT
2207
2208  007326  010004                    MOV     R0,R4
2209  007330  005104                    COM     R4
2210  007332  040004                    BIC     R0,R4
2211  007334  005104                    COM     R4
2212  007336  020004                    CMP     R0,R4
2213  007340  001401                    BEQ     .+4
```

```
2214  007342  104400                          HLT
2215
2216  007344  010004                          MOV     R0,R4
2217  007346  005104                          COM     R4
2218  007350  010403                          MOV     R4,R3
2219  007352  050003                          BIS     R0,R3
2220  007354  103001                          BCC     BISOA
2221  007356  100401                          BMI     .+4
2222  007360  104400                BISOA:    HLT
2223  007362  005203                          INC     R3
2224  007364  001401                          BEQ     .+4
2225  007366  104400                          HLT
2226  007370  010304                          MOV     R3,R4           ;R3=R4=0
2227  007372  005103                          COM     R3              ;R3=177777
2228  007374  000261                          SEC                     ;SET C
2229  007376  006004                          ROR     R4              ;R4=100000
2230  007400  060304                          ADD     R3,R4           ;R3=177777,R4=077777, CC=0011
2231  007402  103003                          BCC     ADDO
2232  007404  102002                          BVC     ADDO
2233  007406  001401                          BEQ     ADDO
2234  007410  100001                          BPL     .+4
2235  007412  104400                ADDO:     HLT
2236  007414  010700                          MOV     PC,R0
2237  007416  022020                          CMP     (R0)+,(R0)+
2238  007420  020007                          CMP     R0,PC
2239  007422  001401                          BEQ     .+4
2240  007424  104400                          HLT
2241
2242  007426  010700                          MOV     PC,R0
2243  007430  062700  000010                  ADD     #10,R0
2244  007434  010002                          MOV     R0,R2
2245  007436  020700                          CMP     PC,R0
2246  007440  001002                          BNE     CMPOA
2247  007442  020200                          CMP     R2,R0
2248  007444  001401                          BEQ     .+4
2249  007446  104400                CMPOA:    HLT
2250  007450  104000                          SCOPE
2251
2252                                  ;CHECK BINARY BYTE OPS USING ADDRESS MODE 0.
2253  007452  012703  125252                  MOV     #125252,R3
2254  007456  010304                          MOV     R3,R4           ;R3=R4=125252
2255  007460  140304                          BICB    R3,R4           ;R3=125252, R4=125000
2256  007462  022704  125000                  CMP     #125000,R4
2257  007466  001401                          BEQ     .+4
2258  007470  104400                          HLT                     ;ERROR! BICB FAILED
2259
2260  007472  005004                          CLR     R4              ;R3=125252, R4=0
2261  007474  150304                          BISB    R3,R4           ;R3=125252, R4=000252
2262  007476  022704  000252                  CMP     #252,R4
2263  007502  001401                          BEQ     .+4
2264  007504  104400                          HLT                     ;ERROR! BISB FAILED
2265
2266  007506  110404                          MOVB    R4,R4           ;R4=177652
2267  007510  022704  177652                  CMP     #177652,R4      ;MOVB EXTENDS THE SIGN
2268  007514  001401                          BEQ     .+4
2269  007516  104400                          HLT                     ;ERROR! MOVB FAILED
```

```
2270
2271  007520  132704  177525          BITB    #177525,R4
2272  007524  001401                  BEQ     .+4
2273  007526  104400                  HLT                     ;ERROR! BITB FAILED
2274
2275  007530  105104                  COMB    R4              ;R4=177525
2276  007532  110404                  MOVB    R4,R4           ;R4=000125
2277  007534  022704  000125          CMP     #125,R4
2278  007540  001401                  BEQ     .+4
2279  007542  104400                  HLT
2280
2281  007544  150304                  BISB    R3,R4           ;R3=125252, R4=000377
2282  007546  105204                  INCB    R4
2283  007550  005704                  TST     R4
2284  007552  001401                  BEQ     .+4
2285  007554  104400                  HLT
2286  007556  104000                  SCOPE
2287
2288
2289                          ;CHECK BINARY OPS USING ADDRESS MODE 1
2290  007560  000402                  BR      .+6             ;RESERVE TWO WORDS
2291  007562  000000                  .WORD   0               ;RESERVED FOR SOURCE DATA
2292  007564  000000                  .WORD   0               ;RESERVED FOR DESTINATION DATA
2293  007566  010704                  MOV     PC,R4
2294  007570  005744                  TST     -(R4)
2295  007572  005044                  CLR     -(R4)           ;R4 POINTS TO DESTINATION DATA
2296  007574  010403                  MOV     R4,R3
2297  007576  005043                  CLR     -(R3)           ;R3 POINTS TO SOUCE DATA
2298
2299  007600  005113                  COM     (R3)            ;(R3)=177777
2300  007602  005214                  INC     (R4)            ;(R4)=000001
2301  007604  000262                  SEV                     ;SET V
2302  007606  061314                  ADD     (R3),(R4)       ;(R3)=177777,(R4)=000000, CC=0101
2303  007610  103002                  BCC     ADD1
2304  007612  102401                  BVS     ADD1
2305  007614  001401                  BEQ     .+4
2306  007616  104400          ADD1:   HLT
2307
2308  007620  000277                  SCC
2309  007622  000250                  CLN
2310  007624  021314                  CMP     (R3),(R4)       ;(R3)=177777,(R4)=000000, CC=1000
2311  007626  103403                  BCS     CMP1
2312  007630  102402                  BVS     CMP1
2313  007632  001401                  BEQ     CMP1
2314  007634  100401                  BMI     .+4
2315  007636  104400          CMP1:   HLT
2316
2317  007640  000277                  SCC
2318  007642  000244                  CLZ
2319  007644  031314                  BIT     (R3),(R4)       ;(R3)=177777,(R4)=000000, CC=0101
2320  007646  103002                  BCC     BIT1
2321  007650  102401                  BVS     BIT1
2322  007652  001401                  BEQ     .+4
2323  007654  104400          BIT1:   HLT
2324
2325  007656  000277                  SCC
```

```
2326  007660  000245                    +CLC!CLZ
2327  007662  005114                    COM     (R4)            ;(R4)=177777
2328  007664  161314                    SUB     (R3),(R4)       ;(R3)=177777,(R4)=000000, CC=0100
2329  007666  103402                    BCS     SUB1
2330  007670  102401                    BVS     SUB1
2331  007672  001401                    BEQ     .+4
2332  007674  104400              SUB1: HLT
2333
2334  007676  105013                    CLRB    (R3)            ;(R3)=177400
2335  007700  000313                    SWAB    (R3)            ;(R3)=000377
2336  007702  000270                    SEN
2337  007704  011314                    MOV     (R3),(R4)       ;(R3)=(R4)=000377
2338  007706  100001                    BPL     .+4
2339  007710  104400                    HLT
2340  007712  000314                    SWAB    (R4)            ;(R3)=000377,(R4)=177400
2341  007714  000263                    +SEC!SEV                ;SET C & V
2342  007716  051314                    BIS     (R3),(R4)       ;(R3)=000377,(R4)=177777, CC=1001
2343  007720  103002                    BCC     BIS1
2344  007722  102401                    BVS     BIS1
2345  007724  100401                    BMI     .+4
2346  007726  104400              BIS1: HLT
2347
2348  007730  041314                    BIC     (R3),(R4)       ;(R3)=000377,(R4)=177400, CC=1001
2349  007732  103002                    BCC     BIC1
2350  007734  102401                    BVS     BIC1
2351  007736  100401                    BMI     .+4
2352  007740  104400              BIC1: HLT
2353
2354  007742  000262                    SEV                     ;SET V
2355  007744  021314                    CMP     (R3),(R4)       ;(R3)=000377,(R4)=177400, CC=0001
2356  007746  103003                    BCC     CMP1A
2357  007750  102402                    BVS     CMP1A
2358  007752  001401                    BEQ     CMP1A
2359  007754  100001                    BPL     .+4
2360  007756  104400            CMP1A:  HLT
2361
2362  007760  005013                    CLR     (R3)            ;(R3)=000000
2363  007762  000261                    SEC
2364  007764  006013                    ROR     (R3)            ;(R3)=100000
2365  007766  011314                    MOV     (R3),(R4)       ;(R3)=(R4)=100000
2366  007770  005114                    COM     (R4)            ;(R4)=077777
2367  007772  161314                    SUB     (R3),(R4)       ;(R3)=100000,(R4)=177777, CC=1011
2368  007774  103002                    BCC     SUB1A
2369  007776  102001                    BVC     SUB1A
2370  010000  100401                    BMI     .+4
2371  010002  104400            SUB1A:  HLT
2372
2373  010004  000277                    SCC
2374  010006  161314                    SUB     (R3),(R4)       ;(R3)=100000,(R4)=077777, CC=0000
2375  010010  101402                    BLOS    SUB1B           ;BRANCH IF C OR Z IS SET
2376  010012  102401                    BVS     SUB1B
2377  010014  100001                    BPL     .+4
2378  010016  104400            SUB1B:  HLT
2379
2380  010020  011314                    MOV     (R3),(R4)       ;(R3)=100000,(R4)=100000, CC=1000
2381  010022  001401                    BEQ     MOV1
```

```
2382  010024  100401                          BMI     .+4
2383  010026  104400                MOV1:     HLT
2384
2385  010030  061314                          ADD     (R3),(R4)       ;(R3)=100000,(R4)=000000, CC=0111
2386  010032  103003                          BCC     ADD1A
2387  010034  102002                          BVC     ADD1A
2388  010036  001001                          BNE     ADD1A
2389  010040  100001                          BPL     .+4
2390  010042  104400                ADD1A:    HLT
2391
2392  010044  005113                          COM     (R3)            ;(R3)=077777
2393  010046  011314                          MOV     (R3),(R4)               ;(R4)=077777
2394  010050  061314                          ADD     (R3),(R4)       ;(R3)=077777,(R4)=177776, CC=1010
2395  010052  103402                          BCS     ADD1B
2396  010054  102001                          BVC     ADD1B
2397  010056  100401                          BMI     .+4
2398  010060  104400                ADD1B:    HLT
2399
2400  010062  062714  000002                  ADD     #2,(R4)
2401  010066  005714                          TST     (R4)            ;CHECK FINAL RESULT
2402  010070  001401                          BEQ     .+4
2403  010072  104400                          HLT
2404  010074  104000                          SCOPE
2405
2406                                ;CHECK BINARY BYTE OPS USING ADDRESS MODE 1
2407  010076  000402                          BR      .+6
2408  010100  000000                          .WORD   0
2409  010102  000000                          .WORD   0
2410  010104  010705                          MOV     PC,R5
2411  010106  005745                          TST     -(R5)
2412  010110  005045                          CLR     -(R5)           ;(R5)=000000
2413  010112  010502                          MOV     R5,R2
2414  010114  005042                          CLR     -(R2)           ;(R2)=000000
2415  010116  005202                          INC     R2              ;R2 POINTS TO ODD BYTE
2416  010120  105112                          COMB    (R2)            ;(R2)=177400
2417
2418  010122  000277                          SCC
2419  010124  111215                          MOVB    (R2),(R5)       ;(R2)=177400,(R5)=000377,CC=1001
2420  010126  103005                          BCC     MOVB1
2421  010130  102404                          BVS     MOVB1
2422  010132  001403                          BEQ     MOVB1
2423  010134  100002                          BPL     MOVB1
2424  010136  105215                          INCB    (R5)            ;CHECK RESULT
2425  010140  001401                          BEQ     .+4
2426  010142  104400                MOVB1:    HLT
2427
2428  010144  106312                          ASLB    (R2)            ;SHIFT (R2) UNTIL
2429  010146  102376                          BVC     .-2             ;(R2)=000000
2430  010150  106012                          RORB    (R2)            ;(R2)=100000
2431  010152  105315                          DECB    (R5)            ;(R5)=00377
2432  010154  106015                          RORB    (R5)            ;(R5)=000177
2433  010156  000257                          CCC
2434  010160  121512                          CMPB    (R5),(R2)       ;(R5)=000177,(R2)=100000, CC=1010
2435  010162  102001                          BVC     CMPB1
2436  010164  100401                          BMI     .+4
2437  010166  104400                CMPB1:    HLT
```

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2438
2439  010170  005003                    CLR     R3
2440  010172  000261                    SEC
2441  010174  006003                    ROR     R3              ;R3=100000
2442  010176  050315                    BIS     R3,(R5)         ;(R5)=100177
2443  010200  000273                    +SEC!SEV!SEN            ;SET C,V, & N
2444  010202  131215                    BITB    (R2),(R5)       ;(R2)=100000,(R5)=100177, CC=0101
2445  010204  103002                    BCC     BITB1
2446  010206  102401                    BVS     BITB1
2447  010210  001401                    BEQ     .+4
2448  010212  104400            BITB1:  HLT
2449
2450  010214  151215                    BISB    (R2),(R5)       ;(R2)=100000,(R5)=100377, CC=1001
2451  010216  103001                    BCC     BISB1
2452  010220  100401                    BMI     .+4
2453  010222  104400            BISB1:  HLT
2454
2455  010224  141215                    BICB    (R2),(R5)       ;(R2)=100000,(R5)=100177, CC=0001
2456  010226  103002                    BCC     BICB1
2457  010230  001401                    BEQ     BICB1
2458  010232  100001                    BPL     .+4
2459  010234  104400            BICB1:  HLT
2460
2461  010236  105112                    COMB    (R2)            ;(R2)=077400,(R5)=100177
2462  010240  121215                    CMPB    (R2),(R5)
2463  010242  001401                    BEQ     .+4
2464  010244  104400                    HLT
2465
2466  010246  141512                    BICB    (R5),(R2)       ;(R5)=100177,(R2)=000000, CC=0100
2467  010250  001002                    BNE     BICB1A
2468  010252  105712                    TSTB    (R2)
2469  010254  001401                    BEQ     .+4
2470  010256  104400           BICB1A:  HLT
2471
2472  010260  000402                    BR      .+6             ;RESERVE TWO WORDS FOR DATA
2473  010262  000000                    .WORD   0               ;SOURCE DATA
2474  010264  000000                    .WORD   0               ;DEST DATA
2475  010266  010705                    MOV     PC,R5
2476  010270  005745                    TST     -(R5)
2477  010272  105045                    CLRB    -(R5)           ;R5 POINTS TO DEST ODD BYTE
2478  010274  010504                    MOV     R5,R4
2479  010276  105044                    CLRB    -(R4)           ;R4 POINTS TO DEST EVEN BYTE
2480  010300  010403                    MOV     R4,R3
2481  010302  105043                    CLRB    -(R3)           ;R3 POINTS TO SOURCE ODD BYTE
2482  010304  010302                    MOV     R3,R2
2483  010306  105042                    CLRB    -(R2)           ;R2 POINTS TO SOURCE EVEN BYTE
2484
2485                            ;COMMENTS ARE LEAST SIGNIFICANT 4 BITS OF BYTES POINTED TO BY R2,R3
2486                            ;R4, AND R5 RESPECTIVELY AND THE REMAINING BITS ARE 0'S.
2487  010310  000261                    SEC                     ;SET CARRY
2488                                                            ;(R2),(R3),(R4),(R5)
2489  010312  106112                    ROLB    (R2)            ;0001,0000,0000,0000
2490  010314  111214                    MOVB    (R2),(R4)       ;0001,0000,0001,0000
2491  010316  106112                    ROLB    (R2)            ;0010,0000,0001,0000
2492  010320  111213                    MOVB    (R2),(R3)       ;0010,0010,0001,0000
2493  010322  106112                    ROLB    (R2)            ;0100,0010,0001,0000
```

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2494  010324  111315                    MOVB    (R3),(R5)       ;0100,0010,0001,0010
2495  010326  106112                    ROLB    (R2)            ;1000,0010,0001,0010
2496  010330  106113                    ROLB    (R3)            ;1000,0100,0001,0010
2497  010332  151215                    BISB    (R2),(R5)       ;1000,0100,0001,1010
2498  010334  131512                    BITB    (R5),(R2)       ;1000,0100,0001,1010
2499  010336  001426                    BEQ     BIN1
2500  010340  151314                    BISB    (R3),(R4)       ;1000,0100,0101,1010
2501  010342  131413                    BITB    (R4),(R3)       ;1000,0100,0101,1010
2502  010344  001423                    BEQ     BIN1
2503  010346  105213                    INCB    (R3)            ;1000,0101,0101,1010
2504  010350  121314                    CMPB    (R3),(R4)       ;1000,0101,0101,1010
2505  010352  001020                    BNE     BIN1
2506  010354  106113                    ROLB    (R3)            ;1000,1010,0101,1010
2507  010356  121315                    CMPB    (R3),(R5)       ;1000,1010,0101,1010
2508  010360  001015                    BNE     BIN1
2509  010362  106212                    ASRB    (R2)            ;0100,1010,0101,1010
2510  010364  131214                    BITB    (R2),(R4)       ;0100,1010,0101,1010
2511  010366  001412                    BEQ     BIN1
2512  010370  106015                    RORB    (R5)            ;0100,1010,0101,0101
2513  010372  121415                    CMPB    (R4),(R5)       ;0100,1010,0101,0101
2514  010374  001007                    BNE     BIN1
2515  010376  105314                    DECB    (R4)            ;0100,1010,0100,0101
2516  010400  141214                    BICB    (R2),(R4)       ;0100,1010,0000,0101
2517  010402  001004                    BNE     BIN1
2518  010404  111314                    MOVB    (R3),(R4)       ;0100,1010,1010,0101
2519  010406  106213                    ASRB    (R3)            ;0100,0101,1010,0101
2520  010410  141315                    BICB    (R3),(R5)       ;0100,0101,1010,0101
2521  010412  001401                    BEQ     .+4
2522  010414  104400           BIN1:    HLT
2523  010416  104000                    SCOPE
2524
2525                            ;CHECK BINARY WORD OPS USING ADDRESS MODE 2 & 4
2526  010420  010405                    MOV     R4,R5           ;SET DESTINATION REGISTER
2527  010422  012715  000001           MOV     #1,(R5)
2528  010426  012712  177777           MOV     #-1,(R2)
2529  010432  000257                    CCC
2530  010434  000262                    SEV
2531  010436  062225                    ADD     (R2)+,(R5)+     ;(R2)=177777,(R5)=000000, CC=0101
2532  010440  103002                    BCC     ADD2
2533  010442  102401                    BVS     ADD2
2534  010444  001401                    BEQ     .+4
2535  010446  104400           ADD2:    HLT
2536
2537  010450  000262                    SEV                     ;SET V
2538  010452  024527  000001           CMP     -(R5),#1        ;(R5)=000000, CC=1001
2539  010456  103002                    BCC     CMP2
2540  010460  102401                    BVS     CMP2
2541  010462  100401                    BMI     .+4
2542  010464  104400           CMP2:    HLT
2543
2544  010466  054225                    BIS     -(R2),(R5)+     ;(R2)=177777,(R5)=177777,CC=1001
2545  010470  103001                    BCC     BIS2
2546  010472  100401                    BMI     .+4
2547  010474  104400           BIS2:    HLT
2548  010476  000277                    SCC
2549  010500  000244                    CLZ
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```
2550  010502  162245                        SUB     (R2)+,-(R5)     ;(R2)=177777,(R5)=000000, CC=0100
2551  010504  103402                        BCS     SUB2
2552  010506  102401                        BVS     SUB2
2553  010510  001401                        BEQ     .+4
2554  010512  104400                SUB2:   HLT
2555
2556  010514  005442                        NEG     -(R2)           ;(R2)=000001
2557  010516  005115                        COM     (R5)            ;(R5)=177777
2558  010520  000277                        SCC
2559  010522  000250                        CLN
2560  010524  042225                        BIC     (R2)+,(R5)+     ;(R2)=000001,(R5)=177776, CC=1001
2561  010526  103003                        BCC     BIC2
2562  010530  102402                        BVS     BIC2
2563  010532  001401                        BEQ     BIC2
2564  010534  100401                        BMI     .+4
2565  010536  104400                BIC2:   HLT
2566
2567  010540  012742  125252                MOV     #125252,-(R2)
2568  010544  012245                        MOV     (R2)+,-(R5)
2569  010546  005125                        COM     (R5)+           ;(R5)=052525
2570  010550  000262                        SEV
2571  010552  034245                        BIT     -(R2),-(R5)     ;(R2)=125252,(R5)=052525, CC=0101
2572  010554  103002                        BCC     BIT2
2573  010556  102401                        BVS     BIT2
2574  010560  001401                        BEQ     .+4
2575  010562  104400                BIT2:   HLT
2576
2577  010564  000262                        SEV
2578  010566  052225                        BIS     (R2)+,(R5)+     ;(R2)=125252,(R5)=177777, CC=1001
2579  010570  103002                        BCC     BIS2A
2580  010572  102401                        BVS     BIS2A
2581  010574  100401                        BMI     .+4
2582  010576  104400                BIS2A:  HLT
2583
2584  010600  042745  125252                BIC     #125252,-(R5)   ;(R5)=052525
2585  010604  005125                        COM     (R5)+           ;(R5)=125252
2586  010606  024245                        CMP     -(R2),-(R5)
2587  010610  001401                        BEQ     .+4
2588  010612  104400                        HLT
2589
2590  010614  005012                        CLR     (R2)
2591  010616  005122                        COM     (R2)+           ;(R2)=177777
2592  010620  162742  000001                SUB     #1,-(R2)        ;(R2)=177776, CC=1000
2593  010624  103402                        BCS     SUB2A
2594  010626  102401                        BVS     SUB2A
2595  010630  100401                        BMI     .+4
2596  010632  104400                SUB2A:  HLT
2597  010634  104000                        SCOPE
2598
2599  010636  010702                        MOV     PC,R2           ;GET CURRENT PC
2600  010640  010205                        MOV     R2,R5           ;MOVE TO R5
2601  010642  124245                1$:     CMPB    -(R2),-(R5)     ;COMPARE ALL PREVIOUS MEMORY ADDRESSES
2602  010644  001401                        BEQ     .+4
2603  010646  104400                        HLT                     ;ERROR!
2604  010650  020237  001010                CMP     R2,@#FRSTAD     ;CHECK FOR LOW LIMIT
2605  010654  001372                        BNE     1$
```

```
2606  010656  104000                          SCOPE
2607
2608                                ;CHECK BINARY BYTE OPS USING ADDRESS MODES 2 & 4.
2609  010660  000402                          BR      .+6                 ;RESERVE TWO WORDS
2610  010662  000000                          .WORD   0                   ;SOURCE DATA
2611  010664  000000                          .WORD   0                   ;DESTINATION DATA
2612  010666  010703                          MOV     PC,R3
2613  010670  005743                          TST     -(R3)
2614  010672  112743  000200                  MOVB    #200,-(R3)
2615  010676  112743  000377                  MOVB    #377,-(R3)          ;(R3)=100377
2616  010702  010304                          MOV     R3,R4
2617  010704  112744  000177                  MOVB    #177,-(R4)
2618  010710  112744  000000                  MOVB    #0,-(R4)            ;(R4)=077400
2619  010714  001401                          BEQ     .+4
2620  010716  104400                          HLT
2621
2622  010720  152324                          BISB    (R3)+,(R4)+         ;(R3)=100377,(R4)=077777
2623  010722  100401                          BMI     .+4
2624  010724  104400                          HLT
2625
2626  010726  122324                          CMPB    (R3)+,(R4)+
2627  010730  103402                          BCS     CMPB2
2628  010732  102001                          BVC     CMPB2
2629  010734  100001                          BPL     .+4
2630  010736  104400                CMPB2:    HLT
2631
2632  010740  000261                          SEC
2633  010742  134344                          BITB    -(R3),-(R4)
2634  010744  103002                          BCC     BITB2
2635  010746  102401                          BVS     BITB2
2636  010750  001401                          BEQ     .+4
2637  010752  104400                BITB2:    HLT
2638
2639  010754  000244                          CLZ
2640  010756  144344                          BICB    -(R3),-(R4)         ;(R3)=100377,(R4)=077400
2641  010760  001401                          BEQ     .+4
2642  010762  104400                          HLT
2643  010764  104000                          SCOPE
2644
2645                                ;CHECK BINARY WORD OPS USING ADDRESS MODES 3 & 5.
2646  010766  000404                          BR      2$                  ;RESERVE SPACE FOR DATA AND ADDRESSES
2647  010770  000000                          .WORD   0                   ;CONTAINS ADDRESS OF SOURCE DATA
2648  010772  000000                          .WORD   0                   ;CONTAINS ADDRESS OF DEST DATA
2649  010774  000000                          .WORD   0                   ;CONTAINS SOURCE DATA
2650  010776  000000                          .WORD   0                   ;CONTAINS DEST DATA
2651  011000  010701                2$:       MOV     PC,R1
2652  011002  010100                          MOV     R1,R0               ;SET SCOPE PTR
2653  011004  024040                          CMP     -(R0),-(R0)         ;ADJUST R0
2654  011006  010005                          MOV     R0,R5               ;R5 POINTS TO DEST DATA
2655  011010  024545                          CMP     -(R5),-(R5)         ;SUB 4 FROM R5
2656  011012  010015                          MOV     R0,(R5)             ;R5 POINTS TO ADDRESS OF DEST DATA
2657  011014  010502                          MOV     R5,R2
2658  011016  010004                          MOV     R0,R4               ;R4 POINTS TO DEST DATA
2659  011020  005740                          TST     -(R0)
2660  011022  010003                          MOV     R0,R3               ;R3 POINTS TO SOURCE DATA
2661  011024  010042                          MOV     R0,-(R2)            ;R2 POINTS TO ADDRESS OF SOURCE DATA
```

```
2662  011026  005013                        CLR     (R3)              ;PRESET SOURCE DATA
2663  011030  005014                        CLR     (R4)              ;PRESET DEST DATA
2664
2665  011032  000277                        SCC
2666  011034  000244                        CLZ
2667  011036  163235                        SUB     @(R2)+,@(R5)+     ;(R3)=000000,(R4)=000000, CC=0100
2668  011040  103402                        BCS     SUB3
2669  011042  102401                        BVS     SUB3
2670  011044  001401                        BEQ     .+4
2671  011046  104400              SUB3:     HLT
2672
2673  011050  052752  100000              BIS     #100000,@-(R2)    ;(R3)=100000
2674  011054  062755  000001              ADD     #1,@-(R5)         ;(R4)=000001
2675  011060  163235                        SUB     @(R2)+,@(R5)+     ;(R3)=100000,(R4)=100001, CC=1011
2676  011062  103002                        BCC     SUB3A
2677  011064  102001                        BVC     SUB3A
2678  011066  100401                        BMI     .+4
2679  011070  104400              SUB3A:    HLT
2680
2681  011072  005414                        NEG     (R4)              ;(R4)=077777
2682  011074  035255                        BIT     @-(R2),@-(R5)     ;(R3)=100000,(R4)=077777
2683  011076  001401                        BEQ     .+4
2684  011100  104400                        HLT
2685  011102  023235                        CMP     @(R2)+,@(R5)+
2686  011104  102401                        BVS     .+4
2687  011106  104400                        HLT
2688  011110  005152                        COM     @-(R2)
2689  011112  000257                        CCC
2690  011114  063255                        ADD     @(R2)+,@-(R5)
2691  011116  102001                        BVC     ADD3
2692  011120  100401                        BMI     .+4
2693  011122  104400              ADD3:     HLT
2694  011124  000261                        SEC
2695  011126  045235                        BIC     @-(R2),@(R5)+     ;(R3)=077777,(R4)=100000
2696  011130  103001                        BCC     BIC3
2697  011132  100401                        BMI     .+4
2698  011134  104400              BIC3:     HLT
2699
2700  011136  005155                        COM     @-(R5)            ;(R4)=077777
2701  011140  023235                        CMP     @(R2)+,@(R5)+     ;(R3)=077777,(R4)=077777
2702  011142  001401                        BEQ     .+4
2703  011144  104400                        HLT
2704  011146  104000                        SCOPE
2705
2706                                ;CHECK BINARY BYTE OPS USING ADDRESS MODES 3 & 5.
2707  011150  000406                        BR      1$                ;RESERVE SPACE FOR ADDRESSES & DATA
2708  011152  000000                        .WORD   0                 ;CONTAINS ADDRESS OF SOURCE DATA (EVEN BYTE)
2709  011154  000000                        .WORD   0                 ;CONTAINS ADDRESS OF SOURCE DATA (ODD BYTE)
2710  011156  000000                        .WORD   0                 ;CONTAINS ADDRESS OF DEST DATA (EVEN BYTE)
2711  011160  000000                        .WORD   0                 ;CONTAINS ADDRESS OF DEST DATA (ODD BYTE)
2712  011162  000000                        .WORD   0                 ;CONTAINS SOURCE DATA
2713  011164  000000                        .WORD   0                 ;CONTAINS DEST DATA
2714
2715  011166  010700              1$:       MOV     PC,R0
2716  011170  024040                        CMP     -(R0),-(R0)       ;R0=ADDRESS OF DEST DATA
2717  011172  010003                        MOV     R0,R3             ;R3     "       "
```

```
2718  011174  010305                  MOV     R3,R5           ;R5     "       "
2719  011176  005743                  TST     -(R3)           ;SUB 2 FROM R3
2720  011200  010043                  MOV     R0,-(R3)        ;R3 POINTS TO ADDRESS OF DEST DATA
2721  011202  005213                  INC     (R3)            ;ODD BYTE
2722  011204  010043                  MOV     R0,-(R3)        ;EVEN BYTE
2723  011206  010304                  MOV     R3,R4
2724  011210  005740                  TST     -(R0)           ;R0=ADDRESS OF SOURCE DATA
2725  011212  010044                  MOV     R0,-(R4)        ;R4 POINTS TO ADDRESS OF SOURCE DATA
2726  011214  005214                  INC     (R4)            ;ODD BYTE
2727  011216  010044                  MOV     R0,-(R4)        ;EVEN BYTE
2728
2729  011220  000261                  SEC                     ;SET CARRY
2730  011222  012734  177001          MOV     #177001,@(R4)+
2731  011226  112734  000200          MOVB    #200,@(R4)+     ;SOURCE DATA=100001
2732  011232  115433                  MOVB    @-(R4),@(R3)+
2733  011234  115433                  MOVB    @-(R4),@(R3)+   ;DEST DATA=000600
2734  011236  103401                  BCS     .+4
2735  011240  104400                  HLT                     ;ERROR! MOV DOES AFFECT C BIT IN PSW
2736  011242  022715  000600          CMP     #600,(R5)       ;CHECK DEST DATA
2737  011246  001401                  BEQ     .+4
2738  011250  104400                  HLT                     ;ERROR! INCORRECT RESULT
2739  011252  024343                  CMP     -(R3),-(R3)     ;POINT R4 BACK TO EVEN BYTE
2740  011254  153433                  BISB    @(R4)+,@(R3)+
2741  011256  153433                  BISB    @(R4)+,@(R3)+   ;DEST DATA=100601
2742  011260  022715  100601          CMP     #100601,(R5)    ;CHECK RESULT
2743  011264  001401                  BEQ     .+4
2744  011266  104400                  HLT                     ;ERROR! INCORRECT DEST DATA AFTER BISB
2745  011270  145453                  BICB    @-(R4),@-(R3)
2746  011272  145453                  BICB    @-(R4),@-(R3)
2747  011274  133433                  BITB    @(R4)+,@(R3)+
2748  011276  001002                  BNE     BITB3
2749  011300  135433                  BITB    @-(R4),@(R3)+
2750  011302  001001                  BNE     .+4
2751  011304  104400          BITB3:  HLT
2752
2753  011306  123453                  CMPB    @(R4)+,@-(R3)
2754  011310  001002                  BNE     CMPB3
2755  011312  123453                  CMPB    @(R4)+,@-(R3)
2756  011314  001401                  BEQ     .+4
2757  011316  104400          CMPB3:  HLT
2758  011320  104000                  SCOPE
2759
2760                          ;CHECK BINARY OPS USING ADDRESS MODE 6
2761  011322  000402                  BR      .+6             ;RESERVE TWO LOCATIONS
2762  011324  000000          SDATA:  .WORD   0               ;RESERVED FOR SOURCE DATA
2763  011326  000000          DDATA:  .WORD   0               ;RESERVED FOR DESTINATION DATA
2764
2765  011330  013702  001004          MOV     @#FACTOR,R2     ;GET RELOCATION FACTOR AND USE AS AN
2766  011334  010205                  MOV     R2,R5           ;INDEX VALUE TO POINT TO DATA
2767  011336  005065  011326          CLR     DDATA(5)        ;PRESET DESTINATION DATA
2768  011342  012762  000001  011324  MOV     #1,SDATA(2)     ;THIS ROUTSINE PUT A 1 BIT INTO EVERY
2769  011350  056265  011324  011326  1$:     BIS     SDATA(2),DDATA(5)       ;OTHER BIT POSITION IN THE DEST-
2770  011356  006362  011324          ASL     SDATA(2)                ;INATION ADDRESS (52525)
2771  011362  006362  011324          ASL     SDATA(2)
2772  011366  103370                  BCC     1$
2773  011370  022765  052525  011326  CMP     #52525,DDATA(5) ;CHECK RESULT
```

```
2774  011376  001401                          BEQ     .+4
2775  011400  104400                          HLT                             ;ERROR! INCORRECT RESULT
2776  011402  012762  177777  011324          MOV     #-1,SDATA(2)
2777  011410  046562  011326  011324          BIC     DDATA(5),SDATA(2)       ;SOURCE DATA=125252
2778  011416  036265  011324  011326          BIT     SDATA(2),DDATA(5)
2779  011424  001401                          BEQ     .+4
2780  011426  104400                          HLT                             ;ERROR! BIT INST FAILED
2781  011430  006365  011326                  ASL     DDATA(5)                ;DDATA=125252
2782  011434  026265  011324  011326          CMP     SDATA(2),DDATA(5)
2783  011442  001401                          BEQ     .+4
2784
2785  011444  104400                          HLT                             ;ERROR! CMP INST FAILED
2786  011446  000257                          CCC
2787  011450  066265  011324  011326          ADD     SDATA(2),DDATA(5)
2788  011456  103002                          BCC     ADD6
2789  011460  102001                          BVC     ADD6
2790  011462  100001                          BPL     .+4
2791  011464  104400                ADD6:     HLT
2792
2793  011466  006362  011324                  ASL     SDATA(2)                ;SDATA=52524
2794  011472  166265  011324  011326          SUB     SDATA(2),DDATA(5)
2795  011500  103401                          BCS     SUB6
2796  011502  001401                          BEQ     .+4
2797  011504  104400                SUB6:     HLT
2798
2799  011506  112700  000377                  MOVB    #377,R0                 ;R0=177777 (MOVB %R EXTENDS SIGN)
2800  011512  010062  011324                  MOV     R0,SDATA(2)
2801  011516  012765  177777  011326          MOV     #-1,DDATA(5)
2802  011524  166500  011326                  SUB     DDATA(5),R0
2803  011530  001401                          BEQ     .+4
2804  011532  104400                          HLT
2805  011534  066265  011324  011326  1$:     ADD     SDATA(2),DDATA(5)
2806  011542  006362  011324                  ASL     SDATA(2)
2807  011546  005162  011324                  COM     SDATA(2)
2808  011552  036265  011324  011326          BIT     SDATA(2),DDATA(5)
2809  011560  001401                          BEQ     .+4
2810  011562  104400                          HLT
2811  011564  005162  011324                  COM     SDATA(2)
2812  011570  026265  011324  011326          CMP     SDATA(2),DDATA(5)
2813  011576  001401                          BEQ     .+4
2814  011600  104400                          HLT
2815  011602  026200  011324                  CMP     SDATA(2),R0
2816  011606  001352                          BNE     1$
2817  011610  104000                          SCOPE
2818
2819                                  ;CHECK BINARY BYTE OPS USING ADDRESS MODE 6
2820                                  ;NOTE: SDATAB(2), AND DDATAB(4) REFERENCE EVEN BYTE OF SOURCE & DEST DATA
2821                                  ;AND SDATAB(3), AND DDATAB(5) FEFERENCE ODD BYTE OF SOURCE & DEST DATA
2822
2823  011612  013702  001004                  MOV     @#FACTOR,R2     ;GET INDEX VALUE
2824  011616  010204                          MOV     R2,R4           ;R2 FOR SOURCE EVEN BYTE INDEX, R4 FOR
2825  011620  010403                          MOV     R4,R3           ;DEST ODD BYTE, R3 FOR SOURCE EVEN
2826  011622  005203                          INC     R3              ;AND R5 FOR DEST ODD BYTE
2827  011624  010305                          MOV     R3,R5
2828  011626  000261                          SEC                     ;SET CARRY
2829  011630  012762  125252  011754          MOV     #125252,SDATAB(2)
```

```
2830  011636  112763  177125  011754          MOVB    #177125,SDATAB(3)       ;SOURCE DATA = 052652
2831  011644  016264  011754  011756          MOV     SDATAB(2),DDATAB(4)
2832  011652  052764  125125  011756          BIS     #125125,DDATAB(4)       ;DEST DATA = 177777
2833  011660  136263  011754  011754          BITB    SDATAB(2),SDATAB(3)
2834  011666  001401                          BEQ     .+4
2835  011670  104400                  BITB6:  HLT
2836
2837  011672  146264  011754  011756          BICB    SDATAB(2),DDATAB(4)
2838  011700  103401                          BCS     .+4
2839  011702  104400                          HLT                     ;ERROR MOV,BIS,BIT;BIC DO NOT AFFECT 'C'
2840  011704  126364  011754  011756          CMPB    SDATAB(3),DDATAB(4)
2841  011712  001401                          BEQ     .+4
2842  011714  104400                          HLT
2843
2844  011716  146365  011754  011756          BICB    SDATAB(3),DDATAB(5)
2845  011724  126265  011754  011756          CMPB    SDATAB(2),DDATAB(5)
2846  011732  001401                          BEQ     .+4
2847  011734  104400                          HLT
2848
2849  011736  136564  011756  011756          BITB    DDATAB(5),DDATAB(4)
2850  011744  001401                          BEQ     .+4
2851  011746  104400                          HLT
2852  011750  104000                          SCOPE
2853
2854  011752  000406                          BR      UB7             ;RESERVE TWO WORDS
2855  011754  000000                  SDATAB: .WORD   0               ;RESERVED FOR SOURCE DATA
2856  011756  000000                  DDATAB: .WORD   0               ;RESERVED FOR DEST DATA
2857
2858                                  ;CHECK BINARY WORD OPS USING ADDRESS MODE 7
2859                                  ;R2=ADDRESS OF SOURCE DATA, AND R3= ADDRESS OF DEST DATA
2860  011760  000000                  SBIN7:  .WORD   0               ;CONTAINS ADDRESS OF SOURCE DATA
2861  011762  000000                  DBIN7:  .WORD   0               ;CONTAINS ADDRESS OF DEST DATA
2862  011764  000000                          .WORD   0               ;CONTAINS SOURCE DATA
2863  011766  000000                          .WORD   0               ;CONTAINS DEST DATA
2864
2865  011770  010700                  UB7:    MOV     PC,R0
2866  011772  024040                          CMP     -(R0),-(R0)
2867  011774  010002                          MOV     R0,R2
2868  011776  024242                          CMP     -(R2),-(R2)
2869  012000  010012                          MOV     R0,(R2)
2870  012002  010203                          MOV     R2,R3
2871  012004  024043                          CMP     -(R0),-(R3)
2872  012006  010013                          MOV     R0,(R3)
2873
2874  012010  000261                          SEC
2875  012012  012777  100000  177740          MOV     #100000,@SBIN7  ;SOURCE DATA = 100000
2876  012020  017777  177734  177734          MOV     @SBIN7,@DBIN7   ;DEST DATA = 100000
2877  012026  103001                          BCC     MOV7
2878  012030  100401                          BMI     .+4
2879  012032  104400                  MOV7:   HLT
2880  012034  006377  177722                  ASL     @DBIN7          ;DEST DATA = 000000
2881  012040  102001                          BVC     .+4
2882  012042  001401                          BEQ     .+4
2883  012044  104400                          HLT
2884
2885  012046  027777  177706  177706          CMP     @SBIN7,@DBIN7   ;(R2)=100000,(R3)=000000
```

```
2886  012054  103402                        BCS     CMP7
2887  012056  102401                        BVS     CMP7
2888  012060  100401                        BMI     .+4
2889  012062  104400                CMP7:   HLT
2890
2891  012064  167777  177670  177670        SUB     @SBIN7,@DBIN7   ;(R2)=100000,(R3)=100000
2892  012072  103003                        BCC     SUB7
2893  012074  102002                        BVC     SUB7
2894  012076  001401                        BEQ     SUB7
2895  012100  100401                        BMI     .+4
2896  012102  104400                SUB7:   HLT
2897
2898  012104  006277  177650                ASR     @SBIN7          ;(R2)=140000
2899  012110  067777  177644  177644        ADD     @SBIN7,@DBIN7   ;(R2)=140000,(R3)=040000
2900  012116  103003                        BCC     ADD7
2901  012120  102002                        BVC     ADD7
2902  012122  001401                        BEQ     ADD7
2903  012124  100001                        BPL     .+4
2904  012126  104400                ADD7:   HLT
2905
2906  012130  047777  177624  177624        BIC     @SBIN7,@DBIN7   ;(R2)=140000,(R3)=000000
2907  012136  001401                        BEQ     .+4
2908  012140  104400                        HLT
2909
2910  012142  057777  177612  177612        BIS     @SBIN7,@DBIN7   ;(R2)=140000,(R3)=140000
2911  012150  100401                        BMI     .+4
2912  012152  104400                        HLT
2913
2914  012154  027777  177600  177600        CMP     @SBIN7,@DBIN7
2915  012162  001401                        BEQ     .+4
2916  012164  104400                        HLT
2917  012166  104000                        SCOPE
2918
2919                                ;SOME MISCELLANEOUS OPERATION INVOLVING THE PC
2920                                ;NOTE: NONE OF THESE OPERATIONS SHOULD AFFECT THE PC
2921  012170  005000                        CLR     R0
2922  012172  005067  000072                CLR     1$
2923  012176  010707                        MOV     PC,PC
2924  012200  120707                        CMPB    PC,PC
2925  012202  030707                        BIT     PC,PC
2926  012204  060007                        ADD     R0,PC
2927  012206  105707                        TSTB    PC
2928  012210  005507                        ADC     PC
2929  012212  021007                        CMP     (R0),PC
2930  012214  131007                        BITB    (R0),PC
2931  012216  062707  000000                ADD     #0,PC
2932  012222  023707  001004                CMP     @#FACTOR,PC
2933  012226  133707  001004                BITB    @#FACTOR,PC
2934  012232  000240                        NOP
2935                                ;THE NEXT TWO INSTRUCTION CAUSE THE PROGRAM TO JUMP TO THE UNRELOCATED
2936                                ;CODE AND TO RETURN ON THE FOLLOWING INST (IF THE CODE IS RELOCATED)
2937  012234  163707  001004                SUB     @#FACTOR,PC     ;JUMPS TO UNRELOCATED CODE
2938  012240  063707  001004                ADD     @#FACTOR,PC     ;RETURNS
2939  012244  000240                        NOP
2940  012246  024607                        CMP     -(SP),PC
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```
2941  012250  132607                        BITB    (SP)+,PC
2942  012252  026707  000012                CMP     1$,PC
2943  012256  166707  000006                SUB     1$,PC
2944  012262  046707  000002                BIC     1$,PC
2945  012266  000401                        BR      .+4             ;BRANCH OVER 1$
2946  012270  000000                1$:     0
2947  012272  104000                        SCOPE
2948
2949  012274  010702                        MOV     PC,R2
2950  012276  062702  000012                ADD     #12,R2
2951  012302  012707  001132                MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
2952  012306  000240                        NOP                     ;PROGRAM RETURNS HERE+2
2953                                ;1111111111111 LAST ADDRESS OF CODE TO BE RELOCATED 11111111111
2954
2955
2956                                ;2222222222222 FIRST ADDRESS TO BE RELOCATED 222222222
2957  012310  010700                REL2:   MOV     PC,R0           ;GET PC
2958  012312  005740                        TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL2
2959  012314  010037  001010                MOV     R0,@#FRSTAD     ;SAVE
2960  012320  010700                        MOV     PC,R0           ;GET CURRENT PC
2961  012322  162700  012322                SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
2962  012326  010037  001004                MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
2963  012332  010701                        MOV     PC,R1           ;SET NEW SCOPE PTR
2964                                ;CHECK BINARY BYTE OPS USING ADDRESS MODE 7
2965  012334  000406                        BR      BINB7           ;RESERVE SPACE FOR ADDRESSES & DATA
2966  012336  000000                SBINB7: .WORD   0               ;CONTAINS ADDRESS OF SOURCE EVEN BYTE
2967  012340  000000                        .WORD   0               ;CONTAINS ADDRESS OF SOURCE ODD BYTE
2968  012342  000000                        .WORD   0               ;CONTAINS ADDRESS OF DEST EVEN BYTE
2969  012344  000000                        .WORD   0               ;CONTAINS ADDRESS OF DEST ODD BYTE
2970  012346  000000                DBINB7: .WORD   0               ;CONTAINS SOURCE DATA
2971  012350  000000                        .WORD   0               ;CONTAINS DEST DATA
2972
2973  012352  010700                BINB7:  MOV     PC,R0
2974  012354  024040                        CMP     -(R0),-(R0)     ;R0 = ADDRESS OF DEST DATA
2975  012356  010060  177772                MOV     R0,-6(R0)       ;LOAD ADDRES OF DEST EVEN BYTE DATA
2976  012362  010060  177774                MOV     R0,-4(R0)
2977  012366  005260  177774                INC     -4(R0)          ;LOAD ADDRESS OF DEST ODD BYTE DATA
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2978  012372  005740                        TST     -(R0)               ;R0=ADDRESS OF SOURCE DATA
2979  012374  010060  177770                MOV     R0,-10(R0)          ;LOAD ADDRESS OF SOURCE EVEN BYTE DATA
2980  012400  010060  177772                MOV     R0,-6(R0)
2981  012404  005260  177772                INC     -6(R0)              ;LOAD ADDRESS OF SOURCE ODD BYTE DATA
2982
2983  012410  005002                        CLR     R2                  ;SET INDEX REGISTERS
2984  012412  012703  000002                MOV     #2,R3               ;@SBINB7(2);@SBINB7(3) REFERENCE EVEN &
2985  012416  012704  177774                MOV     #-4,R4              ;ODD BYTE SOURCE DATA; @DBINB7(4);@DBINB7(5)
2986  012422  012705  177776                MOV     #-2,R5              ;REFERENCE DEST EVEN& ODD BYTE DATA
2987
2988
2989  012426  005020                        CLR     (R0)+               ;PRESET SOURCE DATA
2990  012430  005010                        CLR     (R0)                ;PRESET DEST DATA
2991  012432  013746  001004                MOV     @#FACTOR,-(SP)      ;GET RELOCATION FACTOR
2992  012436  061602                        ADD     (SP),R2             ;AND ADD TO INDEX VALUES
2993  012440  061603                        ADD     (SP),R3
2994  012442  061604                        ADD     (SP),R4
2995  012444  062605                        ADD     (SP)+,R5
2996
2997  012446  112773  177777  012336        MOVB    #-1,@SBINB7(3)      ;SRC DATA = 177400
2998  012454  132772  000377  012336        BITB    #377,@SBINB7(2)     ;CHECK THAT EVEN BYTE WAS NOT AFFECTED
2999  012462  001401                        BEQ     .+4                 ;BY MOVB INSTRUCTION
3000  012464  104400                        HLT
3001
3002  012466  157374  012336  012346        BISB    @SBINB7(3),@DBINB7(4)
3003  012474  105274  012346                INCB    @DBINB7(4)          ;CHECK THAT BIS SET ALL BITS
3004  012500  001401                        BEQ     .+4
3005  012502  104400                        HLT
3006
3007  012504  105375  012346                DECB    @DBINB7(5)          ;DEST DATA = 177400
3008  012510  005274  012346                INC     @DBINB7(4)          ;DEST DATA = 177401
3009  012514  127375  012336  012346        CMPB    @SBINB7(3),@DBINB7(5)
3010  012522  001401                        BEQ     .+4
3011  012524  104400                        HLT
3012
3013  012526  147375  012336  012346        BICB    @SBINB7(3),@DBINB7(5)
3014  012534  001401                        BEQ     .+4
3015  012536  104400                        HLT
3016
3017  012540  105073  012336                CLRB    @SBINB7(3)          ;SRC DATA = 000000
3018                                ;THIS ROUTINE SETS ALL BITS IN THE SOURCE ODD BYTE BY BISING A BIT FROM
3019                                ;THE DEST EVEN BYTE INTO THE SOURCE ODD BYTE
3020  012544  157473  012346  012336  BIS7:   BISB    @DBINB7(4),@SBINB7(3)
3021  012552  106174  012346                ROLB    @DBINB7(4)
3022  012556  103372                        BCC     BIS7
3023  012560  022772  177400  012336        CMP     #177400,@SBINB7(2)      ;CHECK RESULT
3024  012566  001401                        BEQ     .+4
3025  012570  104400                        HLT
3026
3027  012572  000372  012336                SWAB    @SBINB7(2)          ;SRC DATA = 000377
3028  012576  112775  000200  012346        MOVB    #200,@DBINB7(5)     ;DEST DATA = 100000
3029
3030  012604  147572  012346  012336  BIC7:   BICB    @DBINB7(5),@SBINB7(2)
3031  012612  106075  012346                RORB    @DBINB7(5)
3032  012616  103372                        BCC     BIC7
3033  012620  005772  012336                TST     @SBINB7(2)
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  3034  012624  001401                          BEQ     .+4
  3035  012626  104400                          HLT
  3036  012630  104000                          SCOPE
  3037
  3038  012632  012702  000001          0AERR:  MOV     #1,R2           ;LOAD R2 WITH ODD #
  3039  012636  010703                          MOV     PC,R3
  3040  012640  000401                          BR      .+4             ;RESERVE SPACE FOR A WORD
  3041  012642  000000                          .WORD   0               ;WILL CONTAIN AN ODD ADDRESS
  3042  012644  005723                          TST     (R3)+           ;STEP R3 TO POINT TO WORD ABOVE
  3043  012646  010313                          MOV     R3,(R3)
  3044  012650  005213                          INC     (R3)            ;AND MAKE ODD
  3045  012652  012737  013000  000004          MOV     #1$,@#ERRVEC    ;SET ODD ADDRESS & RESERVED INSTRUCTION
  3046  012660  063737  001004  000004          ADD     @#FACTOR,@#ERRVEC
  3047  012666  013737  000004  000010          MOV     @#ERRVEC,@#RESVEC       ;TO TRAP TO 1$ BELOW
  3048
  3049  012674  000277                          SCC                     ;SET ALL CC'S
  3050  012676  160212                          SUB     R2,(R2)
  3051  012700  104400                          HLT
Z 3052  012702  060222                          ADD     R2,(R2)+
  3053  012704  104400                          HLT
  3054  012706  006342                          ASL     -(R2)
  3055  012710  104400                          HLT
  3056  012712  106512                          MFPD    (R2)            ;NOTE: MAY BE RESERVED
  3057  012714  104400                          HLT
  3058  012716  170412                          CLRF    (R2)
  3059  012720  104400                          HLT
  3060  012722  042202                          BIC     (R2)+,R2
  3061  012724  104400                          HLT
  3062  012726  164202                          SUB     -(R2),R2
  3063  012730  104400                          HLT
  3064  012732  155202                          BISB    @-(R2),R2
  3065  012734  104400                          HLT
  3066  012736  105532                          ADCB    @(R2)+
  3067  012740  104400                          HLT
  3068  012742  163302                          SUB     @(R3)+,R2
  3069  012744  104400                          HLT
  3070  012746  005733                          TST     @(R3)+
  3071  012750  104400                          HLT
  3072  012752  106533                          MFPD    @(R3)+
  3073  012754  104400                          HLT
  3074  012756  170453                          CLRD    @-(R3)
  3075  012760  104400                          HLT
  3076  012762  137702  177775                  BITB    @.+1,R2
  3077  012766  104400                          HLT
  3078  012770  105477  177773                  NEGB    @.-1
  3079  012774  104400                          HLT
  3080  012776  000406                          BR      2$
  3081
  3082  013000  062716  000002          1$:     ADD     #2,(SP)         ;ADJUST RETURN PC
  3083  013004  052766  000017  000002          BIS     #17,2(SP)       ;SET CONDITION CODES ON RETURN
  3084  013012  000002                          RTI
  3085
  3086  013014  012706  000500          2$:     MOV     #STKPTR,SP      ;RESET STACK PTR
  3087  013020  012737  000006  000004          MOV     #ERRVEC+2,@#ERRVEC
  3088  013026  012737  000012  000010          MOV     #RESVEC+2,@#RESVEC
  3089  013034  104000                          SCOPE
```

```
3090
3091                                    ;CHECK JMP INSTRUCTIONS
3092
3093  013036  010700                            MOV     PC,R0
3094  013040  062700  000012                    ADD     #12,R0          ;SET ADDRESS FOR JMP INST
3095  013044  000277                            SCC                     ;SET CC'S
3096  013046  000110                            JMP     (R0)
3097  013050  000402                            BR      .+6
3098  013052  000250                            CLN                     ;JMP INST JUMPS HERE
3099  013054  000775                            BR      .-4
3100
3101  013056  103003                            BCC     JMP1
3102  013060  102002                            BVC     JMP1
3103  013062  001001                            BNE     JMP1
3104  013064  100001                            BPL     .+4
3105  013066  104400                    JMP1:   HLT                     ;ERROR! INCORRECT CC'S AFTER JMP
3106
3107  013070  005002                            CLR     R2              ;SET INDICATOR
3108  013072  010703                            MOV     PC,R3
3109  013074  000401                            BR      .+4             ;RESERVE WORD FOR JMP ADDRESS
3110  013076  000000                            .WORD   0               ;CONTAINS ADDRESS FOR JMP INST
3111  013100  005723                            TST     (R3)+
3112  013102  010313                            MOV     R3,(R3)
3113  013104  010300                            MOV     R3,R0
3114  013106  062713  000022                    ADD     #22,(R3)        ;(R3) IS JMP ADDRESS
3115  013112  010300                            MOV     R3,R0
3116  013114  000133                            JMP     @(R3)+          ;JUMP TO ADDRESS CONTAINED IN R3
3117  013116  000402                            BR      .+6
3118  013120  005102                            COM     R2              ;COMPLEMENT INDICATOR
3119  013122  000775                            BR      .-4
3120  013124  005202                            INC     R2              ;CHECK INDICATOR
3121  013126  001003                            BNE     JMP3
3122  013130  005720                            TST     (R0)+
3123  013132  020003                            CMP     R0,R3           ;CHECK AUTO-INC R3
3124  013134  001401                            BEQ     .+4
3125  013136  104400                    JMP3:   HLT
3126
3127  013140  005002                            CLR     R2              ;SET INDICATOR
3128  013142  010704                            MOV     PC,R4           ;SET UP JMP REGISTER
3129  013144  010400                    .       MOV     R4,R0           ;SET UP CHECK REGISTER
3130  013146  000402                            BR      1$
3131  013150  005102                            COM     R2              ;COMPLEMENT INDICATOR
3132  013152  000403                            BR      2$
3133  013154  022424                    1$:     CMP     (R4)+,(R4)+
3134  013156  005724                            TST     (R4)+           ;R4=JMP ADDRESS
3135  013160  000144                            JMP     -(R4)           ;USE R4 AS ADDRESS
3136  013162  005202                    2$:     INC     R2              ;CHECK INDICATOR
3137  013164  001003                            BNE     JMP4
3138  013166  022020                            CMP     (R0)+,(R0)+
3139  013170  020004                            CMP     R0,R4           ;CHECK AUTO-DEC R4
3140  013172  001401                            BEQ     .+4
3141  013174  104400                    JMP4:   HLT
3142
3143  013176  010703                            MOV     PC,R3
3144  013200  000401                            BR      .+4             ;RESERVE WORD FOR JMP ADDRESS
3145  013202  000000                    1$:     .WORD   0               ;CONTAINS JUMP ADDRESS
```

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3146  013204  005723                          TST     (R3)+
3147  013206  010313                          MOV     R3,(R3)
3148  013210  062723  000016                  ADD     #16,(R3)+
3149  013214  010300                          MOV     R3,R0           ;LOAD CHECK REGISTER
3150  013216  000402                          BR      3$
3151  013220  005102                  2$:     COM     R2
3152  013222  000401                          BR      4$
3153  013224  000153                  3$:     JMP     @-(R3)          ;JUMP TO 2$ VIA 1$ ABOVE
3154  013226  005202                  4$:     INC     R2              ;CHECK INDICATOR
3155  013230  001003                          BNE     JMP5
3156  013232  005740                          TST     -(R0)
3157  013234  020003                          CMP     R0,R3           ;CHECK AUTO-DEC R3
3158  013236  001401                          BEQ     .+4
3159  013240  104400                  JMP5:   HLT
3160
3161  013242  000402                          BR      2$
3162  013244  005102                  1$:     COM     R2              ;COMPLEMENT INDICATOR
3163  013246  000402                          BR      3$
3164  013250  000167  177770          2$:     JMP     1$
3165  013254  005202                  3$:     INC     R2
3166  013256  001401                          BEQ     .+4
3167  013260  104400                  JMP6:   HLT
3168
3169  013262  012767  013300  000020          MOV     #1$,7$          ;SET UP JMP ADDRESS
3170  013270  063767  001004  000012          ADD     @#FACTOR,7$     ;ADD RELOCATION FACTOR
3171  013276  000402                          BR      2$              ;GO TO JMP  @7$ INST
3172  013300  005102                  1$:     COM     R2              ;COMPLEMENT INDICATOR
3173  013302  000403                          BR      3$              ;GO TO CHECK ROUTINE
3174  013304  000177  000000          2$:     JMP     @7$             ;JMP TO 1$ ABOVE VIA 7$
3175  013310  000000                  7$:     .WORD   0               ;CONTAINS JMP ADDRESS
3176  013312  005202                  3$:     INC     R2              ;CHECK INDICATOR
3177  013314  001401                          BEQ     .+4
3178  013316  104400                  JMP7:   HLT
3179  013320  104000                          SCOPE
3180
3181                                  ;CHECK JSR INSTRUCTIONS
3182  013322  013705  001004          JSRTST: MOV     @#FACTOR,R5     ;GET RELOCATION FACTOR
3183  013326  012702  013360                  MOV     #3$,R2          ;FORM DEST ADRS
3184  013332  060502                          ADD     R5,R2           ;ADD RELOCATION FACTOR
3185  013334  000277                          SCC                     ;PRESET CC'S
3186  013336  000242                          CLV
3187  013340  004512                          JSR     R5,(R2)         ;GO TO 3$ VIA R2
3188  013342  005702                  1$:     TST     R2              ;CHECK INDICATOR
3189  013344  001017                          BNE     JSR1            ;R2 SHOULD=0
3190  013346  023705  001004                  CMP     @#FACTOR,R5     ;CHECK THAT RTS  R5 RESTORED R5
3191  013352  001014                          BNE     JSR1
3192  013354  000414                          BR      JSR1A           ;EXIT TO SCOPE
3193  013356  000205                  2$:     RTS     R5              ;RETURN FROM SUBROUTINE
3194  013360  103011                  3$:     BCC     JSR1            ;CHECK THAT JSR DID NOT
3195  013362  102410                          BVS     JSR1
3196  013364  001007                          BNE     JSR1            ;AFFECT CC'S
3197  013366  100006                          BPL     JSR1
3198  013370  005002                          CLR     R2              ;CLEAR INDICATOR
3199  013372  012704  013342                  MOV     #1$,R4          ;GET UNRELOCATED RETURN ADDRESS
3200  013376  061604                          ADD     (SP),R4         ;ADD RELOCATION FACTOR (OLD R5)
3201  013400  020405                          CMP     R4,R5           ;CHECK THAT OLD R5 WAS PLACED ON THE
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3202  013402  001765                    BEQ     2$              ;STACK & THAT NEW R5 CONTAINS RETURN PC
3203  013404  104400            JSR1:   HLT                     ;ERROR! ABOVE
3204
3205  013406  013704  001004    JSR1A:  MOV     @#FACTOR,R4     ;GET RELOCATION FACTOR
3206  013412  005000                    CLR     R0              ;SET INDICATOR
3207  013414  012705  013434            MOV     #1$,R5
3208  013420  060405                    ADD     R4,R5           ;SET UP JSR DEFERRED ADRS
3209  013422  010502                    MOV     R5,R2
3210  013424  012715  013452            MOV     #5$,(R5)
3211  013430  060415                    ADD     R4,(R5)         ;(R5)=DEST ADRS
3212  013432  000401                    BR      2$              ;RESERVE WORD FOR ADDRESS
3213  013434  000000            1$:     .WORD   0               ;CONTAINS DEST ADRS FOR JSR
3214  013436  004435            2$:     JSR     R4,@(R5)+       ;JSR TO 5$ VIA 1$ ABOVE
3215  013440  005200            3$:     INC     R0              ;CHECK INDICATOR
3216  013442  001013                    BNE     JSR3
3217  013444  000413                    BR      JSR3A
3218  013446  005100            4$:     COM     R0              ;COMPLEMENT INDICATOR
3219  013450  000204                    RTS     4               ;RETURN FROM SUBROUTINE
3220  013452  012703  013440    5$:     MOV     #3$,R3          ;GET UNRELOCATED RETURN ADDRESS
3221  013456  061603                    ADD     (SP),R3         ;ADD RELOCATION FACTOR (OLD R4)
3222  013460  020403                    CMP     R4,R3
3223  013462  001003                    BNE     JSR3
3224  013464  005722                    TST     (R2)+
3225  013466  020205                    CMP     R2,R5           ;CHECK AUTO-INC R5
3226  013470  001766                    BEQ     4$              ;GO TO RTS
3227  013472  104400            JSR3:   HLT                     ;ERROR ABOVE
3228
3229  013474  013704  001004    JSR3A:  MOV     @#FACTOR,R4
3230  013500  010405                    MOV     R4,R5
3231  013502  010703                    MOV     PC,R3
3232  013504  000401                    BR      2$
3233  013506  000405            1$:     BR      4$
3234  013510  022323            2$:     CMP     (R3)+,(R3)+
3235  013512  000277                    SCC
3236  013514  004443                    JSR     R4,-(R3)                ;GO TO 2$
3237  013516  104400            3$:     HLT
3238  013520  000414                    BR      JSR4A
3239  013522  103012            4$:     BCC     JSR4
3240  013524  102011                    BVC     JSR4
3241  013526  001010                    BNE     JSR4
3242  013530  100007                    BPL     JSR4
3243  013532  012702  013516            MOV     #3$,R2          ;GET UNRELOCATED RETURN ADDRESS
3244  013536  061602                    ADD     (SP),R2         ;ADD RELOCATION FACTOR (OLD R4)
3245  013540  020204                    CMP     R2,R4           ;CHECK THAT CALCULATED RETURN
3246  013542  001002                    BNE     JSR4            ;PC = NEW R4
3247  013544  005724                    TST     (R4)+
3248  013546  000204                    RTS     R4
3249  013550  104400            JSR4:   HLT
3250
3251
3252  013552  000401            JSR4A:  BR      2$
3253  013554  000405            1$:     BR      3$
3254  013556  010700            2$:     MOV     PC,R0
3255  013560  004767  177770            JSR     PC,1$
3256  013564  100407                    BMI     JSR6A
3257  013566  104400                    HLT
```

```
3258  013570  022020                  3$:     CMP     (R0)+,(R0)+
3259  013572  020016                          CMP     R0,(SP)         ;CHECK THAT RETURN ADDRESS IS ON THE
3260  013574  001401                          BEQ     .+4             ;STACK
3261  013576  104400                          HLT
3262  013600  000270                          SEN                     ;SET N
3263  013602  000207                          RTS     PC
3264  013604  104000                  JSR6A:  SCOPE
3265
3266                                  ;CHECK IOT TRAP (AND ROLB/ASLB)
3267  013606  012737  013640  000020          MOV     #IOT1,@#IOTVEC
3268  013614  063737  001004  000020          ADD     @#FACTOR,@#IOTVEC       ;ADD RELOCATION FACTOR
3269  013622  000261                          SEC                     ;SET CARRY
3270  013624  013737  177776  000022          MOV     @#PSW,@#IOTVEC+2        ;RETAIN CURRENT PSW ON TRAP
3271  013632  005000                          CLR     R0              ;PRESET R0
3272  013634  000004                          IOT
3273  013636  000403                          BR      IOT1A
3274  013640  106100                  IOT1:   ROLB    R0                      ;ROTATE R0
3275  013642  102376                          BVC     .-2             ;UNTIL V SETS (R0=200)
3276  013644  000002                          RTI
3277  013646  106300                  IOT1A:  ASLB    R0              ;SHIFT SHOULD SET CARRY
3278  013650  103004                          BCC     IOT1B
3279  013652  102003                          BVC     IOT1B
3280  013654  001002                          BNE     IOT1B
3281  013656  005700                          TST     R0              ;R0 SHOULD =0
3282  013660  001401                          BEQ     .+4
3283  013662  104400                  IOT1B:  HLT                     ;ERROR! ROL/ASL FAILED TO SET CC'S PROPERLY
3284  013664  012737  000022  000020          MOV     #IOTVEC+2,@#IOTVEC      ;RESTORE IOT TRAP
3285  013672  005037  000022                  CLR     @#IOTVEC+2              ;VECTOR
3286  013676  104000                          SCOPE
3287
3288                                  ;CHECK EMT TRAP SEQUENCE
3289  013700  013746  000030                  MOV     @#EMTVEC,-(SP)  ;SAVE SCOPE PTR
3290  013704  012737  013740  000030          MOV     #EMT1,@#EMTVEC  ;SET EMT TRAP VECTOR
3291  013712  063737  001004  000030          ADD     @#FACTOR,@#EMTVEC       ;ADD RELOCATION FACTOR
3292  013720  000262                          SEV                     ;SET V
3293  013722  013737  177776  000032          MOV     @#PSW,@#EMTVEC+2        ;RETAIN CURRENT PSW ON TRAP
3294  013730  000265                          +SEZ!SEC
3295  013732  104000                          EMT                     ;TRAP TO EMT1
3296  013734  001433                          BEQ     EMT1C           ;GO TO EMT1C
3297  013736  104400                          HLT                     ;ERROR! INCORRECT CC'S WERE SET ON RETURN
3298  013740  102027                  EMT1:   BVC     EMT1B           ;'V' SHOULD'VE SET ON EMT TRAP
3299  013742  105100                          COMB    R0              ;R0=000377,CC'S=1001
3300  013744  105500                          ADCB    R0              ;R0=000000,CC'S=0101
3301  013746  106000                          RORB    R0              ;R0=000200,CC'S=1010
3302  013750  102023                          BVC     EMT1B
3303  013752  100022                          BPL     EMT1B
3304  013754  000257                          CCC
3305  013756  105400                          NEGB    R0              ;R0=000200,CC'S=1010
3306  013760  102017                          BVC     EMT1B
3307  013762  100016                          BPL     EMT1B
3308  013764  000242                          CLV                     ;CLEAR 'V'
3309  013766  000261                          SEC                     ;AND SET 'C'
3310  013770  105300                          DECB    R0              ;R0=000177,CC'S=0011
3311  013772  102012                          BVC     EMT1B
3312  013774  100411                          BMI     EMT1B
3313  013776  000242                          CLV                     ;CLEAR 'V'
```

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3314  014000  105200                          INCB    R0              ;R0=000200,CC'S=1011
3315  014002  103006                          BCC     EMT1B
3316  014004  102005                          BVC     EMT1B
3317  014006  100004                          BPL     EMT1B
3318  014010  000242                          CLV                     ;CLEAR 'V'
3319  014012  106200                          ASRB    R0              ;SHIFT R0 UNTIL 'V' CLEARS
3320  014014  102776                          BVS     .-2
3321  014016  000401                          BR      .+4
3322  014020  104400              EMT1B:      HLT                     ;ERROR!
3323  014022  000002                          RTI                     ;EXIT WITH R0=000377
3324  014024  105500              EMT1C:      ADCB    R0              ;R0=000000
3325  014026  103003                          BCC     EMT1D
3326  014030  001002                          BNE     EMT1D
3327  014032  005700                          TST     R0
3328  014034  001401                          BEQ     .+4
3329  014036  104400              EMT1D:      HLT
3330  014040  012637  000030                  MOV     (SP)+,@#EMTVEC  ;RESTORE SCOPE PTR
3331  014044  005037  000032                  CLR     @#EMTVEC+2
3332  014050  104000                          SCOPE
3333
3334                              ;CHECK TRAP INSTRUCTION TRAP SEQUENCE
3335          000004                          HLT=IOT                 ;REDEFINE HLT
3336  014052  013737  000034  000020          MOV     @#TRAPVEC,@#IOTVEC      ;SET IOT (HLT) TRAP VECTOR
3337  014060  012737  014126  000034          MOV     #TRAP1,@#TRAPVEC        ;SET TRAP VECTOR
3338  014066  063737  001004  000034          ADD     @#FACTOR,@#TRAPVEC      ;ADD RELOCATION FACTOR
3339  014074  000270                          SEN                     ;SET N
3340  014076  013737  177776  000036          MOV     @#PSW,@#TRAPVEC+2       ;RETAIN CURRENT PSW ON TRAP
3341  014104  000261                          SEC                     ;SET CARRY
3342  014106  110700                          MOVB    PC,R0
3343  014110  000264                          SEZ                     ;SET Z BIT
3344  014112  104400                          TRAP                    ;TRAP TO TRAP1
3345  014114  103401              1$:         BCS     .+4
3346  014116  000004                          HLT
3347  014120  001401                          BEQ     .+4
3348  014122  000004                          HLT
3349  014124  000412                          BR      TRAP1C
3350  014126  100401              TRAP1:      BMI     .+4             ;N BIT GOT SET ON TRAP
3351  014130  000004                          HLT
3352  014132  062700  000004                  ADD     #4,R0
3353  014136  120016                          CMPB    R0,(SP)         ;CHECK LOW BYTE OF RETURN PC ON
3354  014140  001401                          BEQ     .+4             ;STACK
3355  014142  000004                          HLT
3356  014144  124646                          CMPB    -(SP),-(SP)
3357  014146  032626                          BIT     (SP)+,(SP)+
3358  014150  000002                          RTI                     ;RETURN TO INST FOLLOWING TRAP (1$)
3359
3360  014152  013737  000020  000034  TRAP1C: MOV     @#IOTVEC,@#TRAPVEC      ;RESTORE TRAP (HLT) TRAP VECTOR
3361  014160  012737  000200  000036          MOV     #PRTY4,@#TRAPVEC+2
3362  014166  012737  000022  000020          MOV     #IOTVEC+2,@#IOTVEC
3363  014174  005037  000022                  CLR     @#IOTVEC+2
3364  014200  104000                          SCOPE
3365          104400                          HLT=TRAP                ;RESTORE HLT TO A TRAP INST
3366
3367  014202  010702                          MOV     PC,R2
3368  014204  062702  000012                  ADD     #12,R2
3369  014210  012707  001132                  MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
```

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3370  014214  000240                          NOP                     ;PROGRAM RETURNS HERE+2
3371                                ;2222222222222 LAST ADDRESS OF CODE TO BE RELOCATED 22222222222
3372
3373  014216  010701                          MOV     PC,R1           ;SET SCOPE PTR
3374
3375                                ;THE BELOW ROUTINE ASCERTAINS WHICH CP & CP OPTIONS THE PROGRAM IS RUN-
3376                                ;NING ON AND SETS AN INDICATOR IN OPT.CP ACCORDINGLY.
3377  014220  005767  164554       CPCHK:  TST     ICNT            ;CHECK IF PASS 0
3378  014224  001036                        BNE     REL3            ;DO NOT EXECUTE ROUTINE IF NOT PASS 0
3379  014226  012737  000002 000006       MOV     #RTI,@#ERRVEC+2 ;SET UP ERROR TRAP TO RETURN
3380  014234  012700  000003              MOV     #3,R0
3381  014240  000261                       SEC
3382  014242  005737  177772              TST     @#PIRQ          ;R0=3 IF 11/45
3383  014246  005600                       SBC     R0              ;R0=2 IF 11/40
3384  014250  000261                       SEC
3385  014252  105737  177777              TSTB    @#PSW+1         ;R0=1 IF 11/20
3386  014256  005600                       SBC     R0
3387  014260  005037  177700              CLR     @#177700        ;R0=0 IF 11/05
3388  014264  006300                       ASL     R0              ;SHIFT INDICATOR
3389  014266  010027                       MOV     R0,(PC)+        ;SET CP INDICATOR
3390  014270  000000              OPT.CP: .WORD   0               ;CONTAINS OPTION & CP INDICATORS
3391                                      ;EVEN BYTE:     0=11/05,2=11/20,4=11/40,6=11/45
3392                                      ;ODD BYTE:      200=MEM MGMT,100=EIS, 40=11/45 FLOATING POINT
3393  014272  005037  000006       3$:     CLR     @#ERRVEC+2      ;RESTORE ERROR TRAP TO HALT ON TRAP
3394  014276  005037  000012              CLR     @#RESVEC+2
3395
3396  014302  126727  177762 000004       CMPB    OPT.CP,#4       ;BRANCH IF 11/05 OR 11/20
3397  014310  002404                       BLT     REL3
3398  014312  004767  164714              JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
3399  014316  016677                       ILLTEST
3400  014320  000000                       HALT
3401
3402
3403
3404                                ;3333333333333 FIRST ADDRESS TO BE RELOCATED 333333333
3405  014322  010700              REL3:   MOV     PC,R0           ;GET PC
3406  014324  005740                       TST     -(R0)           ;R0 CONTAINS THE ADDRESS OF REL3
3407  014326  010037  001010              MOV     R0,@#FRSTAD     ;SAVE
3408  014332  010700                       MOV     PC,R0           ;GET CURRENT PC
3409  014334  162700  014334              SUB     #.,R0           ;SUBTRACT RELOCATION FACTOR
3410  014340  010037  001004              MOV     R0,@#FACTOR     ;SAVE RELOCATION FACTOR
3411  014344  010701                       MOV     PC,R1           ;SET NEW SCOPE PTR
3412
3413                                ;CHECK STACK OVERFLOW
3414  014346  013767  177776 000306 OVFLW:  MOV     @#PSW,7$        ;SAVE STATUS IN 7$ BELOW
3415  014354  005037  177776              CLR     @#PSW           ;SET KERNEL MODE
3416  014360  010746                       MOV     PC,-(SP)        ;PUSH CURRENT PC ONTO STACK
3417  014362  062716  000136              ADD     #2$-.,(SP)      ;FORM ADDRESS OF 2$ BELOW
3418  014366  011637  000004              MOV     (SP),@#ERRVEC   ;SET ERROR VECTOR
3419  014372  012737  000340 000006       MOV     #340,@#ERRVEC+2 ;SET PRIORITY LEVEL 7 ON TRAP
3420  014400  062716  000074              ADD     #41$-2$,(SP)    ;FORM ADDRESS OF 41$ BELOW
3421  014404  012637  000020              MOV     (SP)+,@#IOTVEC  ;SET IOT TRAP VECTOR TO 41$
3422  014410  012746  000340              MOV     #340,-(SP)
3423  014414  011637  000022              MOV     (SP),@#IOTVEC+2 ;SET PRIORITY LEVEL 7 ON IOT TRAP
3424  014420  010746                       MOV     PC,-(SP)        ;PUSH CURRENT PC ONTO THE STAK
3425  014422  062716  000006              ADD     #6,(SP)         ;ADD OFFSET TO INST FOLLOWING RTI
```

```
                                        RTI                     ;SET PRIORITY LEVEL 7,CLEAR 'T' BIT
                                                                ;AND EXECUTE FOLLOWING INST NEXT
                                        MOV     #376,R3
                                        MOV     R3,(R3)         ;LOAD 376 INTO ADDRESS 376
                                        MOV     R3,SP           ;SET STACK PTR AT BOUNDARY

                                ;THE BELOW INSTRUCTIONS SHOULD NOT CAUSE AN OVERFLOW TRAP
                                        TST     (SP)            ;BECAUSE TST IS A NON MODIFYING INST
                                        CMP     (SP),-2(SP)     ;SO IS COMPARE
                                        CMPB    #2,@#OPT.CP     ;CHECK IF 11/20 OR 11/05
                                        BLT     12$             ;BRANCH IF 11/40 OR 11/45
                                        BEQ     11$             ;BRANCH IF 11/20
                                        MOV     #14,51$         ;CHANGE CHECK WORD IN 51$ IF 11/05
                                        BR      10$
                                11$:    MOV     #34,51$         ;CHANGE CHECK WORD IN 51$ IF 11/20
                                        BR      10$
                                12$:    MOV     (SP)+,@-(SP)    ;BECAUSE OF ADDRESS MODE 5
                                        BIS     -(SP),@(SP)     ;BECAUSE OF ADDRESS MODE 7
                                10$:    CLR     4(SP)           ;BECAUSE DEST ADDRESS IS > 376
                                        BIS     @(SP),@(SP)+    ;BECAUSE OF ADDRESS MODE 3
                                        BR      3$              ;BRANCH OVER NON KERNEL MODE TESTS


                                ;ERROR SERVICE ROUTINE
                                2$:     MOV     (SP)+,R0        ;SAVE PC OF INSTRUCTION THAT TRAPPED
                                        MOV     (SP)+,R2        ;SAVE PSW
                                        MOV     #STKPTR,SP      ;SET STACK PTR
                                        HLT                     ;ERROR! AN INSTRUCTION THAT WAS NOT
                                                                ;SUPPESED TO TRAP TRAPPED
                                                                ;R0 CONTAINS PC, R2 CONTAINS PSW
                                        BR      6$              ;EXIT TEST
                                ;THE BELOW INSTRUCTIONS WILL CAUSE A STACK OVERFLOW
                                ;STACK PTR IS AT 376
                                3$:     ADD     #4$-2$,@#ERRVEC ;SET ERROR VECTOR TO 4$
                                        MOV     R3,SP           ;SET STACK PTR AT 376
                                        MOV     #1,R2
                                        CLR     R0
                                        CLR     (SP)            ;SETS BIT 0 IN R0
                                        ASL     R2              ;SHIFT INDICATOR BIT
                                        INCB    (SP)+           ;SETS BIT 1 IN R0
                                        ASL     R2
                                        ADD     PC,-(SP)        ;SETS BIT 2 IN R0
                                        ASL     R2
                                        IOT                     ;SETS BIT 3 IN R0
                                        ASL     R2
                                        JSR     PC,40$          ;SETS BIT 4 IN R0
                                        ASL     R2              ;NOTE: 11/05 WITHOUT ECO # KD11A-00005
                                                                ;DOES NOT SET BIT 4.
                                        BIS     SP,-2(SP)       ;SETS BIT 5 IN R0
                                        BR      5$

                                ;PROGRAM WILL TRAP HERE ON OVERFLOW TRAP
                                4$:     BIS     R2,R0           ;SET APPROPRIATE BIT IN R0
                                        RTI                     ;RETURN FROM TRAP

                                40$:    RTS     PC
```

```
                                                ;CHECK THAT ABOVE INSRUCTIONS DID TRAP
014624  012706  000500          5$:     MOV     #STKPTR,SP      ;SET STACK PTR
014630  022700                  50$:    CMP     (PC)+,R0        ;EACH INSTRUCTION SET A BIT IN R0
014632  000000                  51$:    .WORD   0               ;CONTAINS CHECK WORD
014634  001407                          BEQ     6$              ;R0= 77 IF 40 OR 45,14 IF 05,34 IF 20
014636  105737  014270                  TSTB    @#OPT.CP        ;CHECK IF 11/05
014642  001003                          BNE     52$             ;BRANCH IF NOT AN 11/05
014644  022700  000034                  CMP     #34,R0          ;USE ECO KD11A-00005 CHECK WORD
014650  001401                          BEQ     6$
014652  104400                  52$:    HLT
                                                ;EXIT ROUTINE
014654  012706  000600          6$:     MOV     #KPTR,SP        ;SET KERNEL STACK PTR
014660  012746                          MOV     (PC)+,-(SP)     ;PUSH OLD PSW ONTO STACK
014662  000000                  7$:     .WORD   0               ;CONTAINS SAVED PSW
014664  010746                          MOV     PC,-(SP)        ;PUSH CURRENT PC ONTO STACK
014666  062716  000006                  ADD     #6,(SP)         ;ADD OFFSET
014672  000002                          RTI
014674  012706  000500                  MOV     #STKPTR,SP      ;SET STACK PTR
014700  012737  000006  000004          MOV     #ERRVEC+2,@#ERRVEC
014706  104000                          SCOPE
                                                ;CHECK THAT ALL RESERVED INSTRUCTIONS TRAP (TO LOCATION 10)
014710  012737  000002  001114  RESTRP: MOV     #2,@#SCOPED     ;LIMIT TO TWO ITERATIONS
014716  010701                          MOV     PC,R1           ;SET SCOPE POINTER
014720  012702  015040                  MOV     #5$,R2          ;GET ADDRESS OR RESERVED INSTRUCTION TABLE
014724  063702  001004                  ADD     @#FACTOR,R2
014730  122737  000004  014270          CMPB    #4,@#OPT.CP     ;ADJUST TABLE ADDRESS IF 11/20, 11/05
014736  003402                          BLE     11$             ;5$=11/45, 11/40 TABLE, 6$=11/05
014740  062702  000036                  ADD     #6$-5$,R2       ;11/20 TABLE
014744  132737  000040  014271  11$:    BITB    #40,@#OPT.CP+1  ;CHECK IF 11/45 FLOATING POINT IS AVAIL.
014752  001402                          BEQ     .+6             ;BRANCH IF NOT AVAILABLE
014754  005067  000110                  CLR     50$             ;SET TABLE TERMINATOR AT GROUP 7
014760  012737  015016  000010          MOV     #4$,@#RESVEC    ;SET RESERVED INSTRUCTION TRAP
014766  063737  001004  000010          ADD     @#FACTOR,@#RESVEC
014774  012203                  1$:     MOV     (R2)+,R3        ;GET FIRST RESERVED INSTRUCTION
014776  001454                          BEQ     7$              ;0 TERMINATES THE TABLE
015000  012204                          MOV     (R2)+,R4        ;GET LAST RESERVED INSTRUCTION IN GROUP
015002  010317                  2$:     MOV     R3,(PC)         ;EXECUTE RESERVED INSTRUCTION
015004  000000                  3$:     .WORD   0               ;CONTAINS RESERVED INSTRUCTION
015006  104400                          HLT                     ;ERROR! INSTRUCTION IN R3
015010  104400                          HLT                     ;(2$) ABOVE FAILED TO CAUSE A
015012  104400                          HLT                     ;RESERVED INSTRUCTION TRAP
015014  000405                          BR      41$
015016  012716  015030          4$:     MOV     #41$,(SP)       ;ADJUST RETURN PC
015022  063716  001004                  ADD     @#FACTOR,(SP)   ;TO RETURN TO 41$
015026  000002                          RTI                     ;RETURN TO 41$
015030  020304                  41$:    CMP     R3,R4           ;HAS GROUP OF RESERVED INSTRUCTIONS
015032  001760                          BEQ     1$              ;BEEN EXECUTED
015034  005203                          INC     R3              ;INCREMENT THIS RESERVED INSTRUCTION
015036  000761                          BR      2$              ;TO NEXT ONE AND EXECUTE
                                                ;TABLE OF 11/40,11/45 RESERVED INSTRUCTIONS (0 TERMINATES THE TABLE)
```

```
3538  015040  000007                  5$:     7                       ;GROUP 1
3539  015042  000077                          77                      ;  "
3540  015044  000210                          210                     ;GROUP 2
3541  015046  000227                          227                     ;  "
3542  015050  007000                          7000                    ;GROUP 3
3543  015052  007777                          7777                    ;  "
3544  015054  075040                          75040                   ;GROUP 4
3545  015056  076777                          76777                   ;  "
3546  015060  106400                          106400                  ;GROUP 5
3547  015062  106477                          106477                  ;  "
3548  015064  106700                          106700                  ;GROUP 6
3549  015066  107777                          107777                  ;  "
3550  015070  170000                  50$:    170000                  ;GROUP 7        FLOATING POINT
3551  015072  177777                          177777                  ;  "            INSTRUCTIONS
3552  015074  000000                          0                       ;0 TERMINATES THE TABLE
3553
3554                                          ;TABLE OF 11/05, 11/20 RESERVED INSTRUCTIONS (0 TERMINATES THE TABLE)
3555  015076  000006                  6$:     6                       ;GROUP 1
3556  015100  000077                          77                      ;  "
3557  015102  000210                          210                     ;GROUP 2
3558  015104  000237                          237                     ;  "
3559  015106  006400                          6400                    ;GROUP 3
3560  015110  007777                          7777                    ;  "
3561  015112  070000                          70000                   ;GROUP 4
3562  015114  077777                          77777                   ;  "
3563  015116  106400                          106400                  ;GROUP 5
3564  015120  107777                          107777                  ;  "
3565  015122  170000                          170000                  ;GROUP 6
3566  015124  177777                          177777                  ;  "
3567  015126  000000                          0                       ;0 TERMINATES THE TABLE
3568  015130  012737  000012  000010  7$:     MOV     #RESVEC+2,@#RESVEC      ;RESTORE RESERVED TRAP TO HALT AT 12
3569  015136  104000                          SCOPE
3570
3571                                          ;CHECK THAT ALL BITS IN THE PROCESSER STATUS WORD (PSW) CAN BE SET AND
3572                                          ;CLEARED.
3573  015140  013767  177776  000152  PSWCHK: MOV     @#PSW,3$                ;SAVE STATUS
3574  015146  005037  177776                  CLR     @#PSW                   ;CLEAR MODE BITS IN PSW
3575  015152  005046                          CLR     -(SP)                   ;ROUTINE TO CLEAR
3576  015154  010746                          MOV     PC,-(SP)                ;STATUS WORD (PSW)
3577  015156  062716  000006                  ADD     #6,(SP)
3578  015162  000002                          RTI                             ;CLEAR PSW & EXECUTE FOLLOWING INST
3579
3580  015164  013746  000016                  MOV     @#TBITVEC+2,-(SP)
3581  015170  012704  177776                  MOV     #PSW,R4                 ;LOAD ADDRESS OF PSW INTO R4
3582  015174  000250                          CLN
3583  015176  005714                          TST     (R4)                    ;CHECK THAT PSW WAS CLEARED
3584  015200  001401                          BEQ     .+4
3585  015202  104400                          HLT                             ;ERROR! PSW FAILED TO CLEAR
3586  015204  113700  014270                  MOVB    @#OPT.CP,R0             ;GET CP TYPE
3587  015210  016000  016636                  MOV     PSWBIT(0),R0            ;GET BIT MASK FOR TEST R0=THOSE BITS IN
3588                                                                          ;THE PSW WHICH CAN BE SET/CLEARED.
3589  015214  005737  014270                  TST     @#OPT.CP                ;CHECK IF MEM MGMT IS AVAILABLE
3590  015220  100002                          BPL     10$                     ;BRANCH IF NOT AVAILABLE
3591  015222  052700  170000                  BIS     #170000,R0              ;SET BITS 15-12 IF MEM MGMT
3592  015226  012702  000001          10$:    MOV     #1,R2                   ;R2 = TEST BIT
3593  015232  030200                  1$:     BIT     R2,R0                   ;CHECK IF BIT CAN BE SET/CLEARED
```

```
3594  015234  001423                          BEQ     2$
3595  015236  005037  000016                  CLR     @#TBITVEC+2
3596  015242  030227  000020                  BIT     R2,#20          ;CHECK IF TEST WILL SET 'T' BIT
3597  015246  001403                          BEQ     20$
3598  015250  012737  000002  000016          MOV     #RTI,@#TBITVEC+2;SET RTI INTO RETURN
3599  015256  005014                  20$:    CLR     (R4)            ;CLEAR PSW
3600  015260  050214                          BIS     R2,(R4)         ;SET R2 INTO PSW
3601  015262  011403                          MOV     (R4),R3         ;GET BIT
3602  015264  020203                          CMP     R2,R3           ;CHECK THAT BIT WAS SET IN PSW
3603  015266  001401                          BEQ     .+4
3604  015270  104400                          HLT                     ;ERROR! BIT IN R2 FAILED TO SET IN PSW
3605  015272  000244                          CLZ                     ;CLEAR Z BIT
3606  015274  040214                          BIC     R2,(R4)         ;CLEAR BIT IN PSW
3607  015276  011403                          MOV     (R4),R3         ;GET PSW RESULT
3608  015300  001401                          BEQ     2$              ;BRANCH IF BIC ABOVE CLEARED BIT IN PSW
3609  015302  104400                          HLT                     ;ERROR! BIT IN R2 FAILED TO CLEAR IN PSW
3610  015304  006302                  2$:     ASL     R2              ;SHIFT TEST BIT
3611  015306  103351                          BCC     1$              ;BRANCH IF ALL BITS NOT TESTED
3612  015310  005014                          CLR     (R4)            ;CLEAR STATUS
3613  015312  012637  000016                  MOV     (SP)+,@#TBITVEC+2       ;RESTORE T BIT RETURN
3614  015316  012746                          MOV     (PC)+,-(SP)     ;PUSH ORIGINAL STATUS ON STACK
3615  015320  000000                  3$:     .WORD   0               ;CONTAINS ORIGINAL PSW
3616  015322  010746                          MOV     PC,-(SP)        ;SET RETURN PC
3617  015324  062716  000006                  ADD     #6,(SP)
3618  015330  000002                          RTI                     ;RETURN
3619  015332  104000                  4$:     SCOPE
3620
3621  015334  013704  177776                  MOV     @#PSW,R4                ;SAVE PSW IN R4
3622  015340  010446                          MOV     R4,-(SP)                ;PUSH R4 ONTO STACK
3623  015342  112716  000300                  MOVB    #300,(SP)               ;SET PRIORITY LEVEL 6 AND
3624  015346  010746                          MOV     PC,-(SP)                ;CLEAR 'T' BIT AND EXECUTE
3625  015350  062716  000006                  ADD     #6,(SP)                 ;INSTRUCTION FOLLOWING RTI
3626  015354  000002                          RTI
3627
3628                          ;CHECK THAT ALL BITS IN THE CURRENT STACK PTR CAN BE SET/CLEARED
3629  015356  010603          CHKSP:  MOV     SP,R3           ;SAVE STACK PTR
3630  015360  000257                  CCC
3631  015362  112706  000377        MOVB    #377,SP         ;SET STACK PTR = -1
3632  015366  006006          1$:     ROR     SP              ;ROTATE 0 BIT THROUGH ALL BIT
3633  015370  103776                  BCS     1$              ;BIT POSITIONS
3634  015372  005206                  INC     SP              ;SHOULD INCREMENT SP TO 0
3635  015374  001403                  BEQ     2$
3636  015376  010602                  MOV     SP,R2           ;SAVE ERROR STACK PTR
3637  015400  010306                  MOV     R3,SP           ;SET STACK PTR FOR TRAP
3638  015402  104400                  HLT                     ;ERROR!
3639
3640  015404  010306          2$:     MOV     R3,SP           ;RESTORE ORIGINAL STACK PTR
3641
3642                          ;CHECK BYTE OPERATIONS USING THE STACK
3643  015406  010600          SPCHK:  MOV     SP,R0           ;SAVE STACK PTR
3644  015410  010003                  MOV     R0,R3
3645  015412  005043                  CLR     -(R3)
3646  015414  112746  177777        MOVB    #-1,-(SP)       ;(SP) = 377
3647  015420  022713  000377        CMP     #377,(R3)       ;CHECK THAT ONLY EVEN BYTE WAS AFFECTED
3648  015424  001002                  BNE     1$
3649  015426  020306                  CMP     R3,SP           ;CHECK AUTO-DEC
```

```
3650  015430  001401                    BEQ     .+4
3651  015432  104400              1$:   HLT
3652
3653  015434  105226                    INCB    (SP)+
3654  015436  005723                    TST     (R3)+           ;CHECK RESULT
3655  015440  001002                    BNE     2$
3656  015442  020006                    CMP     R0,SP           ;CHECK AUTO-INC
3657  015444  001401                    BEQ     .+4
3658  015446  104400              2$:   HLT
3659
3660  015450  005143                    COM     -(R3)           ;(R3)=177777
3661  015452  144613                    BICB    -(SP),(R3)
3662  015454  022713  177400            CMP     #177400,(R3)    ;CHECK RESULT
3663  015460  001002                    BNE     3$
3664  015462  020603                    CMP     SP,R3
3665  015464  001401                    BEQ     .+4
3666  015466  104400              3$:   HLT
3667
3668  015470  132627  000377            BITB    (SP)+,#377
3669  015474  001002                    BNE     4$
3670  015476  020600                    CMP     SP,R0
3671  015500  001401                    BEQ     .+4
3672  015502  104400              4$:   HLT
3673
3674  015504  012746  000001            MOV     #1,-(SP)
3675  015510  062706  000002            ADD     #2,SP
3676  015514  012702  177401            MOV     #177401,R2
3677  015520  120246                    CMPB    R2,-(SP)
3678  015522  001004                    BNE     5$
3679  015524  122602                    CMPB    (SP)+,R2
3680  015526  001002                    BNE     5$
3681  015530  020006                    CMP     R0,SP
3682  015532  001401                    BEQ     .+4
3683  015534  104400              5$:   HLT
3684  015536  010446                    MOV     R4,-(SP)        ;RESTORE ORIGINAL PSW TO STACK
3685  015540  010746                    MOV     PC,-(SP)
3686  015542  062716  000006            ADD     #6,(SP)
3687  015546  000002                    RTI
3688  015550  104000                    SCOPE
3689
3690                              ;CHECK THAT 'C' BIT SETS/CLEARS PROPERLY
3691  015552  012727  177776      CBIT: MOV     #177776,(PC)+   ;LOAD CONSTANT
3692  015556  000000              1$:   .WORD   0
3693  015560  010700                    MOV     PC,R0           ;GET CURRENT PC
3694  015562  162700  000004            SUB     #4,R0           ;POINT R0 TO 1$ ABOVE
3695  015566  005520              2$:   ADC     (R0)+           ;ADD 'C' BIT TO 1$ ABOVE
3696  015570  006340                    ASL     -(R0)           ;SHIFT 1$
3697  015572  102375                    BVC     2$              ;UNTIL 'V' BIT SETS
3698  015574  022767  077776  177754    CMP     #077776,1$      ;CHECK RESULT
3699  015602  001401                    BEQ     .+4
3700  015604  104400                    HLT                     ;ERROR! INCORRECT RESULT IN 1$ ABOVE
3701                                                            ;R0=ADDRESS OF DATA
3702
3703                              ;CHECK THAT CONDITION CODES ARE SET PROPERLY WHEN A NUMBER (CURRENT PC)
3704                              ;AND THAT NUMBER +1 ARE COMPARED, AND VICE VERSA.
3705  015606  010700              CMPN:   MOV     PC,R0           ;GET CURRENT PC
```

```
3706   015610   010002                          MOV     R0,R2           ;SAVE IN R2
3707   015612   005202                          INC     R2              ;MAKE R2 = R0+1
3708   015614   000277                          SCC
3709   015616   000251                          +CLC!CLN                ;CLEAR C & N BITS
3710   015620   020002                          CMP     R0,R2           ;COMPARE # WITH #+1
3711   015622   103003                          BCC     1$              ;CARRY BIT SHOULD SET
3712   015624   102402                          BVS     1$              ;V BIT SHOULD CLEAR
3713   015626   001401                          BEQ     1$              ;Z BIT SHOULD CLEAR
3714   015630   100401                          BMI     .+4             ;N BIT SHOULD SET
3715   015632   104400                  1$:     HLT                     ;ERROR! COMPARE # WITH #+1 FAILED TO
3716                                                                    ;SET CONDITION CODES IN PSW CORRECTLY
3717
3718   015634   000277                          SCC                     ;SET CONDITION CODES IN PSW
3719   015636   120200                          CMPB    R2,R0           ;COMPARE #+1 WITH #
3720   015640   103403                          BCS     2$              ;C BIT SHOULD CLEAR
3721   015642   102402                          BVS     2$              ;V BIT SHOULD CLEAR
3722   015644   001401                          BEQ     2$              ;Z BIT SHOULD CLEAR
3723   015646   100001                          BPL     .+4             ;N BIT SHOLD CLEAR
3724   015650   104400                  2$:     HLT                     ;ERROR! COMPARE #+1 WITH # FAILED TO SET
3725                                                                    ;CONDITION CODES IN PSW CORRECTLY
3726
3727                                    ;24 NOP (240) INSTRUCTIONS FOLLOW. THESE NOPS MAY
3728                                    ;BE CHANGED TO TEST CODE IF THE NEED ARISES. THE TEST CODE SHOULD
3729                                    ;BE POSITION INDEPENDENT AND SHOULD RUN WHEN RELOCATED BY THE PROGRAM.
3730   015652   000240                          NOP
3731   015654   000240                          NOP
3732   015656   000240                          NOP
3733   015660   000240                          NOP
3734   015662   000240                          NOP
3735   015664   000240                          NOP
3736   015666   000240                          NOP
3737   015670   000240                          NOP
3738   015672   000240                          NOP
3739   015674   000240                          NOP
3740   015676   000240                          NOP
3741   015700   000240                          NOP
3742   015702   000240                          NOP
3743   015704   000240                          NOP
3744   015706   000240                          NOP
3745   015710   000240                          NOP
3746   015712   000240                          NOP
3747   015714   000240                          NOP
3748   015716   000240                          NOP
3749   015720   000240                          NOP
3750   015722   000240                          NOP
3751   015724   000240                          NOP
3752   015726   000240                          NOP
3753   015730   000240                          NOP
3754   015732   104000                          SCOPE
3755
3756   015734   010702                          MOV     PC,R2
3757   015736   062702   000012                 ADD     #12,R2
3758   015742   012707   001132                 MOV     #RELOC,PC       ;GO RELOCATE PROGRAM CODE
3759   015746   000240                          NOP                     ;PROGRAM RETURNS HERE+2
3760                                  ;3333333333333 LAST ADDRESS OF CODE TO BE RELOCATED 33333333333
3761
```

```
3762
3763                                    ;CHECK TTY INTERRUPT.
3764  015750  005037  001004            TTYCHK: CLR     @#FACTOR
3765  015754  010701                            MOV     PC,R1
3766  015756  032737  000100  177564            BIT     #100,@#TPS      ;CHECK IF TTY IS READY
3767  015764  001374                            BNE     .-6
3768  015766  012737  016042  000064            MOV     #3$,@#TPVEC     ;SET TTY INTERRUPT VECTOR
3769  015774  012737  000200  000066            MOV     #200,@#TPVEC+2  ;PRIORITY LEVEL 4 ON INTERRUPT
3770  016002  012767  016100  000064            MOV     #NULLS,MSG      ;ADDRESS OF MESSAGE TO BE TYPPED
3771  016010  117737  000060  177566            MOVB    @MSG,@#TPB      ;TYPE FIRST CHARACTER OF MESSAGE
3772  016016  105737  177564                    TSTB    @#TPS
3773  016022  100375                            BPL     .-4
3774  016024  006237  177564                    ASR     @#TPS           ;SET IE BIT IN TTY CSR REG
3775  016030  000001                            WAIT                    ;WAIT FOR FIRST INTERRUPT
3776  016032  000424                            BR      KW11
3777  016034  006337  177564            2$:     ASL     @#TPS           ;CLEAR IE BIT
3778  016040  000002                            RTI
3779
3780  016042  122777  000012  000024    3$:     CMPB    #12,@MSG        ;BRANCH IF CHAR IS NOT <LF>
3781  016050  001004                            BNE     4$
3782  016052  004767  163154                    JSR     PC,.PRINT       ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
3783  016056  001760                            $CRLF
3784  016060  000404                            BR      5$
3785  016062  117737  000006  177566    4$:     MOVB    @MSG,@#TPB      ;TYPE CHARACTER
3786  016070  001761                            BEQ     2$              ;BRANCH IF TERMINATOR
3787  016072  005227                    5$:     INC     (PC)+           ;SET MSG TO NEXT CHAR ADDRESS
3788  016074  000000                    MSG:    .WORD   0               ;CONTAINS ADDRESS OF CHAR TO BE TYPED
3789  016076  000002                            RTI                     ;RETURN
3790  016100  020015  000015            NULLS:  .ASCIZ  <15><40><15>
3791                                            .EVEN
3792
3793                                    ;ROUTINE TO TURN ON KW11-L LINE CLOCK IF AVAILABLE
3794  016104  012737  000002  000006    KW11:   MOV     #RTI,@#ERRVEC+2         ;SET UP DIRECT RTI ON TRAP
3795  016112  012737  016246  000100            MOV     #4$,@#LKVEC             ;LOAD INTERRUPT VECTOR
3796  016120  012737  000300  000102            MOV     #300,@#LKVEC+2          ;SET PRIORITY LEVEL 6 ON INT.
3797  016126  000262                            SEV                             ;SET TIME OUT INDICATOR
3798  016130  052737  000100  177546            BIS     #100,@#LKS              ;SET INTERRUPT ENABLE
3799  016136  102446                            BVS     5$                      ;SKIP PRIORITY ARBITRATION TEST
3800                                                                            ;BELOW IF NO KW11-L
3801
3802                                    ;ROUTINE TO CHECK PRIORITY ARBITRATION LOGIC
3803                                    ;THE BELOW TEST WILL INHIBIT INTERRUPTS ON LEVEL 6 AND ABOVE (LOCKING
3804                                    ;OUT THE LINE CLOCK) AND THEN SET UP THE TTY TO INTERRUPT. NEXT THE
3805                                    ;PRIORITY LEVEL WILL BE SET TO 0 ALLOWING INTERRUPTS IN WHICH CASE
3806                                    ;THE LINE CLOCK (AT LEVEL 6) SHOULD INTERRUPT BEFORE THE TTY (AT LEVEL 4).
3807
3808  016140  132737  000020  177776            BITB    #20,@#PSW               ;CHECK IF 'T' BIT IS SET
3809  016146  001042                            BNE     5$                      ;DO NOT DO TEST IF SET
3810  016150  112737  000300  177776            MOVB    #300,@#PSW              ;SET PRIORITY LEVEL = 6
3811  016156  013727  000064                    MOV     @#TPVEC,(PC)+           ;SAVE TTY INTERRUPT VECTOR
3812  016162  000000                    1$:     .WORD   0                       ;CONTAINS CURRENT TTY VECTOR
3813  016164  105737  177564                    TSTB    @#TPS                   ;CHECK IF READY
3814  016170  100375                            BPL     .-4                     ;WAIT FOR TTY TO BECOME READY
3815  016172  012737  016216  000064            MOV     #2$,@#TPVEC             ;SET NEW VECTOR
3816  016200  005227                            INC     (PC)+                   ;STALL WAITING FOR LINE CLOCK
3817  016202  000000                            .WORD   0                       ;TO BE READY
```

```
3818  016204  012737  016222  000100          MOV     #3$,@#LKVEC             ;SET LINE CLOCK VECTOR
3819  016212  105037  177776                  CLRB    @#PSW                   ;SET PRIORITY LEVEL 0
3820  016216  104400                  2$:     HLT                             ;ERROR! EITHER TTY INTERRUPTED
3821                                  ;BEFORE THE LINE CLOCK OR BOTH FAILED TO INTERRUPT
3822  016220  000415                          BR      5$                      ;EXIT TEST
3823  016222  016737  177734  000064  3$:     MOV     1$,@#TPVEC              ;RESTORE TTY VECTOR
3824  016230  012737  016246  000100          MOV     #4$,@#LKVEC             ;SET LINE CLOCK VECTOR
3825  016236  105037  177776                  CLRB    @#PSW                   ;RESTORE PRIORITY LEVEL 0
3826  016242  012716  016254                  MOV     #5$,(SP)                ;SET RETURN ADDRESS TO 5$ BELOW
3827
3828  016246  005267  162524          4$:     INC     TICKS                   ;INCREMENT TICK COUNT
3829  016252  000002                          RTI                             ;RETURN
3830
3831  016254  005037  000006          5$:     CLR     @#ERRVEC+2              ;RESTORE ERROR TRAP TO HALT AT 6
3832
3833  016260  000240                  END:    NOP
3834  016262  012767  000062  000242  END1:   MOV     #50.,TEMP1
3835  016270  000005                  4$:     RESET
3836  016272  005367  000234                  DEC     TEMP1
3837  016276  001374                          BNE     4$
3838  016300  032767  000100  161262          BIT     #SW06,SWR       ;DO YOU WANT TO HALT ON
3839                                                                  ;END OF PASS?
3840  016306  001402                          BEQ     5$
3841  016310  004767  161734                  JSR     PC,EOPHLT
3842  016314  005037  177776          5$:     CLR     @#PSW           ;CLEAR MODE BITS IN PSW
3843  016320  005046                          CLR     -(SP)           ;CLEAR PSW
3844  016322  012746  016330                  MOV     #.+6,-(SP)
3845  016326  000002                          RTI                     ;GO TO NEXT INST WITH PSW=0
3846  016330  012706  000600                  MOV     #KPTR,SP        ;SET KERNEL STACK PTR (NOT APPLICABLE
3847                                                                  ;FOR 11/20,11/05 CP'S)
3848  016334  032737  000100  177564          BIT     #100,@#TPS      ;CHECK IF OUTPUT DEVICE IS BUSY
3849  016342  001374                          BNE     .-6             ;IS AVAILABLE
3850  016344  105737  177570                  TSTB    @#SWR           ;DELETE END OF PASS TYPE OUT IF SW7=0
3851  016350  100020                          BPL     1$              ;BRANCH IF SW7 IS DOWN
3852  016352  016702  162422                  MOV     ICNT,R2         ;GET PASS COUNT
3853  016356  004767  162746                  JSR     PC,$FORMO       ;GO TO FORMAT ROUTINE
3854  016362  012702  001700                  MOV     #DIGITS+2,R2    ;GET ASCII VALUES
3855  016366  012703  001716                  MOV     #PASSES,R3      ;AND MOVE THEM INTO MESSAGE
3856  016372  012223                          MOV     (R2)+,(R3)+
3857  016374  012223                          MOV     (R2)+,(R3)+
3858  016376  012737  001706  016074          MOV     #PASCNT,@#MSG   ;PASS MESSAGE ADRS TO TELETYPE SERVICE
3859  016404  052737  000100  177564          BIS     #100,@#TPS      ;SET IE BIT
3860  016412  012737  000610  000024  1$:     MOV     #PDWN,@#PFVEC   ;ENABLE POWER FAIL TRAP
3861  016420  012737  000340  000026          MOV     #340,@#PFVEC+2  ;PRIORITY 7 ON POWER FAI_
3862  016426  005267  162346                  INC     ICNT
3863  016432  116700  175632                  MOVB    OPT.CP,R0       ;GET CP TYPE
3864  016436  026067  016642  162334          CMP     PASTAB(R0),ICNT ;CHECK IF END OF TEST
3865  016444  001002                          BNE     2$              ;BRANCH IF NOT AT END
3866  016446  000167  000062                  JMP     DONE
3867  016452  016702  162322          2$:     MOV     ICNT,R2         ;GET PASS COUNT
3868  016456  006302                          ASL     R2
3869  016460  046002  016632                  BIC     CPPASS(0),R2    ;LIMIT PASS COUNT TO 0-6
3870  016464  005037  000016                  CLR     @#16            ;CLEAR T BIT TRAP ADDRESS
3871  016470  012737  000040  001122          MOV     #40,@#SCOPEF+2  ;SET ITERATION COUNT = 40
3872  016476  016216  016626                  MOV     PSWTAB(2),(SP)  ;PUSH NEXT PASS PSW ON STACK
3873  016502  032716  000020                  BIT     #20,(SP)        ;WILL 'T' BIT BE SET ON NEXT PASS?
```

```
3874  016506  001406                        BEQ     3$                ;BRANCH IF NOT
3875  016510  012737  000002  001122        MOV     #2,@#SCOPEF+2     ;SET ITERATION COUNT = 2 FOR 'T' BIT
3876  016516  016737  000006  000016        MOV     RTI1,@#16         ;SET 'T' BIT TRAP TO RETURN VIA 16
3877  016524  012746  002244          3$:   MOV     #START2,-(SP)     ;RESART PROGRAM AT START2
3878  016530  000002                RTI1:   RTI                       ;RESTART PROGRAM AT START2 WITH NEW PSW
3879                                                                  ;(FROM TABLE BELOW) NOTE: THE RTI IS
3880                                                                  ;CHANGED TO AN RTT IF NOT AN 11/05,11/20
3881
3882  016532  000000                TEMP1:  .WORD 0
3883                  ;ROUTINE TO SET UP MEMORY MANAGEMENT TO RELOCATE PROGRAM CODE ABOVE 28K
3884
3885  016534  032737  000100  177564  DONE:   BIT     #100,@#TPS        ;WAIT FOR TTY OUTPUT TO FINISH
3886  016542  001374                        BNE     DONE
3887  016544  105737  177564              TSTB    @#TPS             ;WAIT FOR LAST CHARACTER TO BE PRINTED
3888  016550  100375                        BPL     .-4
3889  016552  005027                        CLR     (PC)+
3890  016554  000000                1$:     .WORD   0
3891  016556  005267  177772          2$:   INC     1$                ;DELAY WAITING FOR TELETYPE TO FINISH
3892  016562  001375                        BNE     2$                ;TYPING CHARACTER BEFORE ISSUING RESET
3893  016564  000005                        RESET
3894  016566  105737  177570              TSTB    @#SWR
3895  016572  100003                        BPL     3$
3896  016574  004767  162432              JSR     PC,.PRINT         ;PRINT MESSAGE BEGINING AT FOLLOWING ADRS
3897  016600  016766                        ENDMSG
3898  016602  013702  000042          3$:   MOV     @#42,R2           ;CHECK DDP/ACT11 MONITOR HOOK
3899  016606  001405                        BEQ     DONE1
3900  016610  000005                        RESET
3901  016612  004712                LOGICAL:JSR     PC,(R2)           ;GO TO DDP/ACT11 MONITOR VIA 42
3902  016614  000240                        NOP
3903  016616  000240                        NOP
3904  016620  000240                        NOP
3905  016622  000137  002240          DONE1:  JMP     @#START3                  ;RESTART PROGRAM
3906
3907                                  ;THE BELOW TABLE REPRESENTS THE 'NEW' PSW SET BY THE PROGRAM ON
3908                                  ;SUCCESSIVE PASSES.
3909                                  ;NOTE THE BELOW TABLE MAY BE MODIFIED TO CAUSE THE PROGRAM TO RUN
3910                                  ;UNDER USER DEFINED PARAMETERS BY PATCHING IN THE DESIRED PASS PARAMETER
3911                                  ;FOR EXAMPLE TO CAUSE THE PROGRAM TO RUN WITHOUT SETTING THE 'T' BIT
3912                                  ;IN ALL PASSES PATCH OUT THE 'T' BIT IN THE TABLE.
3913  016626  000000                PSWTAB: 000000                    ;ALL 11 FAMILY CP'S
3914  016630  000020                        000020
3915
3916                                  ;THE BELOW TABLE IS THE 'BIT MASK' USED TO DETERMINE THE INDEX VALUE
3917                                  ;NEEDED TO SET THE 'NEW' PSW.
3918  016632  177774                CPPASS: 177774                    ;11/05
3919  016634  177774                        177774                    ;11/20
3920
3921                                  ;THE BELOW TABLE REPRESENTS THOSE BITS IN THE CP WHICH CAN BE SET/CLEARED
3922  016636  000377                PSWBIT: 000377                    ;11/05
3923  016640  000377                        000377                    ;11/20
3924
3925                                  ;THE BELOW TABLE CONTAINS THE # OF PASSES REQUIRED TO COMPLETE TEST
3926  016642  000002                PASTAB: .WORD   2                 ;11/05
3927  016644  000002                        .WORD   2                 ;11/20
3928                                  ;MESSAGES
3929  016646  005015  047514  020127  MSG1:   .ASCIZ  <15><12>'LOW LIMIT?'
```

```
3930  016654  044514  044515  037524
3931  016662     000
3932  016663     110  043511  020110  MSG2:   .ASCIZ  'HIGH LIMIT?'
3933  016670  044514  044515  037524
3934  016676     000
3935  016677     015  052012  044510  ILLTEST:.ASCIZ  <15><12>'THIS TEST INVALID FOR 11/40-11/45 PLEASE RUN DCQKC'<15><12>
3936  016704  020123  042524  052123
3937  016712  044440  053116  046101
3938  016720  042111  043040  051117
3939  016726  030440  027461  030064
3940  016734  030455  027461  032464
3941  016742  050040  042514  051501
3942  016750  020105  052522  020116
3943  016756  041504  045521  006503
3944  016764  000012
3945  016766  005015  042040  050504  ENDMSG: .ASCIZ  <15><12>' DDQAA DONE'
3946  016774  040501  042040  047117
3947  017002  000105
3948
3949          017400                  .=017400
3950  017400  000000          SAVPC:  .WORD 0
3951  017402  000000          SAVPS:  .WORD 0
3952  017404  000000          SAVIC:  .WORD 0
3953          000001                  .END
```

```
ADCB2   004600          1476    1478#
ADCB5   005410          1705    1707#
ADCB6   006076          1858    1859    1861#
ADCB7   006724          2066    2067    2068    2070#
ADC0    002540           887     888     889     891#
ADC1    003414          1110    1111    1112    1114#
ADC2    004410          1408    1410#
ADC5    005216          1632    1633    1635#
ADC6    005706          1803    1804    1806#
ADC7    006620          2030    2031    2033#
ADD0    007412          2231    2232    2233    2235#
ADD1    007616          2303    2304    2306#
ADD1A   010042          2386    2387    2388    2390#
ADD1B   010060          2395    2396    2398#
ADD2    010446          2532    2533    2535#
ADD3    011122          2691    2693#
ADD6    011464          2788    2789    2791#
ADD7    012126          2900    2901    2902    2904#
ASLB1   003756          1242    1243    1245#
ASLB1A  004202          1329    1330    1332#
ASLB3   005400          1699    1700    1702#
ASLB4   004704          1513    1514    1515    1517#
ASLB6   006060          1850    1851    1852    1854#
ASLB7   007022          2098    2099    2101#
ASL0    002662           931     932     933     934     936#
ASL1    003570          1173    1174    1175    1177#
ASL3    005132          1601    1602    1604#
ASL4    004502          1440    1441    1442    1444#
ASL6    005656          1791    1792    1794#
ASL7    006446          1977    1978    1980#
ASRB1   004052          1278    1280#
ASRB1A  004066          1284    1285    1287#
ASRB2   004650          1498    1499    1501#
ASRB2A  004666          1506    1507    1509#
ASRB5   005340          1680    1681    1683#
ASRB6   006176          1890    1891    1893#
ASRB7   007040          2105    2106    2108#
ASR0    002710           945     946     947     949#
ASR1    003456          1130    1131    1132    1134#
ASR2    004424          1414    1415    1417#
ASR3    005116          1595    1597#
ASR6    005540          1753    1754    1756#
ASR7    006502          1991    1992    1994#
BELL    001763           697     720#
BICB1   010234          2456    2457    2459#
BICB1A  010256          2467    2470#
BIC0    007324          2202    2203    2204    2206#
BIC1    007740          2349    2350    2352#
BIC2    010536          2561    2562    2563    2565#
BIC3    011134          2696    2698#
BIC7    012604          3030#   3032
BINB7   012352          2965    2973#
BIN1    010414          2499    2502    2505    2508    2511    2514    2517    2522#
BISB1   010222          2451    2453#
BIS0    007302          2193    2194    2196#
BIS0A   007360          2220    2222#
```

```
BIS1    007726          2343    2344    2346#
BIS2    010474          2545    2547#
BIS2A   010576          2579    2580    2582#
BIS7    012544          3020#   3022
BITB1   010212          2445    2446    2448#
BITB2   010752          2634    2635    2637#
BITB3   011304          2748    2751#
BITB6   011670          2835#
BIT1    007654          2320    2321    2323#
BIT13 = 020000           434#
BIT14 = 040000           433#    463
BIT15 = 100000           432#
BIT2    010562          2572    2573    2575#
BIT6  = 000100           436#
BIT8  = 000400           435#
BPTVEC= 000014           398#
C     = 000001           384#
CBIT    015552          3691#
CC0     002354           811     812     813     814     815     816     817     819#
CC1     002370           823     824     825     827#
CC2     002404           831     832     833     835#
CC3     002416           839     840     842#
CC4     002432           846     847     848     850#
CHKSP   015356          3629#
CLR0    002456           858     859     860     861     863#
CMPB1   010166          2435    2437#
CMPB2   010736          2627    2628    2630#
CMPB3   011316          2754    2757#
CMPN    015606          3705#
CMP0    007204          2156    2157    2158    2160#
CMPDA   007446          2246    2249#
CMP1    007636          2311    2312    2313    2315#
CMP1A   007756          2356    2357    2358    2360#
CMP2    010464          2539    2540    2542#
CMP7    012062          2886    2887    2889#
COMB1   004034          1269    1270    1272#
COMB1A  004214          1335    1336    1338#
COMB2   004562          1467    1468    1470#
COMB5   005316          1670    1672#
COMB6   006130          1871    1872    1874#
COMB7   006740          2073    2074    2076#
COM0    002522           878     879     880     881     883#
COM1    003602          1180    1181    1183#
COM3    005174          1622    1624#
COM4    004312          1371    1373#
COM6    005524          1747    1748    1750#
COM7    006572          2019    2020    2022#
CPCHK   014220          3377#
CPPASS  016632          3869    3918#
DBINB7  012346          2970#   3002*   3003*   3007*   3008*   3009    3013*   3020    3021*   3028*   3030    3031*
DBIN7   011762          2861#   2876*   2880*   2885    2891*   2899*   2906*   2910*   2914
DDATA   011326          2763#   2767*   2769*   2773    2777    2778    2781*   2782    2787*   2794*   2801*   2802    2805*
                        2808    2812
DDATAB  011756          2831*   2832*   2837*   2840    2844*   2845    2849    2856#
DECB1   004004          1255    1256    1258#
DECB1A  004134          1307    1308    1310#
```

DDQAAA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

```
DECB2   004716          1520    1521    1523#
DECB5   005456          1728    1730#
DECB6A  006230          1902    1903    1904    1906#
DECB7   007006          2092    2093    2095#
DECO    002602           904     905     906     907     909#
DEC1    003374          1103    1105#
DEC1A   003644          1201    1203#
DEC2    004460          1431    1432    1434#
DEC5    005150          1608    1609    1610    1612#
DEC6    005672          1797    1798    1800#
DEC7    006464          1984    1985    1987#
DIGITS  001676           632     665     666     675     681     691     708#    3854
DIGTAB  001666           644     704#
DISPLA= 177570           421#    796*
DONE    016534          3866    3885#   3886
DONE1   016622          3899    3905#
EMTVEC= 000030           401#    797*    3289    3290*   3291*   3293*   3330*   3331*
EMT1    013740          3290    3298#
EMT1B   014020          3298    3302    3303    3306    3307    3311    3312    3315    3316    3317    3322#
EMT1C   014024          3296    3324#
EMT1D   014036          3325    3326    3329#
END     016260          3833#
ENDMSG  016766          3897    3945#
END1    016262          3834#
EOPHLT  000250           481#    3841
ERROR   001412           652#     798
ERRPC   001723           673     713#
ERRPCO  001735           689     715#
ERRVEC= 000004           394#    523*    530*    770*    771*    794*    3045*   3046*   3047    3087*   3379*   3393*   3418*
                        3419*   3459*   3505*   3794*   3831*
FACTOR  001004           541#    559     581     684     686     807*    1818    1942*   2765    2823    2932    2933    2937
                        2938    2962*   2991    3046    3170    3182    3190    3205    3229    3268    3291    3338    3410*
                        3512    3520    3531    3764*
FORXOR  000740           523#    547
FPEVEC= 000244           406#
FRSTAD  001010           545#    576     804*    1939*   2604    2959*   3407*
FRSTME  001012           546#    584     779*    786*
GSTST   003174          1048#
HLT   = 104400           442#    594     819     827     835     842     850     863     873     883     891     900     909
                         918     927     936     942     949     956     964     986     996    1006    1013    1020    1029
                        1045    1080    1098    1105    1114    1121    1127    1134    1141    1149    1156    1164    1169
                        1177    1183    1191    1198    1203    1221    1227    1233    1239    1245    1251    1258    1265
                        1272    1280    1287    1291    1298    1303    1310    1317    1323    1327    1332    1338    1342
                        1348    1351    1368    1373    1380    1387    1393    1398    1402    1410    1417    1424    1428
                        1434    1438    1444    1448    1451    1470    1474    1478    1486    1494    1501    1509    1517
                        1523    1529    1535    1540    1545    1551    1559    1563    1566    1584    1591    1597    1604
                        1612    1618    1624    1629    1635    1642    1648    1672    1676    1683    1688    1696    1702
                        1707    1714    1718    1724    1730    1744    1750    1756    1764    1772    1778    1786    1794
                        1800    1806    1810    1813    1827    1832    1838    1847    1854    1861    1868    1874    1881
                        1887    1893    1899    1906    1911    1917    1923    1965    1972    1980    1987    1994    2002
                        2009    2015    2022    2026    2033    2038    2045    2062    2070    2076    2083    2089    2095
                        2101    2108    2114    2121    2128    2137    2145    2151    2160    2168    2183    2188    2196
                        2206    2214    2222    2225    2235    2240    2249    2258    2264    2269    2273    2279    2285
                        2306    2315    2323    2332    2339    2346    2352    2360    2371    2378    2383    2390    2398
                        2403    2426    2437    2448    2453    2459    2464    2470    2522    2535    2542    2547    2554
                        2565    2575    2582    2588    2596    2603    2620    2624    2630    2637    2642    2671    2679
```

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                    2684    2687    2693    2698    2703    2735    2738    2744    2751    2757    2775    2780    2785
                    2791    2797    2804    2810    2814    2835    2839    2842    2647    2851    2879    2883    2889
                    2896    2904    2908    2912    2916    3000    3005    3011    3015    3025    3035    3051    3053
                    3055    3057    3059    3061    3063    3065    3067    3069    3071    3073    3075    3077    3079
                    3105    3125    3141    3159    3167    3178    3203    3227    3237    3249    3257    3261    3283
                    3297    3322    3329    3335#   3346    3348    3351    3355    3365#   3453    3495    3526    3527
                    3528    3585    3604    3609    3638    3651    3658    3666    3672    3683    3700    3715    3724
                    3820
ICNT    001000       538#     662     663     793*    796    3377    3852    3862*   3864    3867
ILLTES  016677      3399    3935#
INCB1   003720      1224    1225    1227#
INCB2   005012      1555    1556    1557    1559#
INCB3   005350      1686    1688#
INCB6   006042      1845    1847#
INCB6A  006212      1896    1897    1899#
INCB7   006772      2086    2087    2089#
INCO    002622       913     914     915     916     918#
INC1    003510      1145    1146    1147    1149#
INC3    005204      1627    1629#
INC4    004342      1384    1385    1387#
INC6    005634      1782    1783    1784    1786#
INC7    006632      2036    2038#
IOTVEC= 000020       399#   3267*   3268*   3270*   3284*   3285*   3336*   3360    3362*   3363*   3421*   3423*   3483*
IOT1    013640      3267    3274#
IOT1A   013646      3273    3277#
IOT1B   013662      3278    3279    3280    3283#
JMP1    013066      3101    3102    3103    3105#
JMP3    013136      3121    3125#
JMP4    013174      3137    3141#
JMP5    013240      3155    3159#
JMP6    013260      3167#
JMP7    013316      3178#
JSRTST  013322      3182#
JSR1    013404      3189    3191    3194    3195    3196    3197    3203#
JSR1A   013406      3192    3205#
JSR3    013472      3216    3223    3227#
JSR3A   013474      3217    3229#
JSR4    013550      3239    3240    3241    3242    3246    3249#
JSR4A   013552      3238    3252#
JSR6A   013604      3256    3264#
KPTR    = 000600     427#     507     767    3498    3846
KW11    016104      3776    3794#
LKS     = 177546     414#   3798*
LKVEC   = 000100     404#   3795*   3796*   3818*   3824*
LOGICA  016612       461    3901#
LPB     = 177516     423#
LPS     = 177514     422#
LSTMEM  002154       587     777#    778*    791*
MMVEC   = 000250     407#
MOVB1   010142      2420    2421    2422    2423    2426#
MOVO    007134      2134    2135    2137#
MOVOA   007164      2149    2151#
MOV1    010026      2381    2383#
MOV7    012032      2877    2879#
MSG     016074      3770*   3771    3780    3785    3788#   3858*
MSG1    016646       783    3929#
```

```
MSG2    016663            788    3932#
N     = 000010            387#
NEGB1   003770           1248    1249    1251#
NEGB4   004742           1532    1533    1535#
NEGB6   006146           1878    1879    1881#
NEGB7   007054           2111    2112    2114#
NEGO    002642            923     924     925    927#
NEG1    003634           1195    1196    1198#
NEG2    004364           1396    1398#
NEG5    005162           1615    1616    1618#
NEG6    005560           1760    1761    1762   1764#
NEG7    006540           2006    2007    2009#
NULL  = 000000            628#
NULLS   016100           3770    3790#
OAERR   012632           3038#
OPT.CP  014270           3390#   3396    3435    3491    3513    3516    3586    3589    3863
OVFLW   014346           3414#
PASCNT  001706            668     710#   3858
PASSES  001716            665*    666*    712#   3855
PASTAB  016642           3864    3926#
PC    =%000007            373#    465*    466*    467*    478*    485*    496*    508*    512*    566*    597*    598*    610*
                          612*    620*    626*    631*    648*    649*    654*    658*    661*    664*    667*    671*    672*
                          674*    676*    679*    680*    687*    688*    690*    693*    696*    744*    776*    782*    787*
                           802     805     808    1051*   1053*   1065*   1089    1209    1357    1457    1573    1656    1734*
                          1736    1928    1930*   1937    1940    1943    1951    2053    2133    2236    2238    2242    2245
                          2293    2410    2475    2599    2612    2651    2715    2865    2923*   2924    2925    2926*   2927
                          2928*   2929    2930    2931*   2932    2933    2937*   2938*   2940    2941    2942    2943*   2944*
                          2949    2951*   2957    2960    2963    2973    3039    3093    3108    3128    3143    3231    3254
                          3255*   3263*   3342    3367    3369*   3373    3389*   3398*   3405    3408    3411    3416    3424
                          3467    3471*   3481*   3488    3499    3501    3510    3524*   3576    3614    3616    3624    3685
                          3691*   3693    3705    3756    3758*   3765    3782*   3787*   3811*   3816*   3841*   3853*   3889*
                          3896*   3901*
PDWN    000610            501#    505     3860
PFAIL   000656            513     516#
PFVEC = 000024            400#    501*    505*   3860*   3861*
PIRQ  = 177772            412#   3382
PIRVEC= 000240            405#
PRTY4 = 000200            391#   3361
PRTY6 = 000300            390#
PRTY7 = 000340            389#
PSW   = 177776            410#    554*    760*   1048    1063*   1068*   3270    3293    3340    3385    3414    3415*   3573
                          3574*   3581    3621    3808    3810*   3819*   3825*   3842*
PSWBIT  016636           3587    3922#
PSWCHK  015140           3573#
PSWTAB  016626           3872    3913#
PUP     000620            501     505#
RECD    001766            726#    784     789
RELOC   001132            574#   1930    2951    3369    3758
RELR1   001006            543#    558*    559*
RELO    002306            802#
REL1    006316           1937#
REL2    012310           2957#
REL3    014322           3378    3397    3405#
RESTRP  014710           3509#
RESVEC= 000010            395#   3047*   3088*   3394*   3519*   3520*   3568*
RETPC   001230            583*    599#
```

```
ROLB1   003732          1230   1231   1233#
ROLB2   004634          1490   1491   1492   1494#
ROLB3   005424          1711   1712   1714#
ROLB6   006162          1884   1885   1887#
ROLB6A  006256          1914   1915   1917#
ROLB7   007072          2118   2119   2121#
ROLO    002674           939    940    942#
ROL1    003430          1117   1118   1119   1121#
ROL1A   003442          1124   1125   1127#
ROL3    005232          1639   1640   1642#
ROL4    004440          1421   1422   1424#
ROL6    005510          1740   1741   1742   1744#
ROL7    006650          2042   2043   2045#
RORB1   004020          1262   1263   1265#
RORB1A  004110          1295   1296   1298#
RORB4   004616          1482   1483   1484   1486#
RORB5   005366          1692   1693   1694   1696#
RORB6   006114          1865   1866   1868#
RORB7   006756          2080   2081   2083#
RORO    002560           895    896    897    898    900#
RORI    003360          1095   1096   1098#
RORIA   003472          1137   1138   1139   1141#
ROR2    004326          1377   1378   1380#
ROR5    005104          1588   1589   1591#
ROR6    005600          1768   1769   1770   1772#
ROR7    006522          1999   2000   2002#
RTI1    016530          3876   3878#
RO      =%000000         366#    576*    577     589     590     592     595     602     603*    606     609*    637*    646*
                         726     730*    731*    732     741     742     749*    753     761*    772*    773     775*    776
                         802*    803     804     805*    806*    807     857*    867     877*    886*    894*    903*    912*
                         922*    930*    938*    944*    952*    958*    959*    968*    970*    971     983     991*    992*
                         994*    998*   1002*   1057*   1058    1069    1074    1459*   1460    1462*   1576*   1578    1659*
                        1660*   1663    1664*   1665    1666*   1736*   1737    1811    1817*   1818*   1937*   1938    1939
                        1940*   1941*   1942    1951*   1952    1953    1954*   1955    1956*   1957    1958    1959*   1960*
                        2049    2050*   2051    2052*   2133*   2139    2141    2162    2192    2198    2201    2208    2210
                        2212    2216    2219    2236*   2237    2238    2242*   2243*   2244    2245    2247    2652*   2653
                        2654    2656    2658    2659    2660    2661    2715*   2716    2717    2720    2722    2724    2725
                        2727    2799*   2800    2802*   2815    2865*   2866    2867    2869    2871    2872    2921*   2926
                        2929    2930    2957*   2958    2959    2960*   2961*   2962    2973*   2974    2975*   2976*   2977*
                        2978    2979*   2980*   2981*   2989*   2990*   3093*   3094*   3096    3113*   3115*   3122    3123
                        3129*   3138    3139    3149*   3156    3157    3206*   3215*   3218*   3254*   3258    3259    3271*
                        3274*   3277*   3281    3299*   3300*   3301*   3305*   3310*   3314*   3319*   3324*   3327    3342*
                        3352*   3353    3380*   3383*   3386*   3388*   3389    3405*   3406    3407    3408*   3409*   3410
                        3450*   3462*   3478*   3488    3493    3586*   3587*   3591*   3593    3643*   3644    3656    3670
                        3681    3693*   3694*   3695*   3696*   3705*   3706    3710    3719    3863*   3864
R1      =%000001         367#    529*    531     557     558     570*    634*    641*    643*    762*    808*   1050    1058*
                        1059    1075    1083*   1943*   2053*   2651*   2652    2963*   3373*   3411*   3510*   3765*
R10     =%000000         374#
R11     =%000001         375#
R12     =%000002         376#
R13     =%000003         377#
R14     =%000004         378#
R15     =%000005         379#
R2      =%000002         368#    578     580     583     584*    585     589*    592     597     634     635*    639*    662*
                         669*    670     678*    682*    683     686*    763*    971*    972*    973     982     999*   1001*
                        1004*   1032*   1033*   1034    1036*   1037*   1039*   1059*   1060    1076    1089*   1090*   1091*
```

```
                    1094*  1102*  1109*  1116*  1123*  1129*  1136*  1144*  1151*  1159*  1167*  1172*  1179*
                    1186   1194*  1200*  1460*  1461*  1472*  1489*  1503*  1505*  1519*  1531*  1542   1548*
                    1561   1564   1656*  1657   1658   1659   1661   1662   1663*  1665*  1666   1667   1669*
                    1674   1685*  1698*  1704*  1716*  1726*  1727*  1928*  1929*  1955*  1956   1959   1960
                    2139*  2141*  2148   2155   2162*  2163   2164   2165*  2166   2172*  2173*  2175*  2177
                    2179   2184   2186   2190*  2192*  2244*  2247   2413*  2414*  2415*  2416*  2419   2428*
                    2430*  2434   2444   2450   2455   2461*  2462   2466*  2468   2482*  2483*  2489*  2490
                    2491*  2492   2493*  2495*  2497   2498   2509*  2510   2516   2528*  2531   2544   2550
                    2556*  2560   2567*  2568   2571   2578   2586   2590*  2591*  2592*  2599*  2600   2601
                    2604   2657*  2661*  2667   2673*  2675   2682   2685   2688*  2690   2695   2701   2765*
                    2766   2823*  2824   2867*  2868   2869*  2870   2949*  2950*  2983*  2992*  3038*  3050*
                    3052*  3054*  3056   3058*  3060*  3062*  3064*  3066*  3068*  3076   3107*  3118*  3120*
                    3127*  3131*  3136*  3151*  3154*  3162*  3165*  3172*  3176*  3183*  3184*  3187   3188
                    3198*  3209*  3224   3225   3243*  3244*  3245   3367*  3368*  3451*  3461*  3464*  3466*
                    3468*  3470*  3472*  3478   3511*  3512*  3515*  3521   3523   3592*  3593   3596   3600
                    3602   3606   3610*  3636*  3676*  3677   3679   3706*  3707*  3710   3719   3756*  3757*
                    3852*  3854*  3856   3857   3867*  3868*  3869*  3898*  3901
R3      =%000003     369#    580*   590    633*   636*   640*   645*   764*   973*   974*   975    981    1008*
                    1009*  1011*  1034*  1038   1041*  1060*  1061   1077   1209*  1210*  1211   1213*  1216*
                    1241*  1247*  1254*  1261*  1274*  1306*  1313*  1328*  1334*  1340*  1344*  1346*  1349
                    1573*  1574*  1575*  1576   1577   1578*  1579   1582   1587*  1600*  1614*  1626*  1644*
                    2148*  2155   2163*  2164*  2166   2198*  2201*  2218*  2219*  2223*  2226   2227*  2230
                    2253*  2254   2255   2261   2281   2296*  2297*  2299*  2302   2310   2319   2328   2334*
                    2335*  2337   2342   2348   2355   2362*  2364*  2365   2367   2374   2380   2385   2392*
                    2393   2394   2439*  2441*  2442   2480*  2481*  2482   2492*  2494   2496*  2500   2501
                    2503*  2504   2506*  2507   2518   2519*  2520   2612*  2613   2614*  2615*  2615   2622
                    2626   2633   2640   2660*  2662*  2717*  2718   2719   2720*  2721*  2722*  2723   2732*
                    2733*  2739   2740*  2741*  2745*  2746*  2747   2749   2753   2755   2825*  2826*  2827
                    2870*  2871   2872*  2984*  2993*  3039*  3042   3043*  3044*  3068   3070   3072   3074*
                    3108*  3111   3112*  3113   3114*  3115   3116   3123   3143*  3146   3147*  3148*  3149
                    3153   3157   3220*  3221*  3222   3231*  3234   3236   3428*  3429*  3430   3460   3521*
                    3524   3533   3535*  3601*  3602   3607*  3629*  3637   3640   3644*  3645*  3647   3649
                    3654   3660*  3661*  3662   3664   3855*  3856*  3857*
R4      =%000004     370#    578*   579*   585*   587    632*   765*   975*   976*   977    980    1015*  1016*
                    1018   1038*  1043*  1061*  1062   1078   1211*  1212*  1218*  1223*  1229*  1235*  1268*
                    1276*  1282*  1283*  1289*  1294*  1301*  1319   1325*  1357*  1358*  1359   1376*  1383*
                    1390*  1400*  1413*  1420*  1436*  1439*  1446   1449   1579*  1594*  1607*  1621*  1631*
                    1638*  1645*  2208*  2209*  2210*  2211*  2212   2216*  2217*  2218   2226*  2229*  2230*
                    2254*  2255*  2256   2260*  2261*  2262   2266*  2267   2271   2275*  2276*  2277   2281*
                    2282*  2283   2293*  2294   2295*  2296   2300*  2302*  2310   2319   2327*  2328*  2337*
                    2340*  2342*  2348*  2355   2365*  2366*  2367*  2374*  2380*  2385*  2393*  2394*  2400*
                    2401   2478*  2479*  2480   2490*  2500*  2501   2504   2510   2513   2515*  2516*  2518*
                    2526   2616*  2617*  2618*  2622*  2626   2633   2640*  2658*  2663*  2681*  2723*  2725*
                    2726*  2727*  2730*  2731*  2732   2733   2740   2741   2745   2746   2747   2749   2753
                    2755   2824*  2825   2985*  2994*  3128*  3129   3133   3134   3135   3139   3199*  3200*
                    3201   3205*  3208   3211   3214*  3222   3229*  3230   3236*  3245   3247   3248*  3523*
                    3533   3581*  3583   3599*  3600*  3601   3606*  3607   3612*  3621*  3622   3684
R5      =%000005     371#    577*   579    595    727*   736*   737*   738*   746    747*   750*   751*   752*
                    753*   766*   784*   789*   977*   978*   979    1022*  1023*  1025*  1027   1062*  1064
                    1079   1359*  1360*  1364   1370*  1395*  1405*  1407*  1426*  1430*  1449   1457*  1458*
                    1459   1466*  1475*  1481*  1497*  1512*  1525*  1537   1554*  1564   1667*  1679*  1691*
                    1710*  1721*  2177*  2179   2184*  2186   2410*  2411   2412*  2413   2419*  2424*  2431*
                    2432*  2434   2442*  2444   2450*  2455*  2462   2466   2475*  2476   2477*  2478   2494*
                    2497*  2498   2507   2512*  2513   2520*  2526*  2527*  2531*  2538   2544*  2550*  2557*
                    2560*  2568*  2569*  2571   2578*  2584*  2585*  2586   2600*  2601   2654*  2655   2656*
                    2657   2667*  2674*  2675*  2682   2685   2690*  2695*  2700*  2701   2718*  2736   2742
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                    2766*  2827*  2986*  2995*  3182*  3184   3187*  3190   3193*  3201   3207*  3208*  3209
                    3210*  3211*  3214   3225   3230*
SAVIC   017404       663*  3952#
SAVPC   017400       656*   657*  3950#
SAVPS   017402       660*  3951#
SBCB1   003744      1236   1237   1239#
SBCB3   005444      1722   1724#
SBCB4   004730      1526   1527   1529#
SBCB6   006016      1835   1836   1838#
SBCB7   006704      2058   2059   2060   2062#
SBCO    002724       953    954    956#
SBC1    003524      1152   1153   1154   1156#
SBC1A   003542      1160   1161   1162   1164#
SBC5    005244      1646   1648#
SBC6    005614      1775   1776   1778#
SBC7    006426      1969   1970   1972#
SBINB7  012336      2966#  2997*  2998   3002   3009   3013   3017*  3020*  3023   3027*  3030*  3033
SBIN7   011760      2860#  2875*  2876   2885   2891   2898*  2899   2906   2910   2914
SCOPE = 104000       443#   851    965   1084   1204   1352   1452   1567   1649   1731   1814   1927   2046
                    2129   2250   2286   2404   2523   2597   2606   2643   2704   2758   2817   2852   2917
                    2947   3036   3089   3179   3264   3286   3332   3364   3506   3569   3619   3688   3754
SCOPEA  001016       551#   797
SCOPEB  001046       557#   568    571
SCOPEC  001102       556    564#
SCOPED  001114       567#   569*   3509*
SCOPEE  001126       565    570#
SCOPEF  001120       569#  3871*  3875*
SDATA   011324      2762#  2768*  2769   2770*  2771*  2776*  2777*  2778   2782   2787   2793*  2794   2800*
                    2805   2806*  2807*  2808   2811*  2812   2815
SDATAB  011754      2829*  2830*  2831   2833   2837   2840   2844   2845   2855#
SLR     = 177774     411#
SP      =%000006     372#   471    472*   473*   474*   475*   476*   477*   489    490    491    492    493
                     494    495    507*   529    531*   552    557*   570    602*   603    604*   606*   608
                     609    613    616*   618*   625    654    656    658    660    726*   767*   795*   979*
                     980*   981*   982*   983*   984   1050*  1051   1064*  1065   1067*  1074*  1075*  1076*
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SWAB2    004354          1391    1393#
SWAB4    004774          1549    1551#
SWAB6    006242          1909    1911#
SWAB7    006554          2013    2015#
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SW06   = 000100           440#   3838
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TPS    = 177564           417#    623    3766    3772    3774*   3777*   3813    3848    3859*   3885    3887
TPVEC  = 000064           403#   3768*   3769*   3811    3815*   3823*
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TRAP1C   014152          3349    3360#
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TSTB6    005770          1823    1824    1825    1827#
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        1059  1060  1061  1062  1064  1065  1067  1074  1075  1076  1077  1078  1079  1082  1083
        1089  1209  1211  1357  1359  1457  1459  1460  1573  1576  1578  1579  1656  1659  1663
        1665  1666  1667  1736  1817  1928  1930  1937  1939  1940  1942  1943  1951  1955  1956
        1959  1960  2053  2133  2139  2148  2162  2163  2177  2184  2198  2208  2216  2218  2226
        2236  2242  2244  2253  2254  2293  2296  2337  2365  2380  2393  2410  2413  2475  2478
        2480  2482  2526  2527  2528  2567  2568  2599  2600  2612  2616  2651  2652  2654  2656
        2657  2658  2660  2661  2715  2717  2718  2720  2722  2723  2725  2727  2730  2765  2766
        2768  2776  2800  2801  2823  2824  2825  2827  2829  2831  2865  2867  2869  2870  2872
        2875  2876  2923  2949  2951  2957  2959  2960  2962  2963  2973  2975  2976  2979  2980
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        3818  3823  3824  3826  3834  3844  3846  3852  3854  3855  3856  3857  3858  3860  3861
        3867  3871  3872  3875  3876  3877  3898
MOVB     562   606   625   644   730   734   741   991  1015  2266  2276  2419  2490  2492  2494
        2518  2614  2615  2617  2618  2731  2732  2733  2799  2830  2997  3028  3342  3586  3623
        3631  3646  3771  3785  3810  3863
NEG      922   958  1194  1395  1614  1759  2005  2556  2681
NEGB    1247  1531  1726  1877  2110  3078  3305
NOP      532   551  1931  2934  2939  2952  3370  3730  3731  3732  3733  3734  3735  3736  3737
        3738  3739  3740  3741  3742  3743  3744  3745  3746  3747  3748  3749  3750  3751  3752
        3753  3759  3833  3902  3903  3904
RESET   3835  3893  3900
ROL      636   640   938   970   992  1116  1123  1420  1638  1739  2041
ROLB    1229  1489  1710  1883  1913  2117  2489  2491  2493  2495  2496  2506  3021  3274
ROR      736   894  1001  1036  1094  1136  1376  1405  1587  1767  1998  2229  2364  2441  3632
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RORB      1261  1294  1481  1691  1864  2079  2430  2432  2512  3031  3301
RTI        523   533   563   701   757  3084  3276  3323  3358  3379  3426  3479  3484  3503  3532
          3578  3598  3618  3626  3687  3778  3789  3794  3829  3845  3878
RTS        485   610   626   649   747  3193  3219  3248  3263  3481
SBC        952  1151  1159  1426  1645  1774  1968  3383  3386
SBCB      1235  1346  1525  1721  1834  2057
SCC        855   865   901   920   951   969  1253  1312  1362  1464  1488  1504  1553  1606  1709
          1738  1758  1766  1820  1961  1967  1974  2028  2064  2132  2178  2191  2199  2308  2317
          2325  2373  2418  2548  2558  2665  3049  3095  3185  3235  3708  3718
SEC        524   838   885   893   929  1000  1093  1101  1108  1143  1158  1166  1171  1215  1293
          1305  1345  1389  1404  1406  1480  1547  1586  1720  1789  1840  1863  2056  2228  2341
          2363  2440  2443  2487  2632  2694  2729  2828  2874  3269  3294  3309  3341  3381  3384
SEN        822  2154  2336  2443  3262  3339
SEV        830   876  1193  1412  1419  1480  1511  1620  1678  1876  1989  1997  2004  2017  2056
          2116  2140  2154  2301  2341  2354  2443  2530  2537  2570  2577  3292  3797
SEZ        845   876  1511  3294  3343
SUB        559   579   657   686   775   778   806  1090  1210  1358  1458  1574  1941  2141  2328
          2367  2374  2550  2592  2667  2675  2794  2802  2891  2937  2943  2961  3050  3062  3068
          3409  3694
SWAB       959  1313  1340  1390  1548  1716  1808  1908  2012  2024  2335  2340  3027
TRAP       442  3344  3365
TST        525   581   608   670   683   684   698   746   773   803   867  1018  1027  1186  1364
          1577  1582  1657  1658  1661  1662  1919  1938  1952  1953  1957  1958  1963  2049  2051
          2283  2294  2401  2411  2476  2613  2659  2719  2724  2958  2978  3033  3042  3070  3111
          3122  3134  3146  3156  3188  3224  3247  3281  3327  3377  3382  3406  3433  3583  3589
          3654
TSTB       623   728  1319  1537  1542  1674  1822  1830  2468  2927  3385  3491  3772  3813  3850
          3887  3894
WAIT      3775
.ABS       361
.ASCII     710   711
.ASCIZ     516   708   712   713   714   715   719   720  3790  3929  3932  3935  3945
.END      3953
.EVEN      721  3791
.LIST        7   359   360   460
.MACR      446   447   448   449   450   451   452   453   454   456   457   458   459
.MACRO     445   454
.NLIST       7   359   460
.REM         8
.REPT      460  3730
.TITLE     362   758
.WORD      509   536   539   545   546   655   659   777   785   790  1052  1054  1066  1088  1208
          1356  1456  1571  1572  1653  1654  1655  1735  1926  1947  1948  1949  2291  2292  2408
          2409  2473  2474  2610  2611  2647  2648  2649  2650  2708  2709  2710  2711  2712  2713
          2762  2763  2855  2856  2860  2861  2862  2863  2966  2967  2968  2969  2970  2971  3041
          3110  3145  3175  3213  3390  3489  3500  3525  3615  3692  3788  3812  3817  3882  3890
          3926  3927  3950  3951  3952
```

```
ERRORS DETECTED:  0 HARD     2 SOFT
DEFAULT GLOBALS GENERATED:  0

*,DDQAAA.SEQ/SOL/CRF/PAGNUM=DDQAAA
RUN-TIME: 12 24 6 SECONDS
```

RUN-TIME RATIO: 221/43=5.1
CORE USED: 11K (21 PAGES)

Spooler runtime 13 Seconds, 59 KCS, 358 disk reads, 3 disk writes, 93 pages

[redacted]

[redacted]5678901234567890123456789012 ##

[redacted]