PDP11/45

11/45 REGISTERS
CCKBHB0

AH-7813B-MC

FICHE 1 OF 1

JUL 1978
digital
MADE IN USA

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IDENTIFICATION

PRODUCT CODE:	AC-7812B-MC
PRODUCT NAME:	CCKBHB0 11/45 REGISTERS
DATE CREATED:	JUNE 1978
MAINTAINER:	DIAGNOSTIC GROUP
AUTHOR:	JOHN ADAMS
REVISED:	BY CLEM WALSH

1.0 ABSTRACT

THIS IS A TEST OF ALL THE 11/45 HARDWARE REGISTERS (R10-15, SUPERVISOR STACK POINTER(R16). USER STACK POINTER(R17), AND THE MICRO BREAK REGISTER. THIS TEST INSURES THAT ALL BITS IN EACH OF THE REGISTERS CAN BE SET AND CLEARED PROPERLY.

2.0 REQUIREMENTS

2.1 EQUIPMENT
BASIC 11/45 SYSTEM

2.2 STORAGE
THIS PROGRAM USES 0 THRU 17500

2.3 PRELIMINARY PROGRAMS
DOAA THRU DOMA

3.0 LOADING PROCEDURE
LOAD PROGRAM USING ABS LOADER

4.0 STARTING PROCEDURE
LOAD ADDRESS 200. PRESS START. THE PROGRAM WILL LOOP AND RING BELL ON PASS COMPLETION.

5.0 OPERATING PROCEDURE

5.1 SWITCH SETTINGS
NONE

5.2 SUBROUTINE ABSTRACTS

5.2.1 SCOPE
SCOPE IS A MOVE PC,R1 AND STORES THE PC+2 IN R1.

5.2.2 HLT
HLT IS A HALT INSTRUCTION.

6.0 ERRORS
ALL ERRORS WILL CAUSE A HALT
TRAP AND INTERRUPT ERRORS WILL CAUSE A HALT AT VECTOR+2.

6.1 ERROR RECOVERY
PRESS CONTINUE TO PROCEDE TO NEXT TEST

6.2 ERROR LOOPING
TO LOOP ON AN ERROR, PLACE A BRANCH TO THE PREVIOUS SCOPE INSTRUCTION IN PLACE OF THE HALT INSTRUCTION.
NOTE THAT IF THE ERROR IS INTERMITTANT THAT THE TEST WILL DROP THRU THE HALT AND PROCEED TO THE NEXT TEST.
THEREFORE, TO LOOP THE TEST CONTINUOSLY REPLACE THE BEQ .+4 INSTRUCTION IMMEDIATLY PRECEEDING THE HALT WITH A BRANCH BACK TO THE PREVIOUS SCOPE.

TO LOOP ON TRAP FAILURES, PATCH IN THE FOLLOWING ROUTINE AT THE ADDRESS OF THE TRAP VECTOR.

```
                        TRAPVEC:        TRAPVEC+4
                        TRAPVEC+2:      0
                        TRAPVEC+4:      012716  ;MOVE SCOPE ADDRESS TO STACK
                        TRAPVEC+6:      ADDRESS ;ADDRESS OF PREVIOUS SCOPE
                        TRAPVEC+10:     000006  ;RETURN TO TEST AT SCOPE

                        RESTORE ALL LOCATIONS BEFORE PROCEEDING TO NEXT TEST.

                7.0     RESTRICTIONS
                        NONE

                8.0     MISCELLANEOUS
                        ON TRAP ERRORS THE STACK POINTER(R6) WILL CONTAIN THE
                        ADDRESS WHERE THE TRAP OCCURED.

                8.1     EXECUTION TIME
                        THIS PROGRAM TAKES ABOUT 1 MINUTE.

                8.2     STACK POINTER
                        THIS PROGRAM INITIALY SETS THE STACK POINTER AT 500.

                LISTING
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                %

  137
  138
  139
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                                .TITLE  CCKBHB0 11/45 REGISTERS
                                .NLIST  MC,MD
                                .LIST   ME
                                .ABS

                            ;TEST CCKBHB- THIS DIAGNOSTIC TESTS THAT ALL BITS IN THE NEW 11/45 REGISTERS
                            ;R10-R15, SUPERVISOR & USER STACK POINTER (SSP & USP), AND MICRO BREAK REGISTER
                            ;CAN BE SET AND CLEARED, AND ARE SELECTED PROPERLY.
                            ;NOTE: ALL PREREQUISITE INSTRUCTION TESTS SHOULD BE SUCCESSFULLY RUN
                            ;BEFORE THIS PROGRAM.
                            ;NOTE:  R0-R7 REFERS TO CONVENTIONAL (11/20) REGISTERS AND R10-R17 REFERS TO
                            ;ADDITIONAL 11/45 REGISTERS. KSP,SSP,AND USP REFER TO THE KERNEL,SUPERVISOR,
                            ;AND USER STACK POINTERS.
                            ;STARTING PROCEEDURE
                            ;       LOAD ADDRESS=200
                            ;       PRESS START
                            ;       KERNEL STACK POINTER IS AT 500
                            ;       SUPERVISOR STACK POINTER IS AT 600
                            ;       USER STACK POINTER IS AT 700
                            ;       BELL WILL RING WHEN TEST IS COMPLETE

                            ;REGISTER IDENTIFIERS THESE BITS IDENTIFY EACH REGISTER
000001                      BIT0=1                          ;REGISTER 0 IDENT
000002                      BIT1=2                          ;   "     1   "
000004                      BIT2=4                          ;   "     2   "
000010                      BIT3=10                         ;   "     3   "
000020                      BIT4=20                         ;   "     4   "
000040                      BIT5=40                         ;   "     5   "
000100                      BIT6=100                        ;   "     6   "
000200                      BIT7=200                        ;   "     7   "

                            ;UPPER SET
000400                      BIT8=400                        ;REGISTER 10 IDENT
001000                      BIT9=1000                       ;   "     11   "
002000                      BIT10=2000                      ;   "     12   "
004000                      BIT11=4000                      ;   "     13   "
010000                      BIT12=10000                     ;   "     14   "
020000                      BIT13=20000                     ;   "     15   "
040000                      BIT14=40000                     ;   "     16   "
100000                      BIT15=100000                    ;   "     17   "

000000                      R0=%0
000001                      R1=%1
000002                      R2=%2
000003                      R3=%3
000004                      R4=%4
000005                      R5=%5
000006                      R6=%6
000007                      R7=%7
000006                      SP=%6
000006                      KSP=%6                          ;KERNEL'S STACK POINTER
000006                      SSP=%6                          ;SUPERVISOR'S STACK POINTER
000006                      USP=%6                          ;USER'S STACK POINTER
000007                      PC=%7
```

```
                        R10=%0
                        R11=%1
                        R12=%2
                        R13=%3
                        R14=%4
                        R15=%5
                        R16=%6
                        R17=%7

000500                          KPTR=500                ;KERNEL'S INITIAL STACK POINTER
000600                          SPTR=600                ;SUPERVISOR'S INITIAL STACK POINTER
000700                          UPTR=700                ;USER'S INITIAL STACK POINTER
                        ;REGISTER ADDRESSES
177570                          DISPLAY=177570          ;ADDRESS OF CONSOLE DISPLAY  REGISTER
177776                          PSW=177776              ;ADDRESS OF PROCESSER STATUS WORD
177770                          UBREAK=177770           ;ADDRESS OF MICRO BREAK REGISTER
177564                          TPCSR=177564
177566                          TPBUF=177566
177570                          SWR=177570              ;ADDRESS OF CONSOLE SWITCH REGISTER
022626                          POP2=22626              ;CMP (6)+,(6)+ POPS 2 WORDS OFF STACK
010701                          SCOPE=010701            ;MOV  PC,R1 (R11)
000000                          HLT=0
                        ;VECTOR ADDRESSES
000004                          ERRVEC=4                ;ADDRESS OF ERROR TRAP VECTOR
000014                          TBITVEC=14              ;ADDRESS OF 'T' BIT TRAP VECTOR
000030                          EMTVEC=30               ;ADDRESS OF EMT TRAP VECTOR
000034                          TRAPVEC=34              ;ADDRESS OF TRAP TRAP VECTOR
                        ;BIT ASSIGNMENTS IN PSW
000000                          KM=0                    ;KERNEL MODE
040000                          SM=40000                ;SUPERVISORY MODE
140000                          UM=140000               ;USER MODE



                        ;TRAP CATCHER FROM 0 TO 376

000000                          .=0
```

```
                                ;       ******************************************************************************
                                ;                       MODIFIED FEB 28 1978
                                ;       ++
                                ;                       ACT11 AND XXDP HOOKS
                                ;       --
                                        $SVPC=.                 ;SAVE PROGRAM COUNTER
                                        .=40
000040  000                     DRIVE:  .BYTE   0               ;DRIVE # FOR XXDP LOAD MEDIUM
                                                                ;ASSEMBLE AS A 0
                                        .=41
000041  000                     MEDIUM: .BYTE   0               ;XXDP LOAD MEDIUM
                                                                ;ASSEMBLE AS A 0
                                        .=42
000042  000000                  .WORD   0               ;ACT11 INDICATOR
                                                        ;ASSEMBLE AS A 0
                                        .=46
000046  004004                  .WORD   $ENDAD          ;SET TO $ENDAD IN .$EOP
                                        .=52
000052  000000                  .WORD   0               ;CHARACTERISTICS OF PROGRAM
                                                        ;SET TO 0
                                        .=$SVPC                 ;RESTORE PROGRAM COUNTER
                                ;       ******************************************************************************
                                .=100
```

```
                        ;       ************************************************************************
                        ;                       MODIFIED FEB 28 1978
                        ;
                        ;       ++
                        ;               ACT11 AND XXDP MODE INDICATORS
                        ;       --

000100  000000          AUTOM:  .WORD   0               ;AUTOMATIC MODE INDICATOR
000102  000             ACT11M: .BYTE   0               ;ACT11 AUTO MODE INDICATOR
000103  000             XXDPM:  .BYTE   0               ;XXDP AUTO MODE INDICATOR
000104  000             ADUMPM: .BYTE   0               ;ACT11 DUMP MODE INDICATOR
000105  000             XDUMPM: .BYTE   0               ;XXDP DUMP MODE INDICATOR

                        ;       ************************************************************************
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```
                    000200                          .=200
000200  004767  003614                              JSR     PC,CKMODE       ;CHECK FOR MODE OF OPERATION ++ C.W
000204  000167  000600                              JMP     START

                    001000                          .=1000
001000  000000                      ICNT:0                          ;PASS COUNT
001002  000000                      TEMP:0
                    001010                          .=.+4
001010  005067  177764              START:  CLR     ICNT
001014  016737  177760  177570      BEGIN:  MOV     ICNT,@#DISPLAY  ;DISPLAY PASS COUNT
001022  012706  000500                      MOV     #KPTR,KSP       ;INITIALIZE THE STACK POINTER
001026  032737  000400  177570              BIT     #400,@#SWR      ;LOAD MICRO BREAK REGISTER?
001034  001403                              BEQ     .+10
001036  113737  177570  177770              MOVB    @#SWR,@#UBREAK  ;LOAD MICRO BREAK REG WITH SR0-7
001044  005067  176726                      CLR     PSW
                                    ;LOAD EACH REGISTER WITH ITS IDENTIFIER

001050  012700  000001              T0:     MOV     #BIT0,R0
001054  012701  000002                      MOV     #BIT1,R1
001060  012702  000004                      MOV     #BIT2,R2
001064  012703  000010                      MOV     #BIT3,R3
001070  012704  000020                      MOV     #BIT4,R4
001074  012705  000040                      MOV     #BIT5,R5
001100  012767  004000  176670              MOV     #BIT11,PSW      ;SET REGISTER SET BIT
001106  012700  000400                      MOV     #BIT8,R10
001112  012701  001000                      MOV     #BIT9,R11
001116  012702  002000                      MOV     #BIT10,R12
001122  012703  004000                      MOV     #BIT11,R13
001126  012704  010000                      MOV     #BIT12,R14
001132  012705  020000                      MOV     #BIT13,R15

001136  005067  176634                      CLR     PSW             ;SWITCH TO CONVENTIONAL REGISTERS

                                    ;TEST THAT ALL REGISTERS WERE PROPERLY LOADED
001142  022700  000001                      CMP     #BIT0,R0
001146  001401                              BEQ     .+4
001150  000000                              HLT
001152  022701  000002                      CMP     #BIT1,R1
001156  001401                              BEQ     .+4
001160  000000                              HLT
001162  022702  000004                      CMP     #BIT2,R2
001166  001401                              BEQ     .+4
001170  000000                              HLT
001172  022703  000010                      CMP     #BIT3,R3
001176  001401                              BEQ     .+4
001200  000000                              HLT
001202  022704  000020                      CMP     #BIT4,R4
001206  001401                              BEQ     .+4
001210  000000                              HLT
001212  022705  000040                      CMP     #BIT5,R5
001216  001401                              BEQ     .+4
001220  000000                              HLT
001222  022706  000500                      CMP     #KPTR,KSP
001226  001401                              BEQ     .+4
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```
                                        HLT
                                ;SWTICH TO UPPER REGISTERS
001232  012767  004000  176536            MOV     #BIT11,PSW
001240  022700  000400                    CMP     #BIT8,R10
001244  001401                            BEQ     .+4
001246  000000                            HLT
001250  022701  001000                    CMP     #BIT9,R11
001254  001401                            BEQ     .+4
001256  000000                            HLT
001260  022702  002000                    CMP     #BIT10,R12
001264  001401                            BEQ     .+4
001266  000000                            HLT
001270  022703  004000                    CMP     #BIT11,R13
001274  001401                            BEQ     .+4
001276  000000                            HLT
001300  022704  010000                    CMP     #BIT12,R14
001304  001401                            BEQ     .+4
001306  000000                            HLT
001310  022705  020000                    CMP     #BIT13,R15
001314  001401                            BEQ     .+4
001316  000000                            HLT
                                ;R7 CHECK
001320  012707  001330                    MOV     #TOX,R17
001324  000000                            HLT
001326  000000                            HLT

001330  005067  176442          TOX:      CLR     PSW
001334  010701                            SCOPE

                                ;CHECK THAT ALL BITS IN R10 CAN BE SET/CLEARED.
001336  012767  004000  176432  A0:       MOV     #BIT11,PSW
001344  012767  000020  177432            MOV     #20,TEMP+2
001352  012700  000001                    MOV     #1,R10
001356  010067  177420                    MOV     R10,TEMP
001362  006367  177414          A0A:      ASL     TEMP
001366  006300                            ASL     R10
001370  020067  177406                    CMP     R10,TEMP
001374  001401                            BEQ     .+4
001376  000000                            HLT
001400  005367  177400                    DEC     TEMP+2
001404  001366                            BNE     A0A
001406  010701                            SCOPE

                                ;CHECK THAT ALL BITS IN R11 CAN BE SET/CLEARED.
001410  012767  004000  176360  A1:       MOV     #BIT11,PSW
001416  012767  000020  177360            MOV     #20,TEMP+2
001424  012701  000001                    MOV     #1,R11
001430  010167  177346                    MOV     R11,TEMP
001434  006367  177342          A1A:      ASL     TEMP
001440  006301                            ASL     R11
001442  020167  177334                    CMP     R11,TEMP
001446  001401                            BEQ     .+4
001450  000000                            HLT
001452  005367  177326                    DEC     TEMP+2
001456  001366                            BNE     A1A
001460  010701                            SCOPE
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                                        ;CHECK THAT ALL BITS IN R12 CAN BE SET/CLEARED.
001462  012767  004000  176306  A2:     MOV     #BIT11,PSW
001470  012767  000020  177306          MOV     #20,TEMP+2
001476  012702  000001                  MOV     #1,R12
001502  010267  177274                  MOV     R12,TEMP
001506  006367  177270          A2A:    ASL     TEMP
001512  006302                          ASL     R12
001514  020267  177262                  CMP     R12,TEMP
001520  001401                          BEQ     .+4
001522  000000                          HLT
001524  005367  177254                  DEC     TEMP+2
001530  001366                          BNE     A2A
001532  010701                          SCOPE

                                        ;CHECK THAT ALL BITS IN R13 CAN BE SET/CLEARED.
001534  012767  004000  176234  A3:     MOV     #BIT11,PSW
001542  012767  000020  177234          MOV     #20,TEMP+2
001550  012703  000001                  MOV     #1,R13
001554  010367  177222                  MOV     R13,TEMP
001560  006367  177216          A3A:    ASL     TEMP
001564  006303                          ASL     R13
001566  020367  177210                  CMP     R13,TEMP
001572  001401                          BEQ     .+4
001574  000000                          HLT
001576  005367  177202                  DEC     TEMP+2
001602  001366                          BNE     A3A
001604  010701                          SCOPE

                                        ;CHECK THAT ALL BITS IN R14 CAN BE SET/CLEARED.
001606  012767  004000  176162  A4:     MOV     #BIT11,PSW
001614  012767  000020  177162          MOV     #20,TEMP+2
001622  012704  000001                  MOV     #1,R14
001626  010467  177150                  MOV     R14,TEMP
001632  006367  177144          A4A:    ASL     TEMP
001636  006304                          ASL     R14
001640  020467  177136                  CMP     R14,TEMP
001644  001401                          BEQ     .+4
001646  000000                          HLT
001650  005367  177130                  DEC     TEMP+2
001654  001366                          BNE     A4A
001656  010701                          SCOPE

                                        ;CHECK THAT ALL BITS IN R15 CAN BE SET/CLEARED.
001660  012767  004000  176110  A5:     MOV     #BIT11,PSW
001666  012767  000020  177110          MOV     #20,TEMP+2
001674  012705  000001                  MOV     #1,R15
001700  010567  177076                  MOV     R15,TEMP
001704  006367  177072          A5A:    ASL     TEMP
001710  006305                          ASL     R15
001712  020567  177064                  CMP     R15,TEMP
001716  001401                          BEQ     .+4
001720  000000                          HLT
001722  005367  177056                  DEC     TEMP+2
001726  001366                          BNE     A5A
001730  010701                          SCOPE
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001732 012767 004000 176036          MOV     #BIT11,PSW
001740 012700 000400                 MOV     #BIT8,R10
001744 012701 001000                 MOV     #BIT9,R11
001750 012702 002000                 MOV     #BIT10,R12
001754 012703 004000                 MOV     #BIT11,R13
001760 012704 010000                 MOV     #BIT12,R14
001764 012705 020000                 MOV     #BIT13,R15
001770 005067 176002                 CLR     PSW
001774 010701                        SCOPE

001776 012767 004000 175772  T1:     MOV     #BIT11,PSW      ;GO UPPER SET
002004 010067 175766         T1A:    MOV     R10,PSW         ;MOVE BIT8 TO PSW (SWITCHES
002010 016767 175762 176764          MOV     PSW,TEMP        ;TO 11/20 REGS.)
002016 032767 000001 176756          BIT     #BIT0,TEMP      ;WAS CORRECT %0 LOADED IN PSW
002024 001401                        BEQ     .+4             ;IF BIT 0 WAS SET 11/20 REG 0
002026 000000                        HLT                     ;WAS INCORRECTLY SELECTED
002030 005767 176746                 TST     TEMP            ;IF TRULY R10 PSW WILL BE
002034 001401                        BEQ     .+4             ;CLEAR
002036 000000                        HLT                     ;ERROR!  DID INST AT T1A CLR PSW?
002040 010701                        SCOPE

002042 012767 004000 175726  T2:     MOV     #BIT11,PSW
002050 010067 175722                 MOV     R10,PSW         ;SEL 11/20 REGS.
002054 010067 175716                 MOV     R0,PSW          ;MOVE BIT0 TO PSW (SETS C)
002060 103401                        BCS     .+4             ;IS CARRY SET?
002062 000000                        HLT                     ;R0 NOT SELECTED
002064 010701                        SCOPE

002066 012767 004000 175702  T3:     MOV     #BIT11,PSW
002074 040367 175676                 BIC     R13,PSW         ;CLEAR BIT11 IN PSW
002100 010267 175672                 MOV     R2,PSW          ;MOVE BIT1 TO PSW
002104 016767 175666 176670          MOV     PSW,TEMP
002112 022767 000004 176662          CMP     #BIT2,TEMP
002120 001401                        BEQ     .+4
002122 000000                        HLT
002124 010701                        SCOPE

002126 012767 004000 175642  T4:     MOV     #BIT11,PSW
002134 160367 175636                 SUB     R13,PSW
002140 074267 175632                 XOR     R2,PSW
002144 016767 175626 176630          MOV     PSW,TEMP
002152 022767 000004 176622          CMP     #BIT2,TEMP
002160 001401                        BEQ     .+4
002162 000000                        HLT
002164 010701                        SCOPE
002166 012767 004000 175602  T5:     MOV     #BIT11,PSW
002174 074367 175576                 XOR     R13,PSW
002200 074367 175572                 XOR     R3,PSW
002204 016767 175566 176570          MOV     PSW,TEMP
002212 022767 000010 176562          CMP     #BIT3,TEMP
002220 001401                        BEQ     .+4
002222 000000                        HLT
002224 010701                        SCOPE

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  512  002226  012767  004000  175542  T6:     MOV     #BIT11,PSW
  513  002234  012767  002276  175552          MOV     #T6A,TBITVEC
  514  002242  005067  175550                  CLR     TBITVEC+2
  515  002246  052767  000020  175522          BIS     #BIT4,PSW       ;ATTEMPT TO SET 'T' BIT
  516  002254  016767  175516  176520          MOV     PSW,TEMP
  517  002262  022767  004004  176512          CMP     #BIT11+BIT2,TEMP;'T'BIT SHOULD NOT HAVE SET
  518  002270  001404                          BEQ     T6X             ;'Z' WAS SET BY CLR TBITVEC+2 INST.
  519  002272  000000                          HLT                     ;ERROR! ONLY BIT11 & Z SHOULD BE SET
  520  002274  000402                          BR      T6X
  521  002276  000000                  T6A:    HLT                     ;ERROR! 'T' BIT CAUSED A TRAP
  522  002300  022626                          POP2
  523  002302  010701                  T6X:    SCOPE
  524
  525  002304  012767  002344  175502  T7:     MOV     #T7A,TBITVEC
  526  002312  012767  004000  175456          MOV     #BIT11,PSW
  527  002320  012705  004020                  MOV     #BIT11+BIT4,R15
  528  002324  074567  175446                  XOR     R15,PSW
  529  002330  016767  175442  176444          MOV     PSW,TEMP
  530  002336  001404                          BEQ     T7X
  531  002340  000000                          HLT
  532  002342  000402                          BR      T7X
  533  002344  000000                  T7A:    HLT
  534  002346  022626                          POP2
  535  002350  012767  000016  175436  T7X:    MOV     #16,14
  536  002356  010701                          SCOPE
  537
  538  002360  012767  004000  175410  T10:    MOV     #BIT11,PSW
  539  002366  012705  004000                  MOV     #BIT11,R15
  540  002372  074567  175400                  XOR     R15,PSW
  541  002376  074567  175374                  XOR     R5,PSW
  542  002402  016767  175370  176372          MOV     PSW,TEMP
  543  002410  022767  000040  176364          CMP     #BIT5,TEMP
  544  002416  001401                          BEQ     .+4
  545  002420  000000                          HLT
  546  002422  010701                          SCOPE
  547
  548  002424  012767  004000  175344  T11:    MOV     #BIT11,PSW
  549  002432  005000                          CLR     R10
  550  002434  010067  176342                  MOV     R10,TEMP
  551  002440  001401                          BEQ     .+4
  552  002442  000000                          HLT
  553  002444  010701                          SCOPE
  554
  555  002446  012767  004000  175322  T12:    MOV     #BIT11,PSW
  556  002454  005000                          CLR     R10
  557  002456  012767  000200  176316          MOV     #BIT7,TEMP
  558  002464  116700  176312                  MOVB    TEMP,R10                ;MOVB TO A REG. EXTENDS SIGN
  559  002470  020027  177600                  CMP     R10,#177600     ;DID SIGN EXTEND
  560  002474  001401                          BEQ     .+4
  561  002476  000000                          HLT
  562  002500  012700  000400                  MOV     #BIT8,R10
  563  002504  010701                          SCOPE
  564
  565  002506  012767  004000  175262  T13:    MOV     #BIT11,PSW
  566  002514  012701  177777                  MOV     #-1,R11
  567  002520  010167  176256                  MOV     R11,TEMP
```

```
  568  002524  026727  176252  177777          CMP     TEMP,#-1
  569  002532  001401                          BEQ     .+4
  570  002534  000000                          HLT
  571  002536  010701                          SCOPE
  572
  573                                  ;TEST THAT MOVB TO A REGISTER EXTENDS THE SIGN (SIGN = 0)
  574  002540  012767  004000  175230  T14:     MOV     #BIT11,PSW
  575  002546  012701  177777                  MOV     #-1,R11
  576  002552  012767  017777  176222          MOV     #17777,TEMP
  577  002560  116701  176217                  MOVB    TEMP+1,R11
  578  002564  022701  000037                  CMP     #37,R11
  579  002570  001401                          BEQ     .+4
  580  002572  000000                          HLT
  581  002574  012701  001000                  MOV     #BIT9,R11
  582  002600  010701                          SCOPE
  583
  584                                  ;TEST THAT XOR %R,%R OPERATES PROPERLY
  585  002602  012767  004000  175166  T15:     MOV     #BIT11,PSW
  586  002610  074203                          XOR     R12,R13
  587  002612  010367  176164                  MOV     R13,TEMP
  588  002616  026727  176160  006000          CMP     TEMP,#BIT10+BIT11
  589  002624  001401                          BEQ     .+4
  590  002626  000000                          HLT
  591  002630  012703  004000                  MOV     #BIT11,R13
  592  002634  010701                          SCOPE
  593
  594                                  ;TEST SOB WITH UPPER REGISTER SET
  595  002636  012767  004000  175132  T16:     MOV     #BIT11,PSW
  596  002644  012704  000001                  MOV     #1,R14
  597  002650  000402                          BR      T16B
  598  002652  000000                  T16A:   HLT
  599  002654  000401                          BR      T16X
  600  002656  077403                  T16B:   SOB     R14,T16A
  601  002660  012704  010000          T16X:   MOV     #BIT12,R14
  602  002664  010701                          SCOPE
  603
  604                                  ;TEST ADD %R,%R USING UPPER REGISTER SET
  605  002666  060302                  T17:    ADD     R13,R12
  606  002670  010267  176106                  MOV     R12,TEMP
  607  002674  022767  006000  176100          CMP     #BIT10+BIT11,TEMP
  608  002702  001401                          BEQ     .+4
  609  002704  000000                          HLT
  610  002706  012702  002000                  MOV     #BIT10,R12
  611  002712  010701                          SCOPE
  612
  613                                  ;TEST UPPER REGISTER SET (R13) IN AUTO INCREMENT MODE.
  614  002714  005067  176064          T20:    CLR     TEMP+2          ;PRE SET MEMORY ADDRESS
  615  002720  012767  177777  176054          MOV     #-1,TEMP
  616  002726  012767  004000  175042          MOV     #BIT11,PSW      ;SWITCH TO UPPER REG. SET
  617  002734  012703  001002                  MOV     #TEMP,R13       ;LOAD REGISTER
  618  002740  012367  176040                  MOV     (R13)+,TEMP+2   ;MOVE TEMP TO TEMP+2
  619  002744  022767  177777  176032          CMP     #-1,TEMP+2      ;WAS TEMP MOVED
  620  002752  001401                          BEQ     .+4
  621  002754  000000                          HLT                     ;ERROR!
  622  002756  022703  001004                  CMP     #TEMP+2,R13     ;DID R13 INCREMENT
  623  002762  001401                          BEQ     .+4
```

```
                                        HLT                     ;ERROR! R13 DID NOT AUTO-INCREMENT
                                        SCOPE

                                ;TEST UPPER REG. SET (R14) IN AUTO-DECREMENT MODE
003770  012767  001002  176006  T20A:   MOV     #TEMP,TEMP+2
003776  005067  176000                  CLR     TEMP
003002  012767  004000  174766          MOV     #BIT11,PSW
003010  012704  001006                  MOV     #TEMP+4,R14
003014  014467  175762                  MOV     -(R14),TEMP
003020  022767  001002  175754          CMP     #TEMP,TEMP
003026  001401                          BEQ     .+4
003030  000000                          HLT
003032  022704  001004                  CMP     #TEMP+2,R14     ;DID REGISTER AUTO-DECREMENT
003036  001401                          BEQ     .+4
003040  000000                          HLT
003042  010701                          SCOPE

                                ;TESTS 21 AND 22 HAVE BEEN DELETED.

                                ;TEST UPPER REGISTER SET REGISTERS AS INDEX REGISTERS
003044  000240                  T23:    NOP                     ;THIS LOCATION MAY BE USED TO CLEAR
                                                                ;REGISTER SET BIT.
003046  012767  001002  175730          MOV     #TEMP,TEMP+2
003054  012767  177777  175720          MOV     #-1,TEMP
003062  012702  177776                  MOV     #-2,R12         ;LOAD INDEX
003066  010205                          MOV     R12,R15         ;REGISTERS
003070  067275  001006  001006          ADD     @TEMP+4(2),@TEMP+4(5)   ;ADD TEMP  (TEMP+4(5)  TO ITSELF
003076  103401                          BCS     .+4             ;-1,+-1 RESULTS IN CARRY
003100  000000                          HLT
003102  022767  177776  175672          CMP     #177776,TEMP    ;RESULT CORRECT
003110  001401                          BEQ     .+4
003112  000000                          HLT
003114  010701                          SCOPE

                                ;TEST THAT ALL THREE STACK POINTERS (KSP,SSP,AND USP CAN BE SELECTED.
003116  012767  000000  174652  T24:    MOV     #KM,PSW         ;KERNEL MODE!!!
003124  012706  000500                  MOV     #KPTR,KSP       ;LOAD KERNEL STACK POINTER
003130  052767  040000  174640          BIS     #SM,PSW         ;SUPERVISORY MODE!!!
003136  012706  000600                  MOV     #SPTR,SSP       ;LOAD SUPERVISOR STACK POINTER
003142  052767  140000  174626          BIS     #UM,PSW         ;USER MODE!!!
003150  012706  000700                  MOV     #UPTR,USP       ;LOAD USER STACK POINTER
003154  010667  175622                  MOV     USP,TEMP        ;GET USER STACK POINTER
003160  042767  100000  174610          BIC     #BIT15,PSW      ;SUPERVISORY MODE!!!
003166  010667  175612                  MOV     SSP,TEMP+2      ;GET SUPERVISOR STACK POINTER
003172  005067  174600                  CLR     PSW             ;KERNEL MODE
003176  022706  000500                  CMP     #KPTR,KSP       ;CHECK KERNEL STACK POINTER
003202  001401                          BEQ     .+4
003204  000000                          HLT                     ;ERROR! KERNEL STACK POINTER NOT LOADED

003206  022767  000600  175570          CMP     #SPTR,TEMP+2    ;CHECK SUPERVISOR STACK POINTER
003214  001401                          BEQ     .+4
003216  000000                          HLT                     ;ERROR! SUPERVISOR STACK NOT LOADED

003220  022767  000700  175554          CMP     #UPTR,TEMP      ;CHECK USER STACK POINTER
003226  001401                          BEQ     .+4
003230  000000                          HLT                     ;ERROR! USER STACK POINTER NOT LOADED
```

```
                                        SCOPE

                                ;TEST THAT JSR INST. OPERATES PROPERLY WITH REG. SET BIT SET
003234  012706  000500          T25:    MOV     #KPTR,KSP       ;INITIALIZE THE STACK POINTER
003240  012700  000001                  MOV     #BIT0,R0        ;PRE SET R0
003244  012767  004000  174524          MOV     #BIT11,PSW      ;SET REG. SET BIT
003252  012700  000400                  MOV     #BIT8,R10       ;PRE SET R10
003256  004067  000002                  JSR     R10,T25B        ;GO TO T25B & SAVE R10 ON THE STACK
003262  000000                  T25A:   HLT                     ;JSR DID NOT GO
003264  022706  000476          T25B:   CMP     #KPTR-2,KSP
003270  001401                          BEQ     .+4             ;STACK POINTER DID NOT DECREMENT
003272  000000                          HLT
003274  022767  000400  175174          CMP     #BIT8,KPTR-2    ;WAS OLD CONTENTS OF R10 SAVED?
003302  001401                          BEQ     .+4
003304  000000                          HLT                     ;ERROR! R10 NOT SAVED ON THE STACK
003306  022700  003262                  CMP     #T25A,R10       ;IS RETURN ADDRESS IN R10
003312  001401                          BEQ     .+4
003314  000000                          HLT                     ;ERROR! RETURN ADRS. NOT SAVED IN R10
003316  005067  174454                  CLR     PSW
003322  022700  000001                  CMP     #BIT0,R0        ;R0 LEFT UNCHANGED?
003326  001401                          BEQ     .+4
003330  000000                          HLT                     ;R0 GOT CHANGED
003332  010701                          SCOPE

                                ;TEST JSR INSTRUCTION USING UPPER REG SET IN DEST. CALCULATION
003334  012706  000500          T26:    MOV     #KPTR,KSP
003340  012705  000040                  MOV     #BIT5,R5        ;PRE SET R5
003344  012767  004000  174424          MOV     #BIT11,PSW      ;SWITH TO UPPER REG. SET
003352  005005                          CLR     R15             ;PRE SET R15
003354  004565  003362                  JSR     R15,T26B(5)     ;GO TO T26B
003360  000000                  T26A:   HLT                     ;ERROR! JSR FAILED
003362  005767  175110          T26B:   TST     KPTR-2          ;OLD CONTENTS OF R15 SAVED?
003366  001401                          BEQ     .+4
003370  000000                          HLT                     ;ERROR! OLD CONTENTS OF R15 NOT SAVED
003372  022705  003360                  CMP     #T26A,R15       ;RETURN ADDRESS IN R15?
003376  001401                          BEQ     .+4
003400  000000                          HLT                     ;ERROR! R15 DID NOT GET RETURN ADDRESS
003402  005067  174370                  CLR     PSW             ;SWITCH TO LOWER REGISTERS
003406  022705  000040                  CMP     #BIT5,R5        ;DID R5 CHANGE?
003412  001401                          BEQ     .+4
003414  000000                          HLT                     ;ERROR! R5 GOT CHANGED
003416  010701                          SCOPE

                                ;TEST RTS WITH UPPER REGISTERS
003420  012706  000500          T27:    MOV     #KPTR,KSP
003424  012716  001000                  MOV     #BIT9,(KSP)
003430  012702  000004                  MOV     #BIT2,R2        ;PRE SET R2
003434  012767  004000  174334          MOV     #BIT11,PSW      ;SWITCH TO UPPER REG. SET
003442  012702  003452                  MOV     #T27A,R12       ;LOAD REG. WITH RETURN ADDRESS
003446  000202                          RTS     R12             ;RETURN TO T27A  (R12)
003450  000000                          HLT                     ;ERROR! RTS FAILED
003452  022706  000502          T27A:   CMP     #KPTR+2,KSP     ;WAS STACK POINTER INCREMENTED
003456  001401                          BEQ     .+4
003460  000000                          HLT                     ;ERROR! STACK POINTER WAS NOT INCREMENTED
003462  022702  001000                  CMP     #BIT9,R12       ;WAS R12 RESTORED?
003466  001401                          BEQ     .+4
```

```
                                        HLT                     ;ERROR! RTS DID NOT RESTORE R12
003472  005067  174300                  CLR     PSW             ;SWITCH TO LOWER REG. SET
003476  022702  000004                  CMP     #BIT2,R2        ;DID R2 CHANGE?
003502  001401                          BEQ     .+4
003504  000000                          HLT                     ;ERROR! R2 CHANGED
003506  010701                          SCOPE

                                ;CHECK THAT ALL BITS IN KSP CAN BE SET/CLEARED.
003510  012700  000001                  MOV     #1,R0           ;GET '1' BIT
003514  012767  000000  174254  T30:    MOV     #KM,PSW
003522  010006                          MOV     R0,KSP  ;LOAD KSP
003524  010602                          MOV     KSP,R2  ;GET RESULT
003526  005067  174244                  CLR     PSW             ;KERNEL MODE!!!

003532  020200                          CMP     R2,R0           ;WAS KSP LOADED CORRECTLY?
003534  001401                          BEQ     .+4
003536  000000                          HLT
003540  006300                          ASL     R0              ;SHIFT '1' BIT THRU KSP
003542  103364                          BCC     T30             ;UNTIL ALL BITS ARE TESTED
003544  010701                          SCOPE

                                ;CHECK THAT ALL BITS IN SSP CAN BE SET/CLEARED.
003546  012700  000001                  MOV     #1,R0           ;GET '1' BIT
003552  012767  040000  174216  T31:    MOV     #SM,PSW
003560  010006                          MOV     R0,SSP  ;LOAD SSP
003562  010602                          MOV     SSP,R2  ;GET RESULT
003564  005067  174206                  CLR     PSW             ;KERNEL MODE!!!

003570  020200                          CMP     R2,R0           ;WAS SSP LOADED CORRECTLY?
003572  001401                          BEQ     .+4
003574  000000                          HLT
003576  006300                          ASL     R0              ;SHIFT '1' BIT THRU SSP
003600  103364                          BCC     T31             ;UNTIL ALL BITS ARE TESTED
003602  010701                          SCOPE

                                ;CHECK THAT ALL BITS IN USP CAN BE SET/CLEARED.
003604  012700  000001                  MOV     #1,R0           ;GET '1' BIT
003610  012767  140000  174160  T32:    MOV     #UM,PSW
003616  010006                          MOV     R0,USP  ;LOAD USP
003620  010602                          MOV     USP,R2  ;GET RESULT
003622  005067  174150                  CLR     PSW             ;KERNEL MODE!!!

003626  020200                          CMP     R2,R0           ;WAS USP LOADED CORRECTLY?
003630  001401                          BEQ     .+4
003632  000000                          HLT
003634  006300                          ASL     R0              ;SHIFT '1' BIT THRU USP
003636  103364                          BCC     T32             ;UNTIL ALL BITS ARE TESTED
003640  010701                          SCOPE
```

```
                                        ;CHECK THAT ALL BITS IN THE MICRO BREAK REGISTER (177770) CAN BE SET
                                        ;AND CLEARED
003642  012700  000001        T33:    MOV     #1,R0
003646  012702  177770                MOV     #UBREAK,R2      ;GET ADDRESS OF MICRO BREAK REGISTER
003652  010012                T33A:   MOV     R0,(R2)         ;LOAD TEST BIT INTO REGISTER
003654  011203                        MOV     (R2),R3         ;GET RESULT
003656  020003                        CMP     R0,R3           ;COMPARE RESULT & TEST BIT
003660  001401                        BEQ     .+4
003662  000000                        HLT                     ;ERROR! TEST BIT (R0) DID NOT SET INTO
                                                              ;REGISTER
003664  040012                        BIC     R0,(R2)         ;CLEAR TEST BIT IN REGISTER
003666  011203                        MOV     (R2),R3         ;GET RESULT
003670  001401                        BEQ     .+4
003672  000000                        HLT                     ;ERROR! TEST BIT DID NOT GET CLEARED
003674  106300                        ASLB    R0              ;SHIFT TEST BIT UNTIL DONE
003676  103365                        BCC     T33A
003700  010701                        SCOPE

                                        ;CHECK THAT RESET DOES NOT CLEAR MICRO BREAK REGISTER
003702  012737  177777  177770  T34:    MOV     #-1,@#UBREAK    ;SET ALL 1'S INTO REGISTER
003710  122737  177777  177770        CMPB    #-1,@#UBREAK    ;CHECK RESULT
003716  001401                        BEQ     .+4
003720  000000                        HLT                     ;ERROR!
003722  000005                        RESET                   ;RESET DOES NOT CLEAR REGISTER
003724  122737  177777  177770        CMPB    #-1,@#UBREAK    ;CHECK THAT RESET DID NOT CLEAR ANY BITS
003732  001401                        BEQ     .+4
003734  000000                        HLT                     ;ERROR!
003736  010701                        SCOPE

003740  005267  175034        END:    INC     ICNT            ;INCREMENT PASS COUNT
003744  026727  175030  001000        CMP     ICNT,#1000      ;1000 PASSES?
003752  001402                        BEQ     1$
003754  000167  175034                JMP     BEGIN
003760  012767  000007  173600  1$:   MOV     #7,TPBUF        ;RING THE BELL
003766  105767  173572                TSTB    TPCSR           ;WAIT FOR THE BELL
003772  100375                        BPL     .-4             ;TO RING
003774  013702  000042                MOV     @#42,R2         ;GET DECTAPE MONITOR RETURN ADDRESS
004000  001405                        BEQ     DONE1           ;DO NOT RETURN IF (42)=0
004002  000005                        RESET                   ;CLEAR THE WORLD
004004  004712                $ENDAD: JSR     PC,(R2)         ;RETURN TO DECTAPE MONITOR
004006  000240                        NOP                     ;ACT11
004010  000240                        NOP                     ;OVERLAY
004012  000240                        NOP                     ;AREA
004014  000167  174770        DONE1:  JMP     START           ;RESTART TEST
```

```
                        ;       ********************************************************************************
                        ;                               MODIFIED FEB 28 1978
                        ;       ++
                        ;               CHECK FOR DUMP MODE OR AUTOMATIC/ACT11-XXDP MODE
                        ;       --
004020  005067  174054  CKMODE: CLR     AUTOM                   ;INIT AUTOMATIC MODE INDICATOR
004024  105067  174052          CLRB    ACT11M                  ;INIT ACT11 AUTO MODE INDICATOR
004030  105067  174047          CLRB    XXDPM                   ;INIT XXDP AUTO MODE INDICATOR
004034  105067  174044          CLRB    ADUMPM                  ;INIT ACT11 DUMP MODE INDICATOR
004040  105067  174041          CLRB    XDUMPM                  ;INIT XXDP DUMP MODE INDICATOR
004044  005737  000042          TST     @#42                    ;AUTO MODE?
004050  001414                  BEQ     2$                      ;BRANCH - IF NO
004052  005267  174022          INC     AUTOM                   ;SET AUTO MODE INDICATOR
004056  023737  000042  000046  CMP     @#42,@#46               ;ACT11 MODE?
004064  001403                  BEQ     1$                      ;BRANCH - IF YES
004066  105267  174011          INCB    XXDPM                   ;INDICATE XXDP AUTO MODE
004072  000413                  BR      5$                      ;AND EXIT
004074  105267  174002  1$:     INCB    ACT11M                  ;INDICATE ACT11 MODE
004100  000410                  BR      5$                      ;AND EXIT
004102  105737  000041  2$:     TSTB    @#41                    ;MAN/MODE VIA ACT11/PAPER TAPE?
004106  001003                  BNE     3$                      ;BRANCH - IF NO
004110  105267  173770          INCB    ADUMPM                  ;INDICATE MAN/MODE VIA ACT11/PAPER TAPE
004114  000402                  BR      5$                      ;AND EXIT
004116  105267  173763  3$:     INCB    XDUMPM                  ;INDICATE MANUAL MODE VIA XXDP
004122  005737  000042  5$:     TST     @#42                    ;AUTO MODE?
004126  001002                  BNE     6$                      ;BRANCH - IF YES
004130  105067  173746          CLRB    ACT11M                  ;RE-INIT ACT FLAG
004134  000207          6$:     RTS     PC                      ;RETURN

                        ;       ********************************************************************************

000001                  .END
```

```
ACT11M  000102          281#    841*    852*    861*
ADUMPM  000104          283#    843*    856*
AUTOM   000100          280#    840*    847*
A0      001336          374#
A0A     001362          378#    384
A1      001410          388#
A1A     001434          392#    398
A2      001462          402#
A2A     001506          406#    412
A3      001534          416#
A3A     001560          420#    426
A4      001606          430#
A4A     001632          434#    440
A5      001660          444#
A5A     001704          448#    454
BEGIN   001014          299#    818
BIT0  = 000001          163#    307     324     471     684     699
BIT1  = 000002          164#    308     327
BIT10 = 002000          175#    316     353     461     588     607     610
BIT11 = 004000          176#    313     317     346     356     374     388     402     416     430     444     458     462
                        468     479     486     495     503     512     517     526     527     538     539     548     555
                        565     574     585     588     591     595     607     616     630     685     707     727
BIT12 = 010000          177#    318     359     463     601
BIT13 = 020000          178#    319     362     464
BIT14 = 040000          179#
BIT15 = 100000          180#    666
BIT2  = 000004          165#    309     330     490     499     517     726     738
BIT3  = 000010          166#    310     333     507
BIT4  = 000020          167#    311     336     515     527
BIT5  = 000040          168#    312     339     543     706     718
BIT6  = 000100          169#
BIT7  = 000200          170#    557
BIT8  = 000400          173#    314     347     459     562     686     692
BIT9  = 001000          174#    315     350     460     581     725     734
CKMODE  004020          291     840#
DISPLA= 177570          209#    299*
DONE1   004014          823     829#
DRIVE   000040          247#
EMTVEC= 000030          221#
END     003740          815#
ERRVEC= 000004          219#
HLT   = 000000          217#    326     329     332     335     338     341     344     349     352     355     358     361
                        364     367     368     382     396     410     424     438     452     473     476     483     492
                        501     509     519     521     531     533     545     552     561     570     580     590     598
                        609     621     624     635     638     652     655     671     675     679     688     691     694
                        697     701     710     713     716     720     730     733     736     740     752     766     780
                        794     799     808     812
ICNT    001000          295#    298*    299     815*    816
KM    = 000000          224#    659     745
KPTR  = 000500          205#    300     342     660     669     683     689     692     705     711     724     731
MEDIUM  000041          251#
POP2  = 022626          215#    522     534
PSW   = 177776          210#    304*    313*    321*    346*    370*    374*    388*    402*    416*    430*    444*    458*
                        465*    468*    469*    470     479*    480*    481*    486*    487*    488*    489     495*    496*
                        497*    498     503*    504*    505*    506     512*    515*    516     526*    528*    529     538*
                        540*    541*    542     548*    555*    565*    574*    585*    595*    616*    630*    659*    661*
```

```
                        663*  666*  668*  685*  698*  707*  717*  727*  737*  745*  748*  759*  762*
                        773*  776*
SCOPE = 010701          216#  371   385   399   413   427   441   455   466   477   484   493   502
                        510   523   536   546   553   563   571   582   592   602   611   625   639
                        656   680   702   721   741   755   769   783   802   813
SM    = 040000          225#  661   759
SPTR  = 000600          206#  662   673
START   001010          292   298#  829
SWR   = 177570          214#  301   303
TBITVE= 000014          220#  513*  514*  525*
TEMP    001002          296#  375*  377*  378*  380   383*  389*  391*  392*  394   397*  403*  405*
                        406*  408   411*  417*  419*  420*  422   425*  431*  433*  434*  436   439*
                        445*  447*  448*  450   453*  470*  471   474   489*  490   498*  499   506*
                        507   516*  517   529*  542*  543   550*  557*  558   567*  568   576*  577
                        587*  588   606*  607   614*  615*  617   618*  619   622   628*  629*  631
                        632*  633   636   646*  647*  650*  653   665*  667*  673   677
TPBUF = 177566          213#  819*
TPCSR = 177564          212#  820
TRAPVE= 000034          222#
T0      001050          307#
T0X     001330          366   370#
T1      001776          468#
T1A     002004          469#
T10     002360          538#
T11     002424          548#
T12     002446          555#
T13     002506          565#
T14     002540          574#
T15     002602          585#
T16     002636          595#
T16A    002652          598#  600
T16B    002656          597   600#
T16X    002660          599   601#
T17     002666          605#
T2      002042          479#
T20     002714          614#
T20A    002770          628#
T23     003044          644#
T24     003116          659#
T25     003234          683#
T25A    003262          688#  695
T25B    003264          687   689#
T26     003334          705#
T26A    003360          710#  714
T26B    003362          709   711#
T27     003420          724#
T27A    003452          728   731#
T3      002066          486#
T30     003514          745#  754
T31     003552          759#  768
T32     003610          773#  782
T33     003642          788#
T33A    003652          790#  801
T34     003702          805#
T4      002126          495#
T5      002166          503#
```

```
T6      002226            512#
T6A     002276            513     521#
T6X     002302            518     520     523#
T7      002304            525#
T7A     002344            525     533#
T7X     002350            530     532     535#
UBREAK= 177770            211#    303*    789     805*    806     810
UM    = 140000            226#    663     773
UPTR  = 000700            207#    664     677
XDUMPM  000105            284#    844*    858*
XXDPM   000103            282#    842*    850*
$ENDAD  004004            259     825#
$SVPC = 000400            244#    265
.     = 004136            233#    235     244     246#    250#    254#    258#    261#    265#    269#    290#    294#    297#
                          302     325     328     331     334     337     340     343     348     351     354     357     360
                          363     381     395     409     423     437     451     472     475     482     491     500     508
                          544     551     560     569     579     589     608     620     623     634     637     651     654
                          670     674     678     690     693     696     700     712     715     719     732     735     739
                          751     765     779     793     798     807     811     821

. ABS.  004136     000

 ERRORS DETECTED:  0

 CCKBHB,DSKW:CCKBHB.SEQ/SOL/NL:TOC=CCKBHB.P11
 RUN-TIME: .9 1 .2 SECONDS
 RUN-TIME RATIO: 79/3=25.1
 CORE USED:  6K  (11 PAGES)

 DOCUMENT PAGES:  21
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