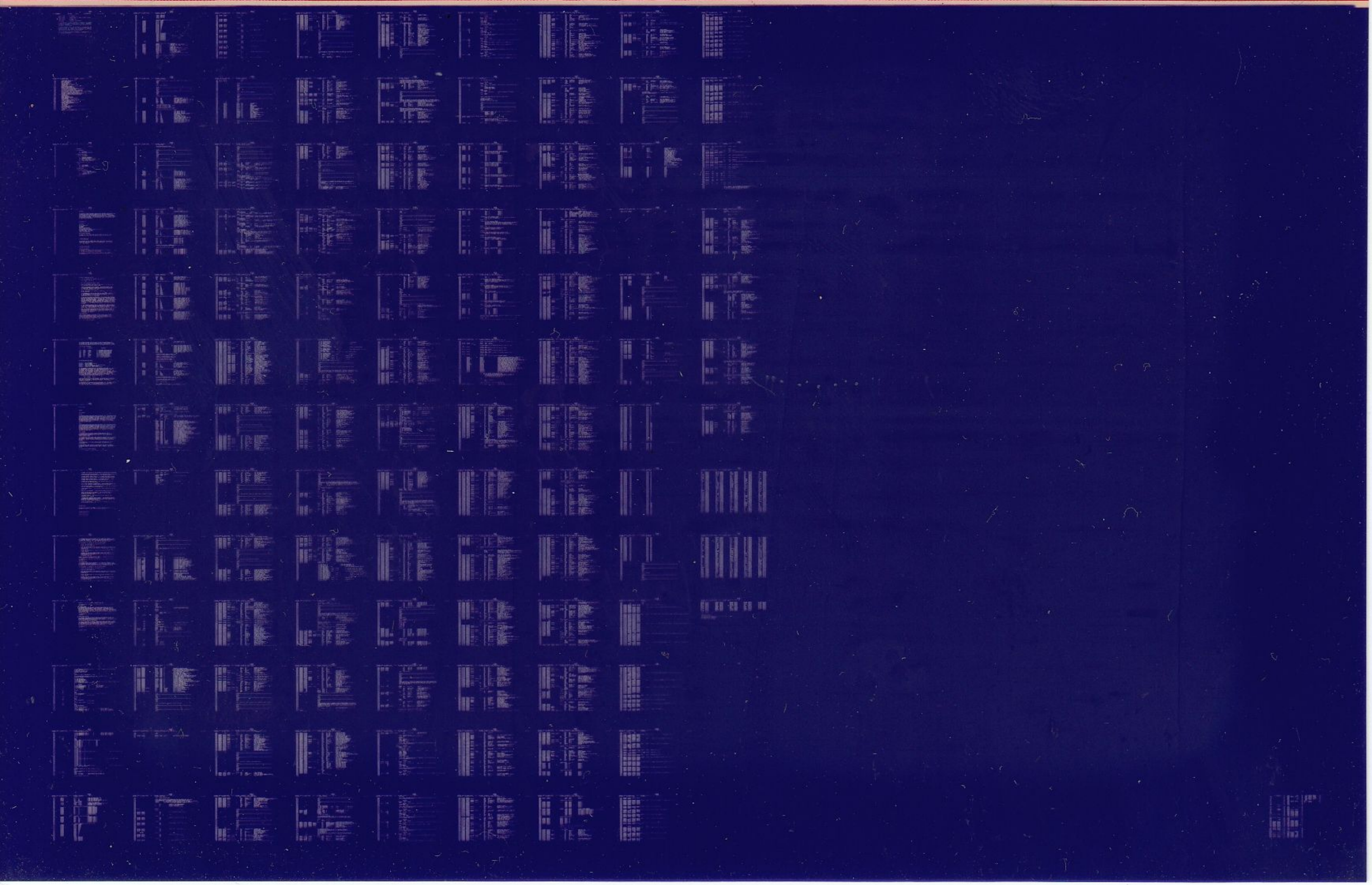
RP04/5/6

HEAD ALIGNMENT
CZRJCB0

AH-9192B-MC

FICHE 1 OF 1

JAN 1978
digital
MADE IN USA



PRODUCT CODE: AC-9190B-MC

PRODUCT NAME: CZRJCB0 RP04/5/6 HEAD ALIGNMENT PROGRAM

PRODUCT DATE: DECEMBER 1977

MAINTAINER: DIAGNOSTIC ENGINEERING

CONTENTS

1. ABSTRACT

THE RP04/5/6 HEAD ALIGNMENT VERIFICATION PROGRAM CHECKS RP04, RP05, OR RP06 DISK DRIVE HEAD ALLIGNMENT OR ALLOWS THE OPERATOR TO ALIGN HEADS WITH THE APPROPRIATE DRIVE'S TEST BOX. THE PROGRAM ALSO CONTAINS A UTILITY ROUTINE WHICH PERFORMS 5,000 RANDOM SEEKS WITHOUT DATA TRANSFERS. THE RANDOM SEEK UTILITY ALLOWS THE OPERATOR TO EXERCISE THE DRIVE WITH THE ALIGNMENT PACK IN PLACE AND THEN RE-VERIFY HEAD ALIGNMENT.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-11 PROCESSOR
8K MEMORY
TELETYPE
PROGRAM LOAD DEVICE
KW11-L OR KW11-P CLOCK
RH11 OR RH70 WITH RP04'S, RP05'S, OR RP06'S
ALIGNMENT PACK ('CE' PACK)
'DDU' OR 'DEDU' FOR RP04'S
'PERCH' FOR RP05/6'S

2.2 PRELIMINARY PROGRAMS

THE RP04/5/6 DISK SUBSYSTEM MUST BE OPERATION AND ALL OTHER PROGRAMS IN THE SET FOR THE SUBSYSTEM MUST RUN SUCESSFULLY.

3. LOADING PROCEDURE

THE PROGRAM MAY BE LOADED FROM PAPER TAPE USING THE ABSOLUTE LOADER OR IT MAY BE LOADED FROM THE APPROPRIATE 'XXDP' MEDIA USING THE ASSOCIATED LOADER. THE PROGRAM MAY NOT BE INCLUDED IN A 'XXDP' CHAIN.

4. STARTING PROCEDURES

4.1 STARTING ADDRESSES

THE PROGRAM IS STARTED FROM LOCATION 200(8) IF THE ADDRESS OF THE RH11 OR RH70 WILL NOT BE CHANGED.

THE PROGRAM IS STARTED FROM LOCATION 204(8) IF THE ADDRESS OF THE RH11 OR RH70 IS TO BE CHANGED FROM THE PRELOADED VALUE. (SEE SECTION 4.4)

4.2 PROGRAM & OPERATION ACTION

1. LOAD THE PROGRAM INTO MEMORY (SEE SECTION 3)

2. LOAD ADDRESS 200 OR 204.

3. SET THE SWITCHES AND PRESS 'START'

4. PLACE AN ALIGNMENT DISK PACK ON THE DRIVE TO BE CHECKED AND SET THE DRIVE IN WRITE PROTECT MODE.

5. CYCLE UP THE DRIVE TO BE CHECKED. ALLOW SUFFICIENT TIME FOR THE ALIGNMENT PACK TO REACH OPERATING TEMPERATURE AND TO STABILIZE. REFER TO APPLICABLE MAINTENANCE PROCEDURES FOR THE REQUIRED AMOUNT OF TIME.

6. SELECT THE DRIVE TO BE CHECKED IN RESPONSE TO THE TYPEOUT ON THE TELETYPE.

7. THE PROGRAM WILL ASK FOR THE MODE OF OPERATION: ENTER AN 'A' IF THE PROGRAM IS TO BE USED FOR HEAD ALIGNMENT; ENTER A 'V' IF HEAD ALIGNMENT IS TO BE CHECKED; OR ENTER AN 'E' IF THE RANDOM SEEK UTILITY IS TO BE RUN.

8. IF AN 'A' IS ENTERED IN RESPONSE TO THE PROGRAM MODE MESSAGE, THE PROGRAM WILL POSITION THE DRIVE TO THE ALIGNMENT CYLINDER: RP04/5 - CYLINDER 245; RP06 - CYLINDER 496. THE PROGRAM WILL THEN ASK FOR A HEAD ADDRESS. THE HEAD ENTERED WILL BE SELECTED AND THE PROGRAM WILL REQUEST ANOTHER HEAD. UNTIL A NEW HEAD ADDRESS IS ENTERED, THE LAST ENTERED HEAD ADDRESS WILL REMAIN SELECTED. THE ALIGNMENT SEQUENCE MAY BE TERMINATED BY TYPING A 'CONTROL C'; THE PROGRAM WILL RETURN TO THE DRIVE SELECTION ROUTINE.

9. IF THE PROGRAM IS BEING RUN IN 'VERIFICATION' MODE AND SW<02> IS SET, THE PROGRAM WILL ASK FOR HEAD AND CYLINDER ADDRESSES. (HEAD AND CYLINDER ADDRESSES ARE ENTERED IN DECIMAL.) WITH SW<02>, ONLY THE ALIGNMENT OF THE SPECIFIED HEAD WILL BE CHECKED.

10. WHEN THE OPERATOR HAS COMPLETED THE PRESENT DRIVE, CYCLE THE DRIVE DOWN, AND TRANSFER THE TEST BOX AND ALIGNMENT PACK TO THE NEXT DRIVE TO BE CHECKED. WHEN THE ALIGNMENT PACK HAS STABILIZED, THE NEW DRIVE CAN BE SELECTED. IT IS NOT NECESSARY TO RESTART THE PROGRAM.

4.3 DRIVE SELECTION

ENTER A DRIVE NUMBER IN RESPONSE TO THE 'ENTER DRIVE NUMBER:' TYPEOUT FROM THE PROGRAM. ONLY VALID DRIVE NUMBERS (0 - 7) WILL BE ACCEPTED BY THE PROGRAM. NOTE THAT THE DRIVE SETUP (TEST BOX CONNECTION AND ALIGNMENT PACK STABILIZATION) MUST HAVE BEEN COMPLETED BEFORE A DRIVE IS SELECTED.

4.4 RH11 - RH70 UNIBUS ADDRESSES

THE PROGRAM ASSUMES THAT THE RH11 OR RH70 ADDRESSES START AT
176700 AND THAT THE VECTOR ADDRESS IS 254. THESE ADDRESSES MAY
BE CHANGED WHEN THE PROGRAM IS STARTED FROM LOCATION 204. ENTER
THE RH11/RH70 ADDRESS IN RESPONSE TO THE REQUEST FROM THE PROGRAM.

4.5 OTHER UNIBUS ADDRESSES

LOC	TAG	CONTENTS	FUNCTION
1144	$TKS	177560	TTY KEYBOARD STATUS REGISTER
1146	$TKB	177562	TTY KEYBOARD BUFFER REGISTER
1150	$TPS	177564	TTY PRINTER STATUS REGISTER
1152	$TPB	177566	TTY PRINTER BUFFER REGISTER
1244	PKV	104	KW11-P CLOCK VECTOR ADDRESS
1246	PKCS	172540	KW11-P CONTROL REGISTER
1250	PKB	172542	KW11-P COUNT SET REGISTER
1252	PKC	172544	KW11-P COUNTER REGISTER
1254	LKV	100	KW11-L CLOCK VECTOR ADDRESS
1256	LKS	177546	KW11-L STATUS REGISTER

5. SWITCH REGISTER SETTINGS

SW<15>=1...HALT ON ERROR
SW<13>=1...INHIBIT ERROR TYPEOUTS
SW<09>=1...LOOP ON ERROR
SW<02>=1...CHECK ALIGNMENT OF THE SPECIFIED HEAD
SW<01>=1...LOOP ON THE CURRENT HEAD
SW<00>=1...TYPEOUT ALL TRACK CENTER VALUES

IF THE PROGRAM IS BEING RUN ON A SWITCHLESS PROCESSOR (I.E. AN 11/34)
THE PROGRAM WILL DETERMINE THAT THE HARDWARE SWITCH REGISTER IS
NOT PRESENT AND WILL USE A 'SOFTWARE' SWITCH REGISTER. THE
'SOFTWARE' SWITCH REGISTER IS LOCATED AT LOCATION 176 (8). THE
SETTINGS OF THE 'SOFTWARE' SWITCHES ARE CONTROLLED THROUGH A KEYBOARD
ROUTINE WHICH IS CALLED BY TYPING A 'CONTROL G'. THE PROGRAM WILL
RECOGNIZE THE 'CONTROL G' AT ANY TIME EXCEPT WHEN THE PROGRAM
IS AT A HIGHER PRIORITY PROCESSING AN RPO4/5/6 INTERRUPT. THE
'SOFTWARE' SWITCH VALUES ARE ENTERED AS AN OCTAL NUMBER IN RESPONSE
TO THE PROMPT FROM THE SWITCH ENTRY ROUTINE:

'SWR = NNNNNN NEW ='

EACH TIME SWITCH SETTING ARE ENTERED, THE ENTIRE SWITCH REGISTER
IMAGE MUST BE ENTERED. LEADING ZEROS ARE NOT REQUIRED. 'RUBOUT' AND
'CONTROL U' FUNCTIONS MAY BE USED TO CORRECT TYPING ERRORS
DURING SWITCH ENTRY.

ON PROCESSORS WITH HARDWARE SWITCH REGISTERS, THE 'SOFTWARE' SWITCH
REGISTER MAY BE USED. IF THE PROGRAM FINDS ALL 16 SWITCHES IN THE
'UP' POSITION, ALL SWITCH REGISTER REFERENCES WILL BE TO THE
'SOFTWARE' REGISTER AND THE PROCEDURES DESCRIBED ABOVE MUST

BE FOLLOWED.

6. ERRORS

6.1 TEST ERRORS

RP04/5:

THE PROGRAM CHECKS THAT EACH HEAD IS WITHIN + OR - 150 MICRO-INCHES FROM THE TRACK CENTERLINE FOR CYLINDER 245 AND IS WITHIN + OR - 350 MICRO-INCHES FOR CYLINDERS 4 AND 400. IF A HEAD IS FOUND THAT IS NOT WITHIN THESE TOLERANCES, AN ERROR MESSAGE IS TYPED. THE ERROR MESSAGE IDENTIFIES THE CYLINDER, HEAD, AND THE ACTUAL POSITION OF THE HEAD RELATIVE TO THE CENTERLINE. (IF SW<00>=1, THE ACTUAL ALIGNMENT OF EACH HEAD WILL BE TYPED OUT; HEADS OUT OF TOLERANCE WILL NOT BE IDENTIFIED.)

RP06:

THE PROGRAM CHECKS THAT EACH HEAD IS WITHIN + OR - 75 MICRO-INCHES FROM THE TRACK CENTERLINE FOR CYLINDER 496 AND IS WITHIN + OR - 175 MICRO-INCHES FOR CYLINDERS 8 AND 800. IF A HEAD IS FOUND THAT IS NOT WITHIN THESE TOLERANCES, AN ERROR MESSAGE IS TYPED. THE ERROR MESSAGE IDENTIFIES THE CYLINDER, HEAD, AND THE ACTUAL POSITION OF THE HEAD RELATIVE TO THE CENTERLINE. (IF SW<00>=1, THE ACTUAL ALIGNMENT OF EACH HEAD WILL BE TYPED OUT; HEADS OUT OF TOLERANCE WILL NOT BE IDENTIFIED.)

6.2 ENTRY ERRORS

THE PROGRAM WILL NOT ACCEPT DRIVE NUMBERS GREATER THAN 7. IF AN INVALID DRIVE NUMBER IS ENTERED IN RESPONSE TO THE DRIVE NUMBER REQUEST, THE PROGRAM WILL TYPE A '?'; THE OPERATOR MAY ENTER A VALID NUMBER.

THE PROGRAM WILL NOT ACCEPT HEAD ADDRESSES GREATER THAN 18 (DECIMAL) OR CYLINDER ADDRESSES OTHER THAN 245(10) FOR RP04/5'S OR 496(10) FOR RP06'S. IF AN INVALID CYLINDER OR HEAD ADDRESS IS ENTERED, THE PROGRAM WILL REJECT THE ENTRY AND RETURN TO THE DRIVE SELECTION ROUTINE.

THE PROGRAM WILL NOT ALLOW A DRIVE TO BE ASSIGNED IF IT IS NOT 'WRITE PROTECTED'. IF THIS IS ATTEMPTED, THE OPERATOR WILL BE NOTIFIED.

DRIVES ASSIGNED ARE CHECKED TO ENSURE THAT THE DRIVE ASSIGNED IS PRESENT, ONLINE, AND IS AN RP04, RP05, OR RP06. THE PROGRAM WILL REJECT ASSIGNMENTS FOR DRIVES WHICH ARE NOT PRESENT OR ARE NOT ONLINE.

6.3 SUBSYSTEM/DEVICE ERROR MESSAGES

1. 'RH11 INTERRUPT OCCURRED (RPAS=0) - AN INTERPUPT

OCCURRED, BUT NOTHING ON THE MASSBUS IS INDICATING AN ATTENTION.

2. 'UNEXPECTED ATTENTION OCCURRED' - THE INDICATED DRIVE INTERRUPTED, BUT NO INTERRUPT WAS EXPECTED FROM THE INDICATED DRIVE.

3. 'MASSBUS PARITY ERROR (MCPE=1)' - A CONTROL BUS PARITY ERROR WAS DETECTED BY THE RH11 WHEN THE INDICATED REGISTER WAS READ.

4. 'MASSBUS PARITY ERROR (PAR=1)' - A CONTROL BUS PARITY ERROR OCCURRED WHEN THE INDICATED REGISTER WAS WRITTEN.

5. 'ADDRESS PLUG CHANGE BIT SET' - THE PROGRAM FOUND THE 'OPE' BIT SET FOR THE INDICATED DRIVE.

6. 'RH11 DIDN'T RESPOND TO ADDRESSING' - THE PROGRAM ACCESSED THE RH11 AT THE INDICATED ADDRESS AND RECEIVED NO RESPONSE.

7. 'DRIVE OR DATA ERROR' - THE INDICATED DRIVE COMPLETED AN OPERATION WITH THE INDICATED ERROR CONDITIONS SET.

8. 'DRIVE UNSAFE ERROR' - THE INDICATED DRIVE SIGNALED AN UNSAFE CONDITION.

9. 'HEAD OUT OF ALIGNMENT' - THE INDICATED HEAD OF NOT WITHIN TOLERANCE.

10. 'HEAD TOO FAR OUT OF ALIGNMENT' - THE INDICATED HEAD IS TOO FAR OUT OF ALIGNMENT FOR THE PROGRAM TO FIND THE TRACK CENTERLINE FOR THAT HEAD.

11. 'SOFTWARE TIMEOUT' - THE INDICATED DID NOT COMPLETE THE OPERATION WITH 1 SECOND.

12. 'UNCORRECTABLE MASSBUS PARITY ERROR' - THE PROGRAM ATTEMPTED TO PERFORM AN OPERATION AND DETECTED 3 SUCESSIVE MASSBUS PARITY ERRORS OR THE PROGRAM ATTEMPTED TO CLEAR A 'PAR' ERROR IN THE DRIVE AND A PARITY ERROR OCCURRED.

13. 'DRIVE IS UNAVAILABLE' - THE INDICATED DRIVE HAS GONE OFFLINE OR HAS BECOME NON-EXISITENT.

7. RESTRICTIONS

BECAUSE AN ALIGNMENT DISK PACK IS USED ON DRIVES TESTED BY THIS PROGRAM, NO DATA TRANSFER OPERATIONS ARE PERFORMED.

8. PROGRAM DESCRIPTION

8.1 VERIFICATION MODE

8.1.1 RP04/5 OPERATIONS

THE PROGRAM CHECKS HEAD ALIGNMENT AT CYLINDER 245, HEADS 0 - 18, AT CYLINDERS 400 AND 4, HEADS 0 AND 18, AND REVERFIES ALIGNMENT AT CYLINDER 245, HEADS 0 - 18. THE OPERATOR WILL BE NOTIFIED IF ANY HEAD IS OUT OF ALIGNMENT BY MORE THAN THE SPECIFIED AMOUNT.

HEAD ALIGNMENT IS CHECKED IN THE FOLLOWING MANNER:

1. OFFSET THE POSITIONER TO +1200 MICRO-INCHES.

2. STORE THE SIGN CHANGE BIT.

3. MOVE THE POSITIONER IN THE OPPOSITE DIRECTION IN 25 MICRO-INCH INCREMENTS UNTIL THE SIGN CHANGE BIT CHANGES VALUE. STORE THE OFFSET VALUE.

4. OFFSET THE POSITIONER TO -1200 MICRO-INCHES AND REPEAT STEPS 2 AND 3 ABOVE.

5. AVERAGE THE TWO SIGN CHANGE OFFSET VALUES AND REPORT IF THE SELECTED HEAD IS MISALIGNED BY MORE THAN + OR - 150 MICRO-INCHES FOR CYLINDER 245 OR + OR - 350 MICRO-INCHES FOR CYLINDERS 4 AND 400.

REPEAT THE ABOVE SEQUENCE FOR ALL HEADS AT CYLINDER 245 AND FOR HEADS 0 AND 18 AT CYLINDERS 4 AND 400.

THE OPERATOR MAY TERMINATE THE OPERATION AT ANY TIME BY TYPING A 'CONTROL C'.

8.1.2 RP06 OPERATIONS

THE PROGRAM CHECKS HEAD ALIGNMENT AT CYLINDER 496, HEADS 0 - 18, AT CYLINDERS 800 AND 8, HEADS 0, 1, 10, 17, AND 18, AND RE-VERFIES ALIGNMENT AT CYLINDER 496, HEADS 0 - 18. THE OPERATOR WILL BE NOTIFIED IF A HEAD IS OUT OF ALIGNMENT BY MORE THAN THE SPECIFIED AMOUNT.

HEAD ALIGNMENT IS CHECKED IN THE FOLLOWING MANNER:

1. OFFSET THE POSITIONER TO +600 MICRO-INCHES.

2. STORE THE SIGN CHANGE BIT.

3. MOVE THE POSITIONER IN THE OPPOSITE DIRECTION IN 25 MICRO-INCH INCREMENTS UNTIL THE SIGN CHANGE BIT CHANGES VALUE. STORE THE OFFSET VALUE.

4. OFFSET THE POSITIONER TO -600 MICRO-INCHES AND REPEAT STEPS 2 AND 3 ABOVE.

5. AVERAGE THE TWO SIGN CHANGE OFFSET VALUES AND REPORT IF THE SELECTED HEAD IS MISALIGNED BY MORE THAN + OR - 75 MICRO-INCHES FOR CYLINDER 496 OR + OR - 175 MICRO-INCHES FOR CYLINDERS 8 AND 800.

REPEAT THE ABOVE SEQUENCE FOR ALL HEADS AT CYLINDER 496 AND FOR

HEADS 0, 1, 10, 17, 18 AT CYLINDERS 8 AND 800.

THE OPERATOR MAY TERMINATE THE OPERATION AT ANY TIME BY TYPING A 'CONTROL C'.

8.2 ALIGNMENT MODE

THE PROGRAM MAY ALSO BE USED TO PROVIDE HEAD SELECTION FOR DDU CONTROLLED HEAD ALIGNMENT. WHEN THIS MODE IS SELECTED, THE PROGRAM WILL PERFORM NO ALIGNMENT CHECKING - ONLY THE REQUESTED HEAD IS SELECTED IN THE DCL. THE ACTUAL ALIGNMENT MUST BE PERFORMED USING THE ALIGNMENT METER ON THE DDU, DEDU, OR PERCH. WHEN USED IN THE ALIGNMENT MODE, THE PROGRAM PROVIDES HEAD SELECTION WHICH IS NOT PRESENT IN THE DDU.

THE OPERATOR MAY TERMINATE THE OPERATION AT AY TIME BY TYPING A 'CONTROL C'.

8.3 RANDOM SEEK UTILITY

THE PROGRAM CONTAINS A UTILITY ROUTINE WHICH PERFORMS 5,000 (10) RANDOM SEEK OPERATIONS ON THE DRIVE BEING CHECKED. THIS UTILITY ALLOWS THE OPERATOR TO EXERCISE THE HEAD ASSEMBLY ON THE DRIVE AFTER HEAD ALIGNMENT HAS BEEN PERFORMED.

THE UTILITY ROUTINE IS NORMALLY USED AFTER HEADS HAVE BEEN ALIGNED: THE RANDOM SEEK UTILITY IS CALLED AND HEAD ALIGNMENT IS RE-VERIFIED AT THE COMPLETION OF THE RANDOM SEEKS. USE OF THIS ROUTINE DOES NOT REQUIRE CYCLING DOWN THE DRIVE AND REPLACING THE ALIGNMENT PACK WITH A SCRATCH PACK FOR THE HEAD SHAKE DOWN.

THE OPERATOR MAY TERMINATE THE OPERATION AT ANY TIME BY TYPING A 'CONTROL C'.

9. PROGRAM LISTING

```
                        
                        .IIF NB <CZRJCB0, RP04/5/6 HEAD ALNMT >,.TITLE  CZRJCB0, RP04/5/6 HEAD ALNMT
001                     .IF NB <1976,1977>
                        ;*COPYRIGHT (C) 1976,1977
                        ;*DIGITAL EQUIPMENT CORP.
                        ;*MAYNARD, MASS. 01754
                        ;*
000                     .ENDC
                        .IIF NB <C. HESS>,;*PROGRAM BY C. HESS
                        ;*
                        ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                        ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
                        ;*
                        .IIF NDF $HD,$HD=0
                        .IIF NDF $TN,$HD=$HD!1
                        .IIF NDF $SWR,$HD=$HD!2
000001                  .IIF NE $HD&1,$TN=1
                        .IIF NE $HD&2,$SWR=160000       ;;HALT ON ERROR, LOOP ON TEST, INHIBIT ERROR TYPOUT
                        .SBTTL  OPERATIONAL SWITCH SETTINGS
                        ;*
                        ;*      SWITCH                  USE
                        ;*      ------                  ---------------------
                        .IIF NE 100000&$SWR,;*    15              HALT ON ERROR
                        .IIF NE 040000&$SWR,;*    14              LOOP ON TEST
                        .IIF NE 020000&$SWR,;*    13              INHIBIT ERROR TYPEOUTS
001                     .IF NE 010000&$SWR
                        ;*        12              INHIBIT TRACE TRAP
                        .IFF
002                     .IF NB <>
                        ;*        12
001                     .ENDC
000                     .ENDC
                        .IIF NE 004000&$SWR,;*    11              INHIBIT ITERATIONS
001                     .IF NE 002000&$SWR
                        ;*        10              BELL ON ERROR
                        .IFF
002                     .IF NB <>
                        ;*        10
001                     .ENDC
000                     .ENDC
001                     .IF NE 001000&$SWR
                        ;*        9               LOOP ON ERROR
                        .IFF
002                     .IF NB <LOOP ON ERROR>
                        ;*        9               LOOP ON ERROR
001                     .ENDC
000                     .ENDC
001                     .IF NE 000400&$SWR
                        .NLIST
                        .IIF NDF $SWRMK,$SWRMK=0
                        .LIST
                        .IIF EQ <$SWRMK&377>,;*    8            LOOP ON TEST IN SWR<7:0>
                        .IIF EQ <$SWRMK&377>-200,;*        8            LOOP ON TEST IN SWR<6:0>
                        .IIF EQ <$SWRMK&377>-300,;*        8            LOOP ON TEST IN SWR<5:0>
                        .IIF EQ <$SWRMK&377>-340,;*        8            LOOP ON TEST IN SWR<4:0>
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                        .IIF EQ <$SWRMK&377>-360,;*        8            LOOP ON TEST IN SWR<3:0>
                        .IIF EQ <$SWRMK&377>-370,;*        8            LOOP ON TEST IN SWR<2:0>
                        .IIF EQ <$SWRMK&377>-374,;*        8            LOOP ON TEST IN SWR<1:0>
                        .IIF EQ <$SWRMK&377>-376,;*        8            LOOP ON TEST IN SWR<0>
                        .IFF
     002                .IF NB <>
                        ;*        8
                        .ENDC
     001                .ENDC
     000                .MACRO  .SWRLO  S07,S06,S05,S04,S03,S02,S01,S00
                        .IIF NB <S07>,;*            7               S07
                        .IIF NB <S06>,;*            6               S06
                        .IIF NB <S05>,;*            5               S05
                        .IIF NB <S04>,;*            4               S04
                        .IIF NB <S03>,;*            3               S03
                        .IIF NB <S02>,;*            2               S02
                        .IIF NB <S01>,;*            1               S01
                        .IIF NB <S00>,;*            0               S00
                        .ENDM   .SWRLO
                        .IIF NB <>,;*       7
                        .IIF NB <>,;*       6
                        .IIF NB <>,;*       5
                        .IIF NB <>,;*       4
                        .IIF NB <>,;*       3
                        .IIF NB <CHECK ONLY THE SPECIFIED HEAD>,;*        2            CHECK ONLY THE SPECIFIED
                        .IIF NB <>,;*       1
                        .IIF NB <>,;*       0
                        .IIF NB <>,;*       7
                        .IIF NB <>,;*       6
                        .IIF NB <>,;*       5
                        .IIF NB <>,;*       4
                        .IIF NB <>,;*       3
                        .IIF NB <>,;*       2
                        .IIF NB <LOOP ON THE CURRENT HEAD>,;*       1            LOOP ON THE CURRENT HEAD
                        .IIF NB <>,;*       0
                        .IIF NB <>,;*       7
                        .IIF NB <>,;*       6
                        .IIF NB <>,;*       5
                        .IIF NB <>,;*       4
                        .IIF NB <>,;*       3
                        .IIF NB <>,;*       2
                        .IIF NB <>,;*       1
                        .IIF NB <TYPE ALL TRACK CENTER VALUES>.;*          0            TYPE ALL TRACK CENTER VA
                        .SBTTL  BASIC DEFINITIONS

     001                .IF NB
                        ;*INITIAL ADDRESS OF THE STACK POINTER *** . ***
                        STACK=
                        .IFF
                        ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
001100                  STACK=  1100
     000                .ENDC
                        .EQUIV  EMT,ERROR       ;;BASIC DEFINITION OF ERROR CALL
                        .EQUIV  IOT,SCOPE       ;;BASIC DEFINITION OF SCOPE CALL

                        ;*MISCELLANEOUS DEFINITIONS
```

```
                        ;
000011                  HT=     11              ;;CODE FOR HORIZONTAL TAB
000012                  LF=     12              ;;CODE FOR LINE FEED
000015                  CR=     15              ;;CODE FOR CARRIAGE RETURN
000200                  CRLF=   200             ;;CODE FOR CARRIAGE RETURN-LINE FEED
177776                  PS=     177776          ;;PROCESSOR STATUS WORD
                        .EQUIV  PS,PSW
177774                  STKLMT= 177774          ;;STACK LIMIT REGISTER
177772                  PIRQ=   177772          ;;PROGRAM INTERRUPT REQUEST REGISTER
177570                  DSWR=   177570          ;;HARDWARE SWITCH REGISTER
177570                  DDISP=  177570          ;;HARDWARE DISPLAY REGISTER
                        ;
                        ;*GENERAL PURPOSE REGISTER DEFINITIONS
000000                  R0=     %0              ;;GENERAL REGISTER
000001                  R1=     %1              ;;GENERAL REGISTER
000002                  R2=     %2              ;;GENERAL REGISTER
000003                  R3=     %3              ;;GENERAL REGISTER
000004                  R4=     %4              ;;GENERAL REGISTER
000005                  R5=     %5              ;;GENERAL REGISTER
000006                  R6=     %6              ;;GENERAL REGISTER
000007                  R7=     %7              ;;GENERAL REGISTER
000006                  SP=     %6              ;;STACK POINTER
000007                  PC=     %7              ;;PROGRAM COUNTER
                        ;
                        ;*PRIORITY LEVEL DEFINITIONS
000000                  PR0=    0               ;;PRIORITY LEVEL 0
000040                  PR1=    40              ;;PRIORITY LEVEL 1
000100                  PR2=    100             ;;PRIORITY LEVEL 2
000140                  PR3=    140             ;;PRIORITY LEVEL 3
000200                  PR4=    200             ;;PRIORITY LEVEL 4
000240                  PR5=    240             ;;PRIORITY LEVEL 5
000300                  PR6=    300             ;;PRIORITY LEVEL 6
000340                  PR7=    340             ;;PRIORITY LEVEL 7
                        ;
                        ;*"SWITCH REGISTER" SWITCH DEFINITIONS
100000                  SW15=   100000
040000                  SW14=   40000
020000                  SW13=   20000
010000                  SW12=   10000
004000                  SW11=   4000
002000                  SW10=   2000
001000                  SW09=   1000
000400                  SW08=   400
000200                  SW07=   200
000100                  SW06=   100
000040                  SW05=   40
000020                  SW04=   20
000010                  SW03=   10
000004                  SW02=   4
000002                  SW01=   2
000001                  SW00=   1
                        .EQUIV  SW09,SW9
                        .EQUIV  SW08,SW8
                        .EQUIV  SW07,SW7
                        .EQUIV  SW06,SW6
                        .EQUIV  SW05,SW5
                        .EQUIV  SW04,SW4
```

```
                        .EQUIV  SW03,SW3
                        .EQUIV  SW02,SW2
                        .EQUIV  SW01,SW1
                        .EQUIV  SW00,SW0
      001               .IF B <>

                        ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
  100000                BIT15=  100000
  040000                BIT14=  40000
  020000                BIT13=  20000
  010000                BIT12=  10000
  004000                BIT11=  4000
  002000                BIT10=  2000
  001000                BIT09=  1000
  000400                BIT08=  400
  000200                BIT07=  200
  000100                BIT06=  100
  000040                BIT05=  40
  000020                BIT04=  20
  000010                BIT03=  10
  000004                BIT02=  4
  000002                BIT01=  2
  000001                BIT00=  1
                        .EQUIV  BIT09,BIT9
                        .EQUIV  BIT08,BIT8
                        .EQUIV  BIT07,BIT7
                        .EQUIV  BIT06,BIT6
                        .EQUIV  BIT05,BIT5
                        .EQUIV  BIT04,BIT4
                        .EQUIV  BIT03,BIT3
                        .EQUIV  BIT02,BIT2
                        .EQUIV  BIT01,BIT1
                        .EQUIV  BIT00,BIT0
      000               .ENDC
      001               .IF B <>

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

```
                        ;;**********  **********
                        .NLIST
                        .ENDR
                        .LIST
000                     .ENDC

                        .SBTTL  RH11 REGISTERS

001                     .IF B
                        ;;*********  **********
                        .IFF
                        .NLIST
                        .REPT
                        .LIST
                        ;;**********
                        .NLIST
                        .ENDR
                        .LIST
000                     .ENDC

                        ;CONTROL AND STATUS REGISTER 1 (RPCS1)

000100          IE=     100             ;INTERRUPT ENABLE (BIT #6)
000200          RDY=    200             ;READY (BIT #7)
000400          A16=    400             ;HIGH ORDER BUS ADDRESS BIT (BIT #8)
001000          A17=    1000            ;HIGH ORDER BUS ADDRESS BIT (BIT #9)
002000          PSEL=   2000            ;PORT SELECT (BIT #10)
020000          MCPE=   20000           ;MASSBUSS PARITY ERROR (BIT #13)
040000          TRE=    40000           ;TRANSFER ERROR (BIT #14)
                ;SC=    100000          ;SPECIAL CONDITION (BIT #15)

                ;WORD COUNT REGISTER (RPWC)
                ;(EACH BIT IS CALLED BY BIT NUMBER)

                ;BUS ADDRESS REGISTER (RPBA)
                ;(EACH BIT IS CALLED BY BIT NUMBER)

                ;CONTROL AND STATUS REGISTER 2 (RPCS2)

000001          US1=    1               ;UNIT SELECT (BIT #0)
000002          US2=    2               ;UNIT SELECT (BIT #1)
000004          US4=    4               ;UNIT SELECT (BIT #2)
000010          BAI=    10              ;BUS ADDRESS INCREMENT INHIBIT (BIT #3
000020          PAT=    20              ;MASSBUS PARITY TEST (BIT #4)
000040          CLR=    40              ;CLEAR (BIT #5)
000100          IR=     100             ;INPUT READY (BIT #6)
000200          OR=     200             ;OUTPUT READY (BIT #7)
000400          MPE=    400             ;MASS BUS PARITY ERROR (BIT #8)
001000          MXF=    1000            ;MISSED TRANSFER ERROR (BIT #9)
002000          PGE=    2000            ;PROGRAM ERROR (BIT #10)
004000          NEM=    4000            ;NON EXISTENT MEMORY (BIT #11)
010000          NED=    10000           ;NON EXISTENT DRIVE (BIT #12)
020000          UPE=    20000           ;UNIBUS PARITY ERROR (BIT #13)
040000          WCE=    40000           ;WRITE CHECK ERROR (BIT #14)
100000          DLT=    100000          ;DATA LATE (BIT #15)
```

```
                        ;DATA BUFFER REGISTER (RPDB)
                        ;(EACH BIT IS CALLED BY BIT NUMBER)


        001             .IF B
                        ;;*****************************************************************
                        .IFF
                        .NLIST
                        .REPT
                        .LIST
                        ;;*****************************************************************
                        .NLIST
                        .ENDR
                        .LIST
        000             .ENDC

                        .SBTTL  RP04/5/6 REGISTERS

        001             .IF B
                        ;;*****************************************************************
                        .IFF
                        .NLIST
                        .REPT
                        .LIST
                        ;;*****************************************************************
                        .NLIST
                        .ENDR
                        .LIST
        000             .ENDC

                        ;CONTROL AND STATUS 1 REGISTER. (#00)

        000001  GO=     1               ;GO BIT (BIT #0)
        000002  F1=     2               ;FUNCTION CODE BIT #1
        000004  F2=     4               ;FUNCTION CODE BIT #2
        000010  F3=     10              ;FUNCTION CODE BIT #3
        000020  F4=     20              ;FUNCTION CODE BIT #4
        000040  F5=     40              ;FUNCTION CODE BIT #5
        004000  DVA=    4000            ;DEVICE AVAILABLE (BIT #11)

                        ;DRIVE STATUS REGISTER (RPDS1) (#01)

                        ;DFS=   1       DRIVE FORWARD 5"/SEC.  (BIT #0)
        000002  DFF20=  2               ;DRIVE FORWARD 20"/SEC.  (BIT #1)
        000004  DIGB=   4               ;DRIVE TO INNER GUARD BAND (BIT #2)
        000010  GRV=    10              ;GO REVERSE (BIT #3)
        000020  DL64=   20              ;DIFFERENCE LESS THAN 64 (BIT #4)
        000040  DE1=    40              ;DIFFERENCE EQUALS 1 (BIT #5)
        000100  VV=     100             ;VOLUME VALID (BIT #6)
        000200  DRY=    200             ;DRIVE READY (BIT #7)
        000400  DPR=    400             ;DRIVE PRESENT (BIT #8)
        001000  PGM=    1000            ;PROGRAMABLE (BIT #9)
        002000  LST=    2000            ;LAST SECTOR TRANSFERRED (BIT #10)
        004000  WRL=    4000            ;WRITE LOCK (BIT #11)
        010000  MOL=    10000           ;MEDIUM ON-LINE (BIT #12)
        020000  PIP=    20000           ;POSITIONING OPERATION IN PROGRESS (BIT #13)
```

```
                        ERR=    40000           ;COMPOSITE ERROR (BIT #14)
                        ATA=    100000          ;ATTENTION ACTIVE (BIT #15)

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

000001                  ILF=    1               ;ILLEGAL FUNCTION (BIT #0)
000002                  ILR=    2               ;ILLEGAL REGISTER (BIT #1)
000004                  RMR=    4               ;REGISTER MODIFICATION REFUSED (BIT #2)
000010                  PAR=    10              ;PARITY ERROR (BIT #3)
000020                  FER=    20              ;FORMAT ERROR (BIT #4)
000040                  WCF=    40              ;WRITE CLOCK FAIL (BIT #5)
000100                  ECH=    100             ;ECC HARD ERROR (BIT #6)
000200                  HCE=    200             ;HEADER COMPARE ERROR (BIT #7)
000400                  HCRC=   400             ;HEADER CRC ERROR (BIT #8)
001000                  AOE=    1000            ;ADDRESS OVERFLOW ERROR (BIT #9)
002000                  IAE=    2000            ;INVALID ADDRESS ERROR (BIT #10)
004000                  WLE=    4000            ;WRITE LOCK ERROR (BIT #11)
010000                  DTE=    10000           ;DRIVE TIMING ERROR (BIT #12)
020000                  OPI=    20000           ;OPERATION INCOMPLETE (BIT #13)
040000                  UNS=    40000           ;DRIVE UNSAFE (BIT #14)
100000                  DCK=    100000          ;DATA CHECK ERROR (BIT 15)

                        ;MAINTAINABILITY REGISTER (RPMR)(#03)

000001                  DMD=    1               ;DIAGINOSTIC MODE (BIT #0)
000002                  MCLK=   2               ;MAINTAINABILITY CLOCK (BIT #1)
000004                  MINX=   4               ;MAINTAINABILITY INDEX (BIT #2)
000010                  MSTCK=  10              ;MAINTAINABILITY SECTOR CLOCK (BIT #3)
000020                  MRD=    20              ;MAINTAINABILITY READ (BIT #4)
000040                  MWR=    40              ;MAINTAINABILITY WRITE (BIT #5)
000200                  DTSY=   200             ;MAINTAINABILITY SYNC DETECTED (BIT #7)

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

000001                  AT0=    1               ;DEVICE 0 (BIT #0)
000002                  AT1=    2               ;DEVICE 1 (BIT #1)
000004                  AT2=    4               ;DEVICE 2 (BIT #2)
000010                  AT3=    10              ;DEVICE 3 (BIT #3)
000020                  AT4=    20              ;DEVICE 4 (BIT #4)
000040                  AT5=    40              ;DEVICE 5 (BIT #5)
000100                  AT6=    100             ;DEVICE 6 (BIT #6)
000200                  AT7=    200             ;DEVICE 7 (BIT #7)

                        ;DESIRED SECTOR/TRACK ADDRESS REGISTER (RPDA) (#05)
                        ;(EACH BIT IS CALLED BY BIT NUMBER)

                        ;DRIVE TYPE REGISTER (RPDT) (#06)

000001                  DT00=   1               ;DRIVE TYPE NUMBER BIT 1
000002                  DT01=   2               ;DRIVE TYPE NUMBER BIT 2
000004                  DT02=   4               ;DRIVE TYPE NUMBER BIT 3
000010                  DT03=   10              ;DRIVE TYPE NUMBER BIT 4
000020                  DT04=   20              ;DRIVE TYPE NUMBER BIT 5
000040                  DT05=   40              ;DRIVE TYPE NUMBER BIT 6
000100                  DT06=   100             ;DRIVE TYPE NUMBER BIT 7
000200                  DT07=   200             ;DRIVE TYPE NUMBER BIT 8
```

```
                        DT08=   400             ;DRIVE TYPE NUMBER BIT 9
                        DRQ=    4000            ;DRIVE REQUEST REQUIRED (BIT #11)
                        MOH=    20000           ;MOVING HEAD (BIT #13)
                        TAP=    40000           ;TAPE DRIVE (BIT #14)
                        NBA=    100000          ;NOT BLOCK ADDRESSED (BIT #15)

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

                        EXT1=   1               ;EXTENSION 1 (BIT #0)
                        EXT2=   2               ;EXTENSION 2 (BIT #1)
                        EXT4=   4               ;EXTENSION 3 (BIT #2)
                        EXT10=  10              ;EXTENSION 4 (BIT #3)
                        EXT20=  20              ;EXTENSION 5 (BIT #4)
                        EXT40=  40              ;EXTENSION 6 (BIT #5)
                        SC1=    100             ;SECTOR COUNT FIELD 0 (BIT #6)
                        SC2=    200             ;SECTOR COUNT FIELD 1 (BIT #7)
                        SC4=    400             ;SECTOR COUNT FIELD 2 (BIT #8)
                        SC10=   1000            ;SECTOR COUNT FIELD 3 (BIT #9
                        SC20=   2000            ;SECTOR COUNT FIELD 4 (BIT #10)
                        TRK1=   4000            ;TRACK FIELD 1 (BIT #11)
                        TRK2=   10000           ;TRACK FIELD 2 (BIT #12)
                        TRK4=   20000           ;TRACK FIELD 3 (BIT #13)
                        TRK10=  40000           ;TRACK FIELD 4 (BIT #14)
                        TRK20=  100000          ;TRACK FIELD 5 (BIT #15)

                        ;RP04 ERROR REGISTER #2 (RPER2) (#10)

                        WCU=    1               ;WRITE CURRENT UNSAFE (BIT #0)
                        CSF=    2               ;CURRENT SINK FAILURE (BIT #1)
                        WSU=    4               ;WRITE SELECT UNSAFE (BIT #2)
                        CSU=    10              ;CURRENT SWITCH UNSAFE (BIT #3)
                        MSE=    20              ;MOTOR SEQUENCE ERROR (BIT #4)
                        TDF=    40              ;TRANSITIONS DETECTOR FAILURE (BIT #5)
                        TUF=    100             ;TRANSITIONS UNSAFE (BIT #6)
                        FEN=    200             ;FAILSAFE ENABLED (BIT #7)
                        WRU=    400             ;WRITE READY UNSAFE (BIT #8)
                        MHS=    1000            ;MULTIPLE HEAD SELECT (BIT #9)
                        NHS=    2000            ;NO HEAD SELECTION (BIT #10)
                        IXE=    4000            ;INDEX ERROR (BIT #11)
                        VU30=   10000           ;30VOLT UNSAFE (BIT #12)
                        PLU=    20000           ;PLO UNSAFE (BIT #13)
                        ACU=    100000          ;AC UNSAFE (BIT #15)

                        ;RP05/6 ERROR REGISTER #02 (RPER2) (#10)

                        WCU=    1               ;WRITE CURRENT UNSAFE (BIT #0)
                        CSF=    2               ;CURRENT SINK FAILURE (BIT #1)
                        WSU=    4               ;WRITE SELECT UNSAFE (BIT #2)
                        CSU=    10              ;CURRENT SWITCH UNSAFE (BIT #3)
                        RAW=    20              ;READ AND WRITE (BIT #4)
                        TDF=    40              ;TRANSITIONS DETECTOR FAILURE (BIT #5
                        TUF=    100             ;TRANSITIONS UNSAFE (BIT #6)
                        ABS=    200             ;ABNORMAL STOP (BIT #7)
                        WRU=    400             ;WRITE READY UNSAFE (BIT #8)
                        MHS=    1000            ;MUTLTIPLE HEAD SELECT (BIT #9)
                        NHS=    2000            ;NO HEAD SELECTION (BIT #10)
```

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                        004000          IXE=    4000                    ;INDEX ERROR (BIT #11)
                        020000          PLU=    20000                   ;PLO UNSAFE (BIT #12)

                                        ;OFFSET REGISTER (RPOF) (#11)

                        000001          OF25=   1                       ;OFFSET 25 MICRO INCHES (BIT #0)
                        000002          OF50=   2                       ;OFFSET 50 MICRO INCHES (BIT #1)
                        000004          OF100=  4                       ;OFFSET 100 MICRO INCHES (BIT #2)
                        000010          OF200=  10                      ;OFFSET 200 MICRO INCHES (BIT #3)
                        000020          OF400=  20                      ;OFFSET 400 MICRO INCHES (BIT #4)
                        000040          OF800=  40                      ;OFFSET 800 MICRO INCHES (BIT #5)
                        000200          OFREV=  200                     ;OFFSET NEGATIVE (REVERSE) (BIT #5)
                        002000          HCI=    2000                    ;HEADER COMPARE INHIBIT (BIT #10)
                        004000          ECI=    4000                    ;ERROR CORRECTION CODE INHIBIT (BIT #11)
                        010000          FMT22=  10000                   ;FORMAT BIT (BIT #12

                                        ;DESIRED CYLINDER ADDRESS (RPCA) (#12)
                                        ;(EACH BIT IS CALLED BY BIT NUMBER)

                                        ;CURRENT CYLINDER ADDRESS (RPCC) (#13)
                                        ;(EACH BIT IS CALLED BY BIT NUMBER)

                                        ;SERIAL NUMBER REGISTER (RPSN) (#14)
                                        ;(EACH IS CALLED BY BIT NUMBER)

                                        ;RP04 ERROR REGISTER #03 (RPER3) (#15)

                        000001          PSU=    1                       ;PACK SPEED UNSAFE (BIT #0)
                        000002          VUF=    2                       ;VELOCITY UNSAFE (BIT #1)
                        000010          UWR=    10                      ;ANY UNSAFE EXCEPT READ/WRITE (BIT #3)
                        000040          ACL=    40                      ;AC LOW (BIT #5)
                        000100          DCL=    100                     ;DC LOW (BIT #6)
                        040000          SKI=    40000                   ;SEEK INCOMPLETE (BIT #14)
                        100000          OCYL=   100000                  ;OFF CYLINDER (BIT #15)

                                        ;RP05/6 ERROR REGISTER #03 (RPER3) (#15)

                        000001          DCU=    1                       ;DC UNSAFE (BIT #0)
                        000002          WAO=    2                       ;WRITE AND OFFSET (BIT #1)
                        000040          ACL=    40                      ;AC LOW (BIT #5)
                        000100          DCL=    100                     ;DC LOW (BIT #6)
                        020000          OPE=    20000                   ;OPERATOR PLUG ERROR (BIT #13)
                        040000          SKI=    40000                   ;SEEK INCOMPLETE (BIT #14)
                        100000          OCYL=   100000                  ;OFF CYLINDER ERROR (BIT #15)

                                        ;ECC POSITION REGISTER (RPEC1) (#16)
                                        ;(EACH BIT IS CALLED BY BIT NUMBER)

                                        ;ECC PATTERN REGISTER (RPEC2) (#17)
                                        ;(EACH BIT IS CALLED BY BIT NUMBER)

                                        .SBTTL  TRAP CATCHER

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

```
                                ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
000174                                  .=174
000174  000000                 DISPREG: .WORD  0                ;;SOFTWARE DISPLAY REGISTER
000176  000000                 SWREG:   .WORD  0                ;;SOFTWARE SWITCH REGISTER
    001                         .IF NB  <>
                                .SBTTL  STARTING ADDRESS(ES)
                                        JMP     @#      ;;JUMP TO STARTING ADDRESS OF PROGRAM
    000                         .ENDC

                                .SBTTL  PROGRAM STARTING ADDRESS = 200
000200                                  .=200
000200  000137  001460                  JMP     START1          ;START THE PROGRAM, USE THE DEFAULT RH11 ADDRESS
000204  000137  001450                  JMP     START           ;START THE PROGRAM, CHANGE THE RH11 ADDRESS

                                        .MACRO  MORETAGS
                                CR      =       15
                                LF      =       12
                                DRVSEL: .WORD   0               ;ADDRESS OF SELECTED DRIVE
                                DRIVE:  .WORD   0               ;DRIVE NUM STORAGE FOR DRIVER ERR CALLS
                                ATTN:   .WORD   0               ;ATTENTION REGISTER STORAGE FOR ERROR MESSAGES
                                $HEAD:  .WORD   0               ;HEAD ADDRESS STORED FOR ERROR MESSAGES
                                TOPLN:  .WORD   0               ;'TYPE THE HEADER' INDICATOR
                                OFFDIR: .WORD   0               ;NEG OFFSET PASS IND
                                BITIND: .WORD   0               ;SIGN CHANGE BIT STORED INDICATOR
                                SINCNG: .WORD   0               ;SIGN CHANGE BIT STORAGE
                                PLUS:   .WORD   0               ;STORE THE POS SIGN CHANGE CODE
                                INREG:  .WORD   0               ;CONTAINS THE VALUE READ FROM THE REGISTER
                                TOLER:  .WORD   0               ;ALIGNMENT TOLERANCE FOR PRESENT CYLINDER
                                MAXCYL: .WORD   0               ;CONTAINS THE MAXIMUM CYLINDER ADDRESS
                                                                ;OF DRIVE UNDER TEST
                                MAXPOS: .WORD   0               ;CONTAINS MAXIMUM POSITIVE OFFSET
                                MAXNEG: .WORD   0               ;CONTAINS MAXIMUM NEGATIVE OFFSET
                                MAXOFF: .WORD   0               ;CONTAINS NUMBER OF OFFSET POSITIONS
                                OUTTOL: .WORD   0               ;CONTAINS TOLERANCE FOR INNER AND OUTER CYLINDERS
                                MIDTOL: .WORD   0               ;CONTAINS TOLERANCE FOR THE ALIGNMENT CYLINDER
                                INCYL:  .WORD   0               ;INNER CYLINDER ADDRESS
                                MIDCYL: .WORD   0               ;ALIGNMENT CYLINDER ADDRESS
                                OUTCYL: .WORD   0               ;OUTER CYLINDER ADDRESS
                                TABLE1: .WORD   0               ;CONTAINS HEAD TABLE ADDRESS FOR 'INCYL' & 'OUTCYL'
                                TABLE2: .WORD   0               ;CONTAINS ADDRESS OF OFFSET CODE TABLE
                                SEKCNT: .WORD   0               ;CONTAINS SEEK COUNT
                                CHGADR: .WORD   0               ;CHANGE RH11 BUS ADDRESS FLAG
                                PKV:    .WORD   104,106         ;KW11-P VECTOR ADDRESS
                                PKCS:   .WORD   172540          ;KW11-P CONTROL AND STATUS REG.
                                PKB:    .WORD   172542          ;KW11-P COUNT SET BUFFER
                                PKC:    .WORD   172544          ;KW11-P COUNTER
                                LKV:    .WORD   100,102         ;KW11-L VECTOR ADDRESS
                                LKS:    .WORD   177546          ;KW11-L STATUS REGISTER

                                STARS

                                .SBTTL  RH11/RP04/5/6 ADDRESS & VECTOR LOCATIONS

                                STARS

                                $RPADR: .WORD   176700          ;RH11/RP04/5 6 UNIBUS ADDRESS
```

```
1024                                    $RPVEC: .WORD   254             ;PH11/RP04/5/6 VECTOR ADDRESS
1025
1026                                            .ENDM   MORETAGS
1027                                    .MACRO  $$CMREG A,B
1028                                    $REG'A: .WORD   0               ;;CONTAINS (($REGAD)+'B)
1029                                    .NLIST
1030                                    $CM1=$CM1+1
1031                                    $CM2=$CM2+2
1032                                    .LIST
1033                                    .ENDM   $$CMREG
1034                                    .MACRO  $$CMTMP A
1035                                    $TMP'A: .WORD   0               ;;USER DEFINED
1036                                    .NLIST
1037                                    $CM4=$CM4+1
1038                                    .LIST
1039                                    .ENDM   $$CMTMP
```

```
                        .SBTTL  COMMON TAGS
                
            001         .IF B
                        ;;*****************************************************************
                        .IFF
                        .NLIST
                        .REPT
                        .LIST
                        ;;*****************************************************************
                        .NLIST
                        .ENDR
                        .LIST
            000         .ENDC
                        ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
                        ;*USED IN THE PROGRAM.
                
            001         .IF NB
                                .=
                        .IFF                                            ,
            001100              .=1100
            000         .ENDC
001100                  $CMTAG:                         ;;START OF COMMON TAGS
            001         .IF NB
                                .WORD   0
                        .IFF
001100  000000          $PASS:  .WORD   0               ;;CONTAINS PASS COUNT
            000         .ENDC
001102      000         $TSTNM: .BYTE   0               ;;CONTAINS THE TEST NUMBER
001103      000         $ERFLG: .BYTE   0               ;;CONTAINS ERROR FLAG
001104  000000          $ICNT:  .WORD   0               ;;CONTAINS SUBTEST ITERATION COUNT
001106  000000          $LPADR: .WORD   0               ;;CONTAINS SCOPE LOOP ADDRESS
001110  000000          $LPERR: .WORD   0               ;;CONTAINS SCOPE RETURN FOR ERRORS
001112  000000          $ERTTL: .WORD   0               ;;CONTAINS TOTAL ERRORS DETECTED
001114      000         $ITEMB: .BYTE   0               ;;CONTAINS ITEM CONTROL BYTE
001115      001         $ERMAX: .BYTE   1               ;;CONTAINS MAX. ERRORS PER TEST
001116  000000          $ERRPC: .WORD   0               ;;CONTAINS PC OF LAST ERROR INSTRUCTION
001120  000000          $GDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'GOOD' DATA
001122  000000          $BDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'BAD' DATA
001124  000000          $GDDAT: .WORD   0               ;;CONTAINS 'GOOD' DATA
001126  000000          $BDDAT: .WORD   0               ;;CONTAINS 'BAD' DATA
001130  000000                  .WORD   0               ;;RESERVED--NOT TO BE USED
001132  000000                  .WORD   0
001134      000         $AUTOB: .BYTE   0               ;;AUTOMATIC MODE INDICATOR
001135      000         $INTAG: .BYTE   0               ;;INTERRUPT MODE INDICATOR
001136  000000                  .WORD   0
001140  177570          SWR:    .WORD   DSWR            ;;ADDRESS OF SWITCH REGISTER
001142  177570          DISPLAY: .WORD  DDISP           ;;ADDRESS OF DISPLAY REGISTER
001144  177560          $TKS:   177560                  ;;TTY KBD STATUS
001146  177562          $TKB:   177562                  ;;TTY KBD BUFFER
001150  177564          $TPS:   177564                  ;;TTY PRINTER STATUS REG. ADDRESS
001152  177566          $TPB:   177566                  ;;TTY PRINTER BUFFER REG. ADDRESS
001154      000         $NULL:  .BYTE   0               ;;CONTAINS NULL CHARACTER FOR FILLS
001155      002         $FILLS: .BYTE   2               ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
001156      012         $FILLC: .BYTE   12              ;;INSERT FILL CHARS. AFTER A "LINE FEED"
001157      000         $TPFLG: .BYTE   0               ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
            001         .IF B
```

```
1096                                    .IFF
1097                                    .NLIST
1098                                    $CM3=
1099                                    .LIST
1100            000                     .ENDC
1101            001                     .IF NE $CM3
1102                                    $REGAD: .WORD   0               ;;CONTAINS THE ADDRESS FROM
1103                                                                    ;;WHICH  ($REGO) WAS OBTAINED
1104                                    .NLIST
1105                                    $CM1=0
1106                                    $CM2=0
1107                                    .LIST
1108                                            .REPT   $CM3
1109                                            $$CMREG \$CM1,\$CM2
1110                                            .ENDR
1111            000                     .ENDC
1112            001                     .IF NB
1113                                    .NLIST
1114                                    $CM4=0
1115                                    .LIST
1116                                    .REPT
1117                                    $$CMTMP \$CM4
1118                                    .ENDR
1119            000                     .ENDC
1120            001                     .IF NE $SWR&4000
1121                                    $TIMES: 0                       ;;MAX. NUMBER OF ITERATIONS
1122            000                     .ENDC
1123            001                     .IF NE 1000&$SWR
1124                                    $ESCAPE:0                       ;;ESCAPE ON ERROR ADDRESS
1125            000                     .ENDC
1126            001                     .IF NE 2000&$SWR
1127                                    $BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
1128            000                     .ENDC
1129   001160     077                   $QUES:  .ASCII  /?/             ;;QUESTION MARK
1130   001161     015                   $CRLF:  .ASCII  <15>            ;;CARRIAGE RETURN
1131   001162  000012                   $LF:    .ASCIZ  <12>            ;;LINE FEED
1132                                    .IIF NE 1&.,    .EVEN
1133            001                     .IF B
1134                                    ;;*****************************************************************
1135                                    .IFF
1136                                    .NLIST
1137                                    .REPT
1138                                    .LIST
1139                                    ;;*****************************************************************
1140                                    .NLIST
1141                                    .ENDR
1142                                    .LIST
1143            000                     .ENDC
1144            001                     .IF NB
1145                                    .NLIST
1146                                    .MCALL  .$APTBLS
1147                                    .LIST
1148                                            .$APTBLS        <>
1149            000                     .ENDC
1150            001                     .IF NB <MORETAGS>
1151         000015                     CR      =       15
```

```
1152            000012                  LF      =       12
1153  001164    000000                  DRVSEL: .WORD   0               ;ADDRESS OF SELECTED DRIVE
1154  001166    000000                  DRIVE:  .WORD   0               ;DRIVE NUM STORAGE FOR DRIVER ERR CALLS
1155  001170    000000                  ATTN:   .WORD   0               ;ATTENTION REGISTER STORAGE FOR ERROR MESSAGES
1156  001172    000000                  $HEAD:  .WORD   0               ;HEAD ADDRESS STORED FOR ERROR MESSAGES
1157  001174    000000                  TOPLN:  .WORD   0               ;'TYPE THE HEADER' INDICATOR
1158  001176    000000                  OFFDIR: .WORD   0               ;NEG OFFSET PASS IND
1159  001200    000000                  BITIND: .WORD   0               ;SIGN CHANGE BIT STORED INDICATOR
1160  001202    000000                  SINCNG: .WORD   0               ;SIGN CHANGE BIT STORAGE
1161  001204    000000                  PLUS:   .WORD   0               ;STORE THE POS SIGN CHANGE CODE
1162  001206    000000                  INREG:  .WORD   0               ;CONTAINS THE VALUE READ FROM THE REGISTER
1163  001210    000000                  TOLER:  .WORD   0               ;ALIGNMENT TOLERANCE FOR PRESENT CYLINDER
1164  001212    000000                  MAXCYL: .WORD   0               ;CONTAINS THE MAXIMUM CYLINDER ADDRFSS
1165                                                                    ;OF DRIVE UNDER TEST
1166  001214    000000                  MAXPOS: .WORD   0               ;CONTAINS MAXIMUM POSITIVE OFFSET
1167  001216    000000                  MAXNEG: .WORD   0               ;CONTAINS MAXIMUM NEGATIVE OFFSET
1168  001220    000000                  MAXOFF: .WORD   0               ;CONTAINS NUMBER OF OFFSET POSITIONS
1169  001222    000000                  OUTTOL: .WORD   0               ;CONTAINS TOLERANCE FOR INNER AND OUTER CYLINDERS
1170  001224    000000                  MIDTOL: .WORD   0               ;CONTAINS TOLERANCE FOR THE ALIGNMENT CYLINDER
1171  001226    000000                  INCYL:  .WORD   0               ;INNER CYLINDER ADDRESS
1172  001230    000000                  MIDCYL: .WORD   0               ;ALIGNMENT CYLINDER ADDRESS
1173  001232    000000                  OUTCYL: .WORD   0               ;OUTER CYLINDER ADDRESS
1174  001234    000000                  TABLE1: .WORD   0               ;CONTAINS HEAD TABLE ADDRESS FOR 'INCYL' & 'OUTCYL'
1175  001236    000000                  TABLE2: .WORD   0               ;CONTAINS ADDRESS OF OFFSET CODE TABLE
1176  001240    000000                  SEKCNT: .WORD   0               ;CONTAINS SEEK COUNT
1177  001242    000000                  CHGADR: .WORD   0               ;CHANGE RH11 BUS ADDRESS FLAG
1178  001244    000104  000106          PKV:    .WORD   104,106         ;KW11-P VECTOR ADDRESS
1179  001250    172540                  PKCS:   .WORD   172540          ;KW11-P CONTROL AND STATUS REG.
1180  001252    172542                  PKB:    .WORD   172542          ;KW11-P COUNT SET BUFFER
1181  001254    172544                  PKC:    .WORD   172544          ;KW11-P COUNTER
1182  001256    000100  000102          LKV:    .WORD   100,102         ;KW11-L VECTOR ADDRESS
1183  001262    177546                  LKS:    .WORD   177546          ;KW11-L STATUS REGISTER
1184
1185            002                     .IF B
1186                                    ;;*****************************************************************
1187                                    .IFF
1188                                    .NLIST
1189                                    .REPT
1190                                    .LIST
1191                                    ;;*****************************************************************
1192                                    .NLIST
1193                                    .ENDR
1194                                    .LIST
1195            001                     .ENDC
1196
1197                                    .SBTTL  RH11/RP04/5/6 ADDRESS & VECTOR LOCATIONS
1198
1199            002                     .IF B
1200                                    ;;*****************************************************************
1201                                    .IFF
1202                                    .NLIST
1203                                    .REPT
1204                                    .LIST
1205                                    ;;*****************************************************************
1206                                    .NLIST
1207                                    .ENDR
```

```
                                .LIST
                    001         .ENDC

001264  176700                  $RPADR: .WORD   176700          ;RH11/RP04/5/6 UNIBUS ADDRESS
001266  000254                  $RPVEC: .WORD   254             ;RH11/RP04/5/6 VECTOR ADDRESS

                    000         .ENDC
```

```
                                .SBTTL  ERROR POINTER TABLE

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

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


001270                          $ERRTB:

                                ;ERROR 1

001270  020506                          EM1             ;RH11 INTERRUPT OCCURRED (RHAS=0)
001272  021237                          DH1
001274  021626                          DT1
001276  021740                          DF1

                                ;ERROR 2

001300  020547                          EM2             ;UNEXPECTED ATTENTION OCCURRED
001302  021244                          DH2
001304  021632                          DT2
001306  021741                          DF2

                                ;ERROR 3

001310  020605                          EM3             ;MASSBUS PARITY ERROR (MCPE=1)
001312  021321                          DH3
001314  021650                          DT3
001316  021747                          DF3


                                ;ERROR 4

001320  020643                          EM4             ;MASSBUS PARITY ERROR (PAR=1)
001322  021347                          DH4
001324  021660                          DT4
001326  021752                          DF4

                                ;ERROR 5

001330  020700                          EM5             ;ADDRESS PLUG CHANGE BIT SET
001332  021244                          DH2
001334  021632                          DT2
001336  021741                          DF2

                                ;ERROR 6

001340  020734                          EM6             ;RH11 DIDN'T RESPOND TO ADDRESSING
001342  021406                          DH6
```

```
1271  001344  021672                    DT6
1272  001346  021740                    DF1
1273
1274                              ;ERROR 7
1275
1276  001350  000000                    0               ;UNUSED
1277  001352  000000                    0
1278  001354  000000                    0
1279  001356  000000                    0
1280
1281                              ;ERROR 10
1282
1283  001360  020776                    EM10            ;DRIVE OR DATA ERROR
1284  001362  021421                    DH10
1285  001364  021676                    DT10
1286  001366  021756                    DF10
1287
1288                              ;ERROR 11
1289
1290  001370  021022                    EM11            ;DRIVE UNSAFE ERROR
1291  001372  021421                    DH10
1292  001374  021676                    DT10
1293  001376  021756                    DF10
1294
1295                              ;ERROR 12
1296
1297  001400  021045                    EM12            ;HEAD OUT OF ALIGNMENT
1298  001402  021507                    DH12
1299  001404  021716                    DT12
1300  001406  021765                    DF12
1301
1302                              ;ERROR 13
1303
1304  001410  021073                    EM13            ;HEAD TOO FAR OUT OF ALIGNMENT
1305  001412  021600                    DH13
1306  001414  021726                    DT13
1307  001416  021770                    DF13
1308
1309                              ;ERROR 14
1310
1311  001420  021131                    EM14            ;SOFTWARE TIMEOUT
1312  001422  021421                    DH10
1313  001424  021676                    DT10
1314  001426  021756                    DF10
1315
1316                              ;ERROR 15
1317
1318  001430  021152                    EM15            ;UNCORRECTABLE MASSBUS PARITY ERROR
1319  001432  000000                    0
1320  001434  000000                    0
1321  001436  000000                    0
1322
1323                              ;ERROR 16
1324
1325  001440  021215                    EM16            ;DRIVE IS UNAVAILABLE
1326  001442  021617                    DH16
```

```
1327  001444  021734                        DT16
1328  001446  021740                        DF1
1329
1330              001                       .IF B
1331                                        ;;**********************************************************************
1332                                        .IFF
1333                                        .NLIST
1334                                        .REPT
1335                                        .LIST
1336                                        ;;**********************************************************************
1337                                        .NLIST
1338                                        .ENDR
1339                                        .LIST
1340              000                       .ENDC
1341
1342                                        .SBTTL  RP04/5/6 DRIVER COMMANDS
1343
1344              001                       .IF B
1345                                        ;;**********************************************************************
1346                                        .IFF
1347                                        .NLIST
1348                                        .REPT
1349                                        .LIST
1350                                        ;;**********************************************************************
1351                                        .NLIST
1352                                        .ENDR
1353                                        .LIST
1354              000                       .ENDC
1355
1356            000101                      RNOP=   101             ;NO OPERATION
1357            000103                      UNLOAD= 103             ;UNLOAD
1358            000105                      SEEK=   105             ;SEEK
1359            000107                      RECAL=  107             ;RECALIBRATE
1360            000111                      DRVCLR= 111             ;DRIVE CLEAR
1361            000113                      REL=    113             ;RELEASE
1362            000115                      OFFSET= 115             ;OFFSET
1363            000117                      RTC=    117             ;RETURN TO CENTER LINE
1364            000121                      PRESET= 121             ;READ IN PRESET
1365            000123                      ACK=    123             ;PACK ACKNOWLEDGE
1366            000131                      SEARCH= 131             ;SEARCH
1367            000141                      GETREG= 141             ;GET REGISTERS
1368            000143                      SETFMT= 143             ;SET FORMAT (& ECI OR HCI)
1369            000145                      SELDRV= 145             ;SELECT DRIVE
1370            000151                      WCHKD=  151             ;WRITE CHECK DATA
1371            000153                      WCHKHD= 153             ;WRITE CHECK HEADER & DATA
1372            000161                      WRTDAT= 161             ;WRITE DATA
1373            000163                      WRTHD=  163             ;WRITE HEADER & DATA
1374            000171                      RDDAT=  171             ;READ DATA
1375            000173                      RDHD=   173             ;READ HEADER & DATA
1376
1377
1378               001                      .IF B
1379                                        ;;**********************************************************************
1380                                        .IFF
1381                                        .NLIST
1382                                        .REPT
```

```
                                .LIST
                                ;;*****************************************************************
                                .NLIST
                                .ENDR
                                .LIST
                        000     .ENDC

                                .SBTTL  PROGRAM START AND INITIALIZATION ROUTINES

                        001     .IF B
                                ;;*****************************************************************
                                .IFF
                                .NLIST
                                .REPT
                                .LIST
                                ;;*****************************************************************
                                .NLIST
                                .ENDR
                                .LIST
                        000     .ENDC

001450  012737  177777  001242  START:  MOV     #-1,CHGADR              ;SET CHANGE RH11 ADDRESS FLAG
001456  000402                   BR      START2          ;FINISH
001460  005037  001242          START1: CLR     CHGADR          ;CLEAR RH11 CHANGE ADDRESS FLAG
001464  000005                  START2: RESET                   ;CLEAR THE BUS
                                .SBTTL  INITIALIZE THE COMMON TAGS
                        001     .IF DF $CMTAG
                                ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
001466  012706  001100                  MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
001472  005026                          CLR     (R6)+           ;;CLEAR MEMORY LOCATION
001474  022706  001140                  CMP     #SWR,R6 ;;DONE?
001500  001374                          BNE     .-6             ;;LOOP BACK IF NO
                        000     .ENDC
                        001     .IF NB
                                        MOV     #,SP            ;;SETUP THE STACK POINTER
                                .IFF
001502  012706  001100                  MOV     #STACK,SP       ;;SETUP THE STACK POINTER
                        000     .ENDC
                                .IIF NDF $SETUP,$SETUP= 0
                                .IIF NE $SETUP&17,;;INITIALIZE A FEW VECTORS
                        001     .IF NE $SETUP&1 ;;BIT00
                                        MOV     #$SCOPE,@#IOTVEC ;;IOT VECTOR FOR SCOPE ROUTINE
                                        MOV     #340,@#IOTVEC+2 ;;LEVEL 7
                                .IIF NDF $CMTAG,        CLRB    $TSTNM          ;;INITIALIZE THE TEST NUMBER
                        000     .ENDC
                        001     .IF NE $SETUP&2 ;;BIT01
001506  012737  004412  000030          MOV     #$ERROR,@#EMTVEC ;;EMT VECTOR FOR ERROR ROUTINE
001514  012737  000340  000032          MOV     #340,@#EMTVEC+2 ;;LEVEL 7
                        000     .ENDC
                        001     .IF NE $SETUP&4 ;;BIT02
001522  012737  007452  000034          MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
001530  012737  000340  000036          MOV     #340,@#TRAPVEC+2;LEVEL 7
                        000     .ENDC
                        001     .IF NE $SETUP&10        ;;BIT03
                                        MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
                                        MOV     #340,@#PWRVEC+2 ;;LEVEL 7
```

```
                    000                     .ENDC
                    001                     .IF NE $SETUP&20            ;;BIT04
                                            .IIF NDF $CMTAG,            CLR     $PASS           ;;CLEAR THE PASS COUNT
                                                    MOV     $ENDCT,$EOPCT   ;;SETUP END-OF-PROGRAM COUNTER
                    000                     .ENDC
                    001                     .IF NE $SETUP&40 ;;BIT05
001536  012737  176543  007132                    MOV     #176543,$HINUM  ;;PRIME THE RANDOM NUMBER GENERATOR
001544  012737  123456  007134                    MOV     #123456,$LONUM  ;;BOTH HIGH AND LOW WORDS
                    000                     .ENDC
                    001                     .IF NE $SETUP&1 ;;BIT00
                    002                     .IF NE $SWR&4000
                                            .IIF NDF $CMTAG,            MOV     #1,$ICNT        ;;INITIALIZE THE ITERATION COUNTER
                                                    CLR     $TIMES          ;;INITIALIZE NUMBER OF ITERATIONS
                    001                     .ENDC
                    000                     .ENDC
                    001                     .IF NE $SETUP&2 ;;BIT01
                                            .IIF NDF $CMTAG,            CLRB    $ERFLG          ;;CLEAR THE ERROR FLAG
                    002                     .IF NE 1000&$SWR
                                            .IIF NDF $CMTAG,            CLR     $ERTTL          ;;CLEAR THE ERROR COUNT
                                                    CLR     $ESCAPE         ;;CLEAR THE ESCAPE ON ERROR ADDRESS
                                                    MOVB    #1,$ERMAX       ;;ALLOW ONE ERROR PER TEST
                    001                      ENDC
                    000                     .ENDC
                    001                     .IF NE $SETUP&20            ;;BIT04
                    002                     .IF NE 10000&$SWR
                                            .MACRO  $$SETUP ?N1,?N2,?N3
                                            ;;INITIALIZE THE "T-BIT" TRAP VECTOR, THEN LOAD LOCATION "$RTRN", IN
                                            ;;THE "END-OF-PASS" ($EOP) ROUTINE, WITH A "RTI" OR "RTT".
                                                    MOV     #$RTRN,@#TBITVEC ;;SET "T" BIT VECTOR TO $RTRN
                                                    MOV     #340,@#TBITVEC+2 ;;LEVEL 7
                                                    MOV     #RTI,$RTRN      ;;SET $RTRN TO A RTI
                                                    MOV     #N2,@#RESVEC    ;;TRY TO DO A RTT
                                                    CLR     -(SP)           ;;DUMMY PS
                                                    MOV     #N1,-(SP)       ;;AND PC
                                                    RTT                     ;;TRY THE RTT
                                            N1:     MOV     #RTT,$RTRN      ;;RTT IS LEGAL--SET $RTRN TO A RTT
                                                    BR      N3
                                            N2:     ADD     #10,SP          ;;RTT ILLEGAL--CLEAN OFF THE STACK
                                            N3:     MOV     #RESVEC+2,@#RESVEC ;;RESTORE TRAP CATCHER
                                                    CLR     $TBIT           ;;CLEAR "T" BIT SWITCH
                                            .ENDM   $$SETUP
                                                    $$SETUP
                    001                     .ENDC
                    000                     .ENDC
                    001                     .IF NE $SETUP&1
                                            .IIF NE $SWR&40000,     MOV     #.,$LPADR       ;;INITIALIZE THE LOOP ADDRESS FOR SCOPE
                                            .IIF NE 1000&$SWR,      MOV     #.,$LPERR       ;;SETUP THE ERROR LOOP ADDRESS
                    000                     .ENDC
                                            ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
                                            ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
001552  013746  000004                            MOV     @#ERRVEC,-(SP)  ;;SAVE ERROR VECTOR
001556  012737  001612  000004                    MOV     #64$,@#ERRVEC   ;;SET UP ERROR VECTOR
001564  012737  177570  001140                    MOV     #DSWR,SWR       ;;SETUP FOR A HARDWARE SWICH REGISTER
001572  012737  177570  001142                    MOV     #DDISP,DISPLAY  ;;AND A HARDWARE DISPLAY REGISTER
001600  022777  177777  177332                    CMP     #-1,@SWR        ;;TRY TO REFERENCE HARDWARE SWR
001606  001012                                    BNE     66$             ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
```

```
                                                        ;;AND  THE HARDWARE SWR IS NOT = -1
001610  000403                          BR      65$     ;;BRANCH IF NO TIMEOUT
001612  012716  001620          64$:    MOV     #65$,(SP)       ;;SET UP FOR TRAP RETURN
001616  000002                          RTI
001620  012737  000176  001140  65$:    MOV     #SWREG,SWR      ;;POINT TO SOFTWARE SWR
001626  012737  000174  001142          MOV     #DISPREG,DISPLAY
001634  012637  000004          66$:    MOV     (SP)+,@#ERRVEC  ;;RESTORE ERROR VECTOR

            001                 .IF DF $MAIL
                                .MACRO  $$SETMAIL       ?$ARG1
                                CLR     $PASS           ;;CLEAR PASS COUNT
                                BITB    #APTSIZE,$ENVM  ;;TEST USER SIZE UNDER APT
                                BEQ     $ARG1           ;;YES,USE NON-APT SWITCH
                                MOV     #$SWREG,SWR     ;;NO,USE APT SWITCH REGISTER
                        $ARG1:
                                .ENDM   $$SETMAIL
                                $$SETMAIL
            000                 .ENDC
001640  005227  177777                  INC     #-1             ;FIRST START ?
001644  001006                          BNE     1$              ;BR IF NOT
001646  104401  016546                  TYPE    ,TITLE          ;TYPE PROGRAM TITLE
001652  104401  016644                  TYPE    ,DDU            ;TYPE 'DDU' SETUP MESSAGE
001656  104401  001161                  TYPE,   $CRLF           ;CR-LF
001662  004737  005604          1$:     JSR     PC,$TKINT       ;TURN ON THE TTY KEYBOARD INTERRUPT
            001                 .IF NE $SETUP&100
                                .SBTTL  GET VALUE FOR SOFTWARE SWITCH REGISTER
001666  005737  000042                  TST     @#42            ;;ARE WE RUNNING UNDER XXDP/ACT?
001672  001006                          BNE     67$             ;;BRANCH IF YES
            002                 .IF DF $MAIL
                                        CMPB    $ENV,#1         ;;ARE WE RUNNING UNDER APT?
                                        BEQ     67$             ;;BRANCH IF YES
            001                 .ENDC
001674  023727  001140  000176          CMP     SWR,#SWREG      ;;SOFTWARE SWITCH REG SELECTED?
001702  001005                          BNE     68$             ;;BRANCH IF NO
001704  104406                          GTSWR                   ;;GET SOFT-SWR SETTINGS
001706  000403                          BR      68$
001710  112737  000001  001134  67$:    MOVB    #1,$AUTOB       ;;SET AUTO-MODE INDICATOR
001716                          68$:
            000                 .ENDC
001716  005227  177777                  INC     #-1             ;FIRST START ?
001722  001010                          BNE     INIT            ;BR IF NOT
001724  004737  022000                  JSR     PC,BUSADR       ;CHECK THE RH11 ADDRESS
001730  013737  001264  007704          MOV     $RPADR,RPADR    ;MOVE RH11 ADDRESS TO DRIVER
001736  013737  001266  007706          MOV     $RPVEC,RPVEC    ;VECTOR ADDRRESS


                        ;GET THE DRIVE NUMBER FROM THE OPERATOR AND SETUP THE VARIABLE LOCATION
                        ;FOR RP04/5 OR RP06'S

001744  012716  001100  INIT:   MOV     #STACK,(SP)     ;SETUP THE STACK ADDRESS
001750  005037  177776          CLR     PS              ;SET PROCESSOR PRIORITY TO ZERO
001754  005037  001174          CLR     TOPLN           ;CLEAR HEADER INDICATOR
001760  004737  005604          JSR     PC,$TKINT       ;INITIALIZE THE TTY KEYBOARD
001764  104401  017545          TYPE    ,ENTERD         ;ASK FOR DRIVE ASSIGNMENT
001770  004737  004270          JSR     PC,GETNUM       ;GET DRIVE NUMBER
001774  000410                  BR      1$              ;'CR' ENTERED
```

```
1551  001776  011637  001164                  MOV     (SP),DRVSEL     ;DRIVE NUMBER
1552  002002  112637  016120                  MOVB    (SP)+,DPB       ;DRIVE NUMBER TO PAR BLOCK
1553  002006  023727  001164  000010          CMP     DRVSEL,#8.      ;CHECK DRIVE NUMBER
1554  002014  103403                          BLO     2$              ;BR IF DRIVE NUMBER OK
1555  002016  104401  001160          1$:     TYPE    ,$QUES          ;TYPE QUESTION MARK
1556  002022  000750                          BR      INIT            ;TRY AGAIN
1557  002024  004737  004114          2$:     JSR     PC,ST.CLK       ;INITIALIZE THE CLOCK
1558  002030  004737  007722                  JSR     PC,RPINIT       ;INITIALIZE THE DRIVER
1559  002034  012737  177777  007646          MOV     #-1,SEEKFG      ;SET SEEK ALLOW FLAG
1560  002042  012737  177777  007644          MOV     #-1,SAVEFG      ;SAVE DRIVE REGISTERS
1561  002050  113700  016120                  MOVB    DPB,R0          ;USE DRIVE NUMBER AS AN INDEX
1562  002054  105760  007556                  TSTB    DRVSTA(R0)      ;SEE IF DRIVE AVAILABLE
1563  002060  003004                          BGT     3$              ;BRANCH IF IT IS
1564  002062  104401  017514                  TYPE    ,NODRV          ;'DRIVE NOT AVAILABLE'
1565  002066  000737  001744                  JMP     INIT            ;TRY IT AGAIN
1566  002072  132760  000003  007566  3$:     BITB    #BIT00!BIT01,DRVTYP(R0) ;RP04/5 ?
1567  002100  001442                          BEQ     4$              ;BR IF NOT
1568  002102  012737  000536  001222          MOV     #350.,OUTTOL    ;SETUP 4 & 400 TOLERANCES
1569  002110  012737  000113  001224          MOV     #75.,MIDTOL     ;TOLERANCE AT CYLINDER 245
1570  002116  012737  000620  001226          MOV     #400.,INCYL     ;INNER ALIGNMENT CYLINDER
1571  002124  012737  000004  001232          MOV     #4,OUTCYL       ;OUTER ALIGNMENT CYLINDER
1572  002132  012737  000365  001230          MOV     #245.,MIDCYL    ;ALIGNMENT CYLINDER
1573  002140  012737  016310  001234          MOV     #HEAD45,TABLE1  ;HEAD ADDRESS TABLE
1574  002146  012737  016405  001236          MOV     #OFTBL4,TABLE2  ;OFFSET TABLE ADDRESS
1575  002154  012737  000633  001212          MOV     #411.,MAXCYL    ;LAST CYLINDER + 1
1576  002162  012737  175520  001216          MOV     #-1200.,MAXNEG  ;MAXIMUM NEGATIVE OFFSET VALUE
1577  002170  012737  002260  001214          MOV     #1200.,MAXPOS   ;MAXIMUM POSITIVE OFFSET VALUE
1578  002176  012737  000141  001220          MOV     #97.,MAXOFF     ;NUMBER OF OFFSET POSITIONS
1579  002204  000441                          BR      5$              ;CONTINUE WITH THE SETUP
1580  002206  012737  000257  001222  4$:     MOV     #175.,OUTTOL    ;TOLERANCE AT CYLINDERS 8 & 800
1581  002214  012737  000113  001224          MOV     #75.,MIDTOL     ;TOLERANCE AT ALIGNMENT CYLINDER
1582  002222  012737  001440  001226          MOV     #800.,INCYL     ;INNER ALIGNMENT CYLINDER
1583  002230  012737  000010  001232          MOV     #8.,OUTCYL      ;OUTER ALIGNMENT CYLINDER
1584  002236  012737  000760  001230          MOV     #496.,MIDCYL    ;ALIGNMENT CYLINDER
1585  002244  012737  016260  001234          MOV     #HEAD6,TABLE1   ;HEAD ADDRESS TABLE
1586  002252  012737  016324  001236          MOV     #OFTBL6,TABLE2  ;OFFSET CODE TABLE
1587  002260  012737  001457  001212          MOV     #815.,MAXCYL    ;MAXIMUM CYLINDER ADDRESS + 1
1588  002266  012737  176650  001216          MOV     #-600.,MAXNEG   ;MAXIMUM NEGATIVE OFFSET VALUE
1589  002274  012737  001130  001214          MOV     #600.,MAXPOS    ;MAXIMUM POSITIVE OFFSET VALUE
1590  002302  012737  000061  001220          MOV     #49.,MAXOFF     ;NUMBER OF OFFSET POSITIONS
1591  002310  004537  003736          5$:     JSR     R5,DRIVER       ;RECALIBRATE
1592  002314  000107                          .WORD   RECAL           ;DRIVER CALL
1593  002316  032737  004000  016152          BIT     #BIT11,REG+RPDS1  ;SEE IF WRITE LOCK SET
1594  002324  001003                          BNE     6$              ;BR IF WRITE LOCKED
1595  002326  104401  017574                  TYPE    ,WLOCK          ;REPORT NOT WRITE LOCKED
1596  002332  000604                          BR      INIT            ;TRY IT AGAIN
1597  002334  104401  017751          6$:     TYPE    ,MODE           ;SEE IF ALIGN, VERIFY, OR EXERCISE
1598  002340  104410                          RDCHR                   ;GET THE ENTRY
1599  002342  012637  002442                  MOV     (SP)+,10$       ;SAVE THE ENTRY
1600  002346  122737  000126  002442          CMPB    #'V,10$         ;WAS A 'V' ENTERED ?
1601  002354  001422                          BEQ     9$              ;BR IF IT WAS
1602  002356  022737  000101  002442          CMP     #'A,10$         ;WAS AN 'A' ENTERED ?
1603  002364  001002                          BNE     7$              ;BR IF NOT
1604  002366  000137  003530                  JMP     DDUALN          ;HEADS TO BE ALIGNED WITH DDU
1605  002372  022737  000105  002442  7$:     CMP     #'E,10$         ;SEE IF EXERCISE
1606  002400  001004                          BNE     8$              ;BR IF 'E' NOT ENTERED
```

```
1607  002402  000137  003640                  JMP     RANDOM          ;GO TO EXERCISE ROUTINE
1608  002406  104401  002442                  TYPE    ,10$            ;ECHO THE INVALID CHARACTER
1609  002412  104401  001160          8$:     TYPE    ,$QUES          ;TYPE A QUESTION MARK
1610  002416  000137  001744                  JMP     INIT            ;GO ALL THE WAY BACK TO DRIVE ENTRY
1611  002422  104401  020015          9$:     TYPE    ,VERIFY         ;TYPE 'VERIFY'
1612  002426  032777  000004  176504          BIT     #SW2,@SWR       ;SWITCH 2 SET ?
1613  002434  001504                          BEQ     CYLDER          ;BR IF NOT SET - CHECK ALL HEADS
1614  002436  000137  002444                  JMP     ONEHD           ;CHECK ONLY THE SPECIFIED HEAD
1615  002442  000000          10$:    .WORD   0               ;OPERATOR ENTRY GOES HERE
1616
1617              001                 .IF B
1618                                  ;;*****************************************************************
1619                                  .IFF
1620                                  .NLIST
1621                                  .REPT
1622                                  .LIST
1623                                  ;;*****************************************************************
1624                                  .NLIST
1625                                  .ENDR
1626                                  .LIST
1627              000                 .ENDC
1628
1629                                  .SBTTL  SETUP TO CHECK ONLY THE SPECIFIED HEAD
1630
1631              001                 .IF B
1632                                  ;;*****************************************************************
1633                                  .IFF
1634                                  .NLIST
1635                                  .REPT
1636                                  .LIST
1637                                  ;;*****************************************************************
1638                                  .NLIST
1639                                  .ENDR
1640                                  .LIST
1641              000                 .ENDC
1642
1643  002444  104401  020355          ONEHD:  TYPE    ,ENTCYL         ;ASK FOR CYLINDER ADDRESS
1644  002450  004737  004270                  JSR     PC,GETNUM       ;GET THE CYLINDER ADDRESS
1645  002454  000427                          BR      1$              ;'CR' ENTERED
1646  002456  012637  016132                  MOV     (SP)+,DPB+CYL   ;MOVE IT TO PARAMETER BLOCK
1647  002462  013737  001222  001210          MOV     OUTTOL,TOLER    ;SET INITIAL ALIGNMENT TOLERANCE
1648  002470  023737  001232  016132          CMP     OUTCYL,DPB+CYL  ;SEE IF OUTER CYLINDER
1649  002476  001432                          BEQ     4$              ;BR IF IT IS
1650  002500  023737  001226  016132          CMP     INCYL,DPB+CYL   ;SEE IF INNER CYLINDER
1651  002506  001426                          BEQ     4$              ;BR IF IT IS
1652  002510  013737  001224  001210          MOV     MIDTOL,TOLER    ;CHANGE TOLERANCE
1653  002516  023737  001230  016132          CMP     MIDCYL,DPB+CYL  ;SEE IF ALIGNMENT CYLINDER
1654  002524  001414                          BEQ     3$              ;BR IF YES
1655  002526  104401  020437                  TYPE    ,BADCYL         ;REPORT INVALID CYLINDER
1656  002532  000744                          BR      ONEHD           ;TRY IT AGAIN
1657  002534  023727  001212  000633  1$:     CMP     MAXCYL,#411.    ;RP04/5 ?
1658  002542  001403                          BEQ     2$              ;BR IF YES
1659  002544  104401  020156                  TYPE    ,CYL496         ;CYLINDER 496 DEFAULT MESSAGE
1660  002550  000402                          BR      3$              ;CONTINUE
1661  002552  104401  020112          2$:     TYPE    ,CYL245         ;CYLINDER 245 DEFAULT MESSAGE
1662  002556  013737  001230  016132  3$:     MOV     MIDCYL,DPB+CYL  ;CYLINDER ADDRESS
```

```
1663   002564  104401  020336          4$:     TYPE    ,ENTHD          ;ASK FOR THE HEAD ADDRESS
1664   002570  004737  004270                  JSR     PC,GETNUM       ;GET THE HEAD ADDRESS
1665   002574  000411                          BR      5$              ;'CR' ENTERED
1666   002576  012637  001172                  MOV     (SP)+,$HEAD     ;SAVE THE HEAD ADDRESS
1667   002602  022737  000022  001172          CMP     #18.,$HEAD      ;ADDRESS VALID ?
1668   002610  002007                          BGE     6$              ;BR IF YES
1669   002612  104401  020410                  TYPE    ,BADTRK         ;INVALID HEAD ADDRESS MESSAGE
1670   002616  000762                          BR      4$              ;TRY AGAIN
1671   002620  104401  020054          5$:     TYPE    ,HDZERO         ;HEAD DEFAULT MESSAGE
1672   002624  005037  001172                  CLR     $HEAD           ;CLEAR HEAD STORAGE
1673   002630  004537  003736          6$:     JSR     R5,DRIVER       ;SEEK TO THE SPECIFIED CYLINDER
1674   002634  000105                          .WORD   SEEK            ;SEEK CODE
1675   002636  004737  003032                  JSR     PC,CHECK        ;CHECK THE HEAD
1676   002642  000137  001744                  JMP     INIT            ;GET THE NEXT DRIVE/HEAD
1677
1678               001                  .IF B
1679                                    ;;*****************************************************************
1680                                    .IFF
1681                                    .NLIST
1682                                    .REPT
1683                                    .LIST
1684                                    ;;*****************************************************************
1685                                    .NLIST
1686                                    .ENDR
1687                                    .LIST
1688               000                  .ENDC
1689
1690                                    .SBTTL  MAIN ROUTINE - CHECK ALL HEADS AT ALL ALIGHMENT CYLNDERS
1691
1692               001                  .IF B
1693                                    ;;*****************************************************************
1694                                    .IFF
1695                                    .NLIST
1696                                    .REPT
1697                                    .LIST
1698                                    ;;*****************************************************************
1699                                    .NLIST
1700                                    .ENDR
1701                                    .LIST
1702               000                  .ENDC
1703
1704   002646  013737  001230  016132  CYLDER: MOV     MIDCYL,DPB+CYL  ;START AT THE ALIGNMENT CYLINDER
1705   002654  013737  001224  001210          MOV     MIDTOL,TOLER    ;ALIGNMENT CHECK TOLERANCE
1706   002662  004537  003736                  JSR     R5,DRIVER       ;SEEK TO THE ALIGNMENT CYLINER
1707   002666  000105                          .WORD   SEEK            ;DRIVER SEEK CODE
1708   002670  012704  016210                  MOV     #HEAD1,R4       ;ADDRESS OF ALIGNMENT HEAD SELECTION TABLE
1709   002674  004737  003014                  JSR     PC,1$           ;CHECK ALIGNMENT, ALL HEADS, AT THE ALIGNMENT CYLINDER
1710   002700  013737  001226  016132          MOV     INCYL,DPB+CYL   ;CHANGE TO INNER CYLINDER
1711   002706  013737  001222  001210          MOV     OUTTOL,TOLER    ;CHANGE TOLERANCE VALUE
1712   002714  004537  003736                  JSR     R5,DRIVER       ;SEEK TO INNER CYLINDER
1713   002720  000105                          .WORD   SEEK            ;DRIVER SEEK CODE
1714   002722  013704  001234                  MOV     TABLE1,R4       ;CHANGE HEAD TABLE ADDRESS
1715   002726  004737  003014                  JSR     PC,1$           ;CHECK ALIGNMENT AT INNER CYLINDER
1716   002732  013737  001232  016132          MOV     OUTCYL,DPB+CYL  ;CHANGE CYLINDER TO OUTER CYLINDER
1717   002740  004537  003736                  JSR     R5,DRIVER       ;SEEK TO OUTER CYLINDER
1718   002744  000105                          .WORD   SEEK            ;DRIVER SEEK CODE
```

```
1719  002746  004737  003014                  JSR     PC,1$           ;CHECK ALIGNMENT AT OUTER CYLINDER
1720  002752  013737  001230  016132          MOV     MIDCYL,DPB+CYL  ;GO BACK TO THE ALIGNMENT CYLINDER
1721  002760  013737  001224  001210          MOV     MIDTOL,TOLER    ;CHANGE ALIGNMENT TOLERANCE
1722  002766  004537  003736                  JSR     R5,DRIVER       ;SEEK
1723  002772  000105                          .WORD   SEEK            ;DRIVER SEEK CODE
1724  002774  012704  016210                  MOV     #HEAD1,R4       ;ADDRESS OF 0 - 18 HEAD ADDRESS TABLE
1725  003000  004737  003014                  JSR     PC,1$           ;RECHECK ALIGNMENT AT ALIGNMENT CYLINDER
1726  003004  104401  020472                  TYPE    ,ENDMSG         ;TYPE 'DONE'
1727  003010  000137  001744                  JMP     INIT            ;GET NEXT DRIVE OR HEAD
1728  003014  012437  001172          1$:     MOV     (R4)+,$HEAD     ;MOVE HEAD ADDRESS FROM TABLE
1729  003020  100403                          BMI     2$              ;BR IF END OF TABLE
1730  003022  004737  003032                  JSR     PC,CHECK        ;CHECK THE ALIGNMENT
1731  003026  000772                          BR      1$              ;GET NEXT HEAD VALUE
1732  003030  000207                  2$:     RTS     PC              ;RETURN
1733
1734              001                 .IF B
1735                                  ;;*****************************************************************
1736                                  .IFF
1737                                  .NLIST
1738                                  .REPT
1739                                  .LIST
1740                                  ;;*****************************************************************
1741                                  .NLIST
1742                                  .ENDR
1743                                  .LIST
1744              000                 .ENDC
1745
1746                                  .SBTTL  ROUTINE TO FIND THE TRACK CENTER
1747
1748              001                 .IF B
1749                                  ;;*****************************************************************
1750                                  .IFF
1751                                  .NLIST
1752                                  .REPT
1753                                  .LIST
1754                                  ;;*****************************************************************
1755                                  .NLIST
1756                                  .ENDR
1757                                  .LIST
1758              000                 .ENDC
1759
1760  003032  005037  001176  CHECK:  CLR     OFFDIR          ;CLEAR THE OFFSET DIRECTION INDICATOR
1761  003036  005037  001200          CLR     BITIND          ;CLEAR THE SIGN BIT INDICATOR
1762  003042  013702  001214          MOV     MAXPOS,R2       ;MAXIMUM POSITIVE OFFSET VALUE
1763  003046  013703  001220          MOV     MAXOFF,R3       ;MAXIMUM NUMBER OF OFFSETS
1764  003052  013701  001236          MOV     TABLE2,R1       ;OFFSET CODE TABLE ADDRESS
1765  003056  013746  001172          MOV     $HEAD,-(SP)     ;HEAD VALUE TO STACK
1766  003062  000316                  SWAB    (SP)            ;SWITCH FOR RPDA LOAD
1767  003064  004037  015012          JSR     R0,WRT.RP       ;LOAD RPDA WITH HEAD ADDRESS
1768  003070  000006                  RPDA                    ;REGISTER ADDRESS
1769  003072  001744                  INIT                    ;UNCORRECTABLE PARITY ERROR RETURN
1770  003074  112137  016121  1$:     MOVB    (R1)+,DPB+CODE  ;OFFSET VALUE TO PARAMETER BLOCK
1771  003100  162702  000031          SUB     #25.,R2         ;DECREMENT OFFSET VALUE
1772  003104  000404                  BR      3$              ;BYPASS REVERSE DIRECTION SETUP
1773  003106  114137  016121  2$:     MOVB    -(R1),DPB+CODE  ;REVERSE OFFSET VALUE TO PAR BLOCK
1774  003112  062702  000031          ADD     #25.,R2         ;INCREMENT OFFSET VALUE
```

```
1775  003116  004537  003736          3$:     JSR     R5,DRIVER       ;OFFSET THE DRIVE
1776  003122  000115                          .WORD   OFFSET          ;OFFSET OP CODE
1777  003124  005737  001200                  TST     BITIND          ;INITIAL SIGN VALUE STORED ?
1778  003130  001011                          BNE     4$              ;BR IF STORED
1779  003132  005137  001200                  COM     BITIND          ;SET THE SIGN BIT INDICATOR
1780  003136  042737  077777  016172          BIC     #^CBIT15,REG+RPOF  ;LEAVE THE SIGN BIT
1781  003144  013737  016172  001202          MOV     REG+RPOF,SINCNG ;STORE THE SIGN CHANGE BIT
1782  003152  000407                          BR      5$
1783  003154  042737  077777  016172  4$:     BIC     #^CBIT15,REG+RPOF  ;KEEP ONLY THE SIGN VALUE
1784  003162  023737  016172  001202          CMP     REG+RPOF,SINCNG ;SIGN CHANGED ?
1785  003170  001044                          BNE     8$              ;BRANCH IF IT DID
1786  003172  005303                  5$:     DEC     R3              ;DECREMENT THE OFFSET ATTEMPT COUNTER
1787  003174  001036                          BNE     7$              ;BRANCH IF OFFSETS NOT COMPLETED
1788  003176  032777  000001  175734          BIT     #SW0,@SWR       ;CHECK SWR0
1789  003204  001002                          BNE     6$              ;BR IF SET
1790  003206  104013                          ERROR   13              ;REPORT OUT OF LIMIT CONDITION
1791  003210  000534                          BR      13$             ;SEE IF LOOP ON ERROR
1792  003212  005737  001174          6$:     TST     TCB+N           ;TYPE THE HEADING LINE ?
1793  003216  001005                          BNE     17              ;BR IF NOT
1794  003220  104401  017657                  TYPE    ,HEADER         ;TYPE THE HEADER
1795  003224  012737  177777  001174          MOV     #-1,TOPLN       ;SET THE BYPASS SWITCH
1796  003232                          17$:
1797  003232  013746  001172                  MOV     $HEAD,-(SP)     ;;SAVE $HEAD FOR TYPEOUT
1798                                  .IIF NB <>                      ;;
1799  003236  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
1800  003240  013746  016132                  MOV     DPB+CYL,-(SP)   ;;SAVE DPB+CYL FOR TYPEOUT
1801                                  .IIF NB <>                      ;;
1802  003244  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
1803  003246  104401  017633                  TYPE    ,TOLRG          ;HEAD OUT OF LIMIT
1804  003252  104401  001161                  TYPE    ,$CRLF          ;CR-LF
1805  003256  032777  100000  175654          BIT     #SW15,@SWR      ;HALT IF ERROR ?
1806  003264  001506                          BEQ     13$             ;BR IF NOT
1807  003266  000000                          HALT                    ;HEAD JUST TYPED OUT OF TOLERANCE
1808  003270  000504                          BR      13$             ;CHECK FOR LOOP
1809  003272  005737  001176          7$:     TST     OFFDIR          ;SEE WHICH DIRECTION
1810  003276  001676                          BEQ     1$              ;BRANCH IF FORWARD
1811  003300  000702                          BR      2$              ;REVERSE DIRECTION
1812  003302  005737  001176          8$:     TST     OFFDIR          ;FINISHED WITH REVERSE ?
1813  003306  001017                          BNE     9$              ;BRANCH IF YES
1814  003310  010237  001204                  MOV     R2,PLUS         ;SAVE THE SIGN CHANGE VALUE
1815  003314  013702  001216                  MOV     MAXNEG,R2       ;MAXIMUM NEGATIVE OFFSET VALUE
1816  003320  013703  001220                  MOV     MAXOFF,R3       ;NUMBER OF OFFSETS
1817  003324  013701  001220                  MOV     MAXOFF,R1       ;NUMBER OF OFFSETS
1818  003330  063701  001236                  ADD     TABLE2,R1       ;BEGINNING OF REVERSE DIRECTION VALUES
1819  003334  005137  001176                  COM     OFFDIR          ;SET REVERSE DIRECTION INDICATOR
1820  003340  005037  001200                  CLR     BITIND          ;RESET SIGN BIT INDICATOR
1821  003344  000660                          BR      2$              ;START REVERSE OFFSETS
1822  003346  063702  001204          9$:     ADD     PLUS,R2         ;ADD THE TWO SIGN CHANGE VALUES
1823  003352  006202                          ASR     R2              ;'DIVIDE' BY 2
1824  003354  010237  001204                  MOV     R2,PLUS         ;SAVE THE RESULT
1825  003360  005702                          TST     R2              ;SEE IF VALUE NEGATIVE
1826  003362  100001                          BPL     10$             ;BRANCH IF POSITIVE
1827  003364  005402                          NEG     R2              ;RECOMPLEMENT THE VALUE
1828  003366  032777  000001  175544  10$:    BIT     #SW0,@SWR       ;SEE IF SWR0 SET
1829  003374  001005                          BNE     11$             ;BRANCH IF IT IS
1830  003376  023702  001210                  CMP     TOLER,R2        ;SEE IF TRACK CENTERLINE WITHIN  TOLERANCE
```

```
1831   003402  002043                          BGE     14$             ;BRANCH IF VALUE OK
1832   003404  104012                          ERROR   12              ;REPORT THE ERROR
1833   003406  000435                          BR      13$             ;CHECK FOR LOOP ON ERROR
1834   003410  010246                  11$:    MOV     R2,-(SP)        ;SAVE TRACK CENTER VALUE
1835   003412  005737  001174                  TST     TOPLN           ;TYPE HEADER ?
1836   003416  001005                          BNE     12$             ;BR IF NOT
1837   003420  104401  017657                  TYPE    ,HEADER         ;TYPE THE HEADER
1838   003424  012737  177777  001174          MOV     #-1,TOPLN       ;CLEAR THE INDICATOR
1839   003432                          12$:
1840   003432  013746  001172                  MOV     $HEAD,-(SP)     ;;SAVE $HEAD FOR TYPEOUT
1841                                  .IIF NB <>,     ;;
1842   003436  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
1843   003440  013746  016132                  MOV     DPB+CYL,-(SP)   ;;SAVE DP3+CYL FOR TYPEOUT
1844                                  .IIF NB <>,     ;;
1845   003444  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
1846   003446  013746  001204                  MOV     PLUS,-(SP)      ;;SAVE PLUS FOR TYPEOUT
1847                                  .IIF NB <>,     ;;
1848   003452  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
1849   003454  104401  001161                  TYPE,   $CRLF           ;CR-LF
1850   003460  023726  001210                  CMP     TOLER,(SP)+     ;SEE IF HEAD IN TOLERANCE
1851   003464  002012                          BGE     14$             ;BR IF IN TOLERANCE
1852   003466  032777  100000  175444          BIT     #SW15,@SWR      ;HALT IF ERROR ?
1853   003474  001406                          BEQ     14$             ;BR IF NOT
1854   003476  000000                          HALT                    ;HEAD JUST TYPED OUT OF TOLERANCE
1855   003500  000404                          BR      14$             ;CHECK FOR SWITCH 1
1856   003502  032777  001000  175430  13$:    BIT     #SW9,@SWR       ;SEE IF SWITCH 9 SET
1857   003510  001004                          BNE     15$             ;BR IF SET
1858   003512  032777  000002  175420  14$:    BIT     #SW1,@SWR       ;SWITCH 1 SET ?
1859   003520  001402                          BEQ     16$             ;NOT SET
1860   003522  000137  003032          15$:    JMP     CHECK           ;DO THE HEAD AGAIN
1861   003526  000207                  16$:    RTS     PC              ;RETURN
1862
1863           001                    .IF B
1864                                  ;;**************************************************************************
1865                                  .IFF
1866                                  .NLIST
1867                                  .REPT
1868                                  .LIST
1869                                  ;;**************************************************************************
1870                                  .NLIST
1871                                  .ENDR
1872                                  .LIST
1873           000                    .ENDC
1874
1875                                  .SBTTL  ROUTINE TO SELECT HEAD FOR DDU CONTROLLED HEAD ALIGNMENT
1876
1877           001                    .IF B
1878                                  ;;**************************************************************************
1879                                  .IFF
1880                                  .NLIST
1881                                  .REPT
1882                                  .LIST
1883                                  ;;**************************************************************************
1884                                  .NLIST
1885                                  .ENDR
1886                                  .LIST
```

```
                    000                     .ENDC
                                            
003530  104401  020027          DDUALN:   TYPE    ,ALIGN              ;TYPE 'ALIGN'
003534  022737  000633  001212            CMP     #411.,MAXCYL        ;RP04/5 ?
003542  001403                            BEQ     1$                  ;BR IF YES
003544  104401  020270                    TYPE    ,ALN496             ;'POSITIONED AT 496' MESSAGE
003550  000402                            BR      2$                  ;CONTINUE
003552  104401  020222            1$:     TYPE    ,ALN245             ;'POSITIONED AT 245'
003556  013737  001230  016132    2$:     MOV     MIDCYL,DPB+CYL      ;LOAD CYLINDER ADDRESS
003564  004537  003736                    JSR     R5,DRIVER           ;SEEK TO ALIGNMENT CYLINDER
003570  000105                            .WORD   SEEK                ;DRIVER CODE FOR SEEK
003572  104401  020336            3$:     TYPE    ,ENTHD              ;ASK FOR HEAD NUMBER
003576  004737  004270                    JSR     PC,GETNUM           ;READ THE KEYBOARD
003602  000403                            BR      4$                  ;'CR' ENTERED
003604  021627  000022                    CMP     (SP),#18.           ;ENTRY CAN'T BE GREATER THAN 18
003610  101403                            BLOS    5$                  ;BR IF LESS OR EQUAL
003612  104401  001160            4$:     TYPE    ,$QUES              ;TYPE A QUESTION MARK
003616  000755                            BR      1$                  ;TRY AGAIN
003620  011637  001172            5$:     MOV     (SP),$HEAD          ;HEAD NUMBER FOR TYPEOUT
003624  000316                            SWAB    (SP)                ;PUT HEAD NUMBER INTO UPPER BYTE
003626  004037  015012                    JSR     R0,WRT.RP           ;LOAD RPDA
003632  000006                            RPDA                        ;REGISTER ADDRESS
003634  001744                            INIT                        ;UNCORRECTABLE PARITY ERROR RETURN
003636  000755                            BR      3$                  ;WAIT FOR NEXT HEAD ENTRY
                                            
                    001                     .IF B
                                            ;;**********************************************************************
                                            .IFF
                                            .NLIST
                                            .REPT
                                            .LIST
                                            ;;**********************************************************************
                                            .NLIST
                                            .ENDR
                                            .LIST
                    000                     .ENDC
                                            
                                            .SBTTL  ROUTINE TO PERFORM 5,000 RANDOM SEEKS
                                            
                    001                     .IF B
                                            ;;**********************************************************************
                                            .IFF
                                            .NLIST
                                            .REPT
                                            .LIST
                                            ;;**********************************************************************
                                            .NLIST
                                            .ENDR
                                            .LIST
                    000                     .ENDC
                                            
003640  104401  020040          RANDOM:   TYPE    ,EXER               ;TYPE 'EXERCISE'
003644  012737  011610  001240            MOV     #5000.,SEKCNT       ;NUMBER OF SEEKS
003652  004737  007034            1$:     JSR     PC,$RAND            ;CYCLE THE RANDOM NUMBER GENERATOR
003656  013746  007132                    MOV     $HINUM,-(SP)        ;PUT UPPER RANDOM NUMBER ON THE STACK
003662  005046                            CLR     -(SP)               ;UPPER DIVIDEND
```

```
                                        ;MOV     MAXCYL,-(SP)     ;PUT DIVISOR ON STACK
                                        JSR     PC,$DIV          ;GET THE REMAINDER (RANDOM CYLINDER ADDRESS)
                                        CMP     (SP),DPB+CYL     ;SEE IF SAME RANDOM CYLINDER AS LAST
                                        BNE     2$               ;BR IF DIFFERENT CYLINDER
                                        ADD     #4,SP            ;ADJUST THE STACK POINTER
                                        BR      1$               ;TRY AGAIN
                                2$:     MOV     (SP)+,DPB+CYL    ;PUT CYL ADDR IN THE DPB
                                        TST     (SP)+            ;CORRECT THE STACK POINTER
                                        JSR     R5,DRIVER        ;DO THE SEEK
                                        .WORD   SEEK             ;SEEK CODE
                                        DEC     SEKCNT           ;DECREMENT THE SEEK COUNT
                                        BNE     1$               ;BR IF NOT DONE
                                        JMP     INIT             ;RETURN TO COMMAND ROUTINE

                    001                 .IF B
                                        ;;*****************************************************************
                                        .IFF
                                        .NLIST
                                        .REPT
                                        .LIST
                                        ;;*****************************************************************
                                        .NLIST
                                        .ENDR
                                        .LIST
                    000                 .ENDC

                                        .SBTTL  COMMON ENTRY TO THE RP04/5/6 DRIVER

                    001                 .IF B
                                        ;;*****************************************************************
                                        .IFF
                                        .NLIST
                                        .REPT
                                        .LIST
                                        ;;*****************************************************************
                                        .NLIST
                                        .ENDR
                                        .LIST
                    000                 .ENDC

                                DRIVER: MOV     (R5)+,DPB+COMND  ;COMMAND CODE
                                1$:     JSR     R0,RP04          ;DRIVER ENTRY
                                        DPB                      ;DATA PARAMETER BLOCK ADDRESS
                                        BR      1$               ;REQUEST NOT ACCEPTED
                                2$:     TST     DPB+STATUS       ;SEE IF ORDER COMPLETE
                                        BEQ     2$               ;BR IF NOT COMPLETE
                                        BMI     4$               ;BRANCH IF ERROR
                                3$:     RTS     R5               ;RETURN
                                4$:     BIT     #BIT7,DPB+STATUS ;DID THE ORDER TERMINATE ?
                                        BNE     5$               ;BRANCH IF IT DID
                                        BIT     #BIT14!BIT13!BIT02!BIT01,DPB+STATUS  ;DRIVE OFFLINE OR
                                                                 ;NON-EXISTENT ?
                                        BNE     6$               ;BR IF IT IS
                                        BIT     #BIT12,DPB+STATUS  ;DRIVE UNSAFE ?
                                        BNE     7$               ;BR IF UNSAFE
                                        BIT     #BIT11!BIT10,DPB+STATUS  ;UNCORRECTABLE PARITY ERROR ?
```

```
                                BNE     8$                      ;BR IF YES
004022  001020
004024  032737  001400  016136        BIT     #BIT09!BIT08,DPB+STATUS  ;TIMEOUT ON THIS DRIVE ?
004032  001016                        BNE     9$                      ;BR IF YES
004034  104010                5$:     ERROR   10                      ;REPORT DRIVE OR DATA ERROR
004036  032777  001000  175074        BIT     #SW09,@SWR              ;LOOP ON ERROR ?
004044  001746                        BEQ     3$                      ;BR IF NOT
004046  162705  000006                SUB     #6,R5                   ;CORRECT R5 FOR LOOP
004052  000743                        BR      3$                      ;RETURN
004054  104016                6$:     ERROR   16                      ;REPORT DRIVE UNAVAILABLE
004056  000405                        BR      10$                     ;CHECK FOR LOOP
004060  104011                7$:     ERROR   11                      ;REPORT PERSISTENT UNSAFE
004062  000403                        BR      10$                     ;CHECK FOR LOOP
004064  104015                8$:     ERROR   15                      ;UNCORRECTABLE PARITY ERROR
004066  000401                        BR      10$                     ;CHECK FOR LOOP
004070  104014                9$:     ERROR   14                      ;SOFTWARE TIMEOUT
004072  032777  001000  175040  10$:    BIT     #SW09,@SWR;LOOP ON ERROR ?
004100  001403                        BEQ     11$                     ;BR IF NOT
004102  162705  000006                SUB     #6,R5                   ;CORRECT R5 FOR LOOP
004106  000725                        BR      3$                      ;RETURN
004110  000137  001744          11$:  JMP     INIT                    ;RETURN TO USER

            001                 .IF B
                                ;;*****************************************************************
                                .IFF
                                .NLIST
                                .REPT
                                .LIST
                                ;;*****************************************************************
                                .NLIST
                                .ENDR
                                .LIST
            000                 .ENDC

                                .SBTTL  SUBROUTINES
            001                 .IF B
                                ;;*****************************************************************
                                .IFF
                                .NLIST
                                .REPT
                                .LIST
                                ;;*****************************************************************
                                .NLIST
                                .ENDR
                                .LIST
            000                 .ENDC

                                ;THIS ROUTINE WILL DETERMINE IF THERE IS A CLOCK ON THE SYSTEM
                                ;AND IF THERE IS IT WILL SETUP THE VECTOR AND START THE CLOCK.
                                ;CALL
                                ;       JSR     PC,@#ST.CLK
                                ;       RETURN

004114  010146          ST.CLK: MOV     R1,-(SP)                ;SAVE R1
004116  012701  000008          MOV     #ERRVEC+2,R1            ;SAVE AND SETUP TIMEOUT VECTOR
004122  011146                  MOV     (R1),-(SP)
```

```
2055  004124  005011                          CLR     (R1)            ;LEVEL 0
2056  004126  014146                          MOV     -(R1),-(SP)
2057  004130  012711  004146                  MOV     #1$,(R1)        ;GO TO 1$ ON TIMEOUT
2058  004134  005777  175110                  TST     @#PKCS          ;IS THERE A KW11-P?
2059  004140  004737  004200                  JSR     PC,ST.PCLK      ;START THE KW11-P
2060  004144  000411                          BR      3$              ;GO TO EXIT
2061  004146  022626                  1$:     CMP     (SP)+,(SP)+     ;CLEAN UP THE STACK
2062  004150  012711  004166                  MOV     #2$,(R1)        ;IF TIMEOUT GO TO 2$
2063  004154  005777  175102                  TST     @#LKS           ;IS THERE A KW11-L?
2064  004160  004737  004232                  JSR     PC,ST.LCLK      ;START THE KW11-L
2065  004164  000401                          BR      3$              ;EXIT
2066  004166  022626                  2$:     CMP     (SP)+,(SP)+     ;CLEAN UP THE STACK
2067  004170  012621                  3$:     MOV     (SP)+,(R1)+     ;RESTORE THE TIMEOUT VECTOR
2068  004172  012621                          MOV     (SP)+,(R1)+
2069  004174  012601                          MOV     (SP)+,R1        ;RESTORE R1
2070  004176  000207                          RTS     PC              ;RETURN
2071
2072  004200  012777  004256  175036  ST.PCLK: MOV    #SRVCLK,@#PKV   ;SETUP THE KW11-P VECTOR
2073  004206  012777  000300  175032          MOV     #300,@#PKV+2
2074  004214  012777  000001  175030          MOV     #1,@#PKB        ;COUNT ONE TICK
2075  004222  012777  000115  175020          MOV     #115,@#PKCS     ;"INT EN," COUNT DOWN", "MODE 1 (REPEAT)",
2076                                                                  ;"LINE FREQ", AND "RUN"
2077  004230  000207                          RTS     PC              ;RETURN
2078
2079  004232  012777  004256  175016  ST.LCLK: MOV    #SRVCLK,@#LKV   ;SETUP THE KW11-L VECTOR
2080  004240  012777  000300  175012          MOV     #300,@#LKV+2
2081  004246  012777  000100  175006          MOV     #100,@#LKS      ;START THE KW11-L
2082  004254  000207                          RTS     PC              ;RETURN
2083
2084  004256  012746  000020          SRVCLK: MOV     #16.,-(SP)      ;TIME PER TICK IN MILLISECONDS
2085  004262  004737  014120                  JSR     PC,@#RPTMR      ;COUNT THE ELAPSED TIME
2086  004266  000002                          RTI                     ;RETURN AFTER INTERRUPT
2087
2088                                          ;ROUTINE TO GET DECIMAL KEYBOARD ENTRIES
2089                                          ;CALL
2090                                          ;       JSR     PC,GETNUM
2091                                          ;       RETURN1                 ;'CR' ENTERED
2092                                          ;       RETURN2                 ;NUMBER ENTERED, CONVERTED NUMBER ON THE STACK
2093
2094  004270  011646                  GETNUM: MOV     (SP),-(SP)      ;PROVIDE SPACE FOR FIRST CHAR
2095  004272  104411                  1$:     RDLIN                   ;READ AN ASCIZ LINE
2096  004274  012600                          MOV     (SP)+,R0        ;ADDRESS OF 1ST CHAR
2097  004276  010037  004376                  MOV     R0,6$           ;SAVE IN CASE OF BAD INPUT
2098  004302  105710                          TSTB    (R0)            ;FIRST CHARACTER A 'CR' ?
2099  004304  001440                          BEQ     7$              ;BR IF IT IS
2100  004306  005046                          CLR     -(SP)           ;CLEAR DATA WORD
2101  004310  112001                  2$:     MOVB    (R0)+,R1        ;PICKUP THIS CHARACTER
2102  004312  001421                          BEQ     4$              ;GET OUT IF ZERO
2103  004314  122701  000060                  CMPB    #'0,R1          ;MAKE SURE THAT THIS CHARACTER
2104  004320  003016                          BGT     4$              ;IS A DIGIT BETWEEN 0 & 9
2105  004322  122701  000071                  CMPB    #'9,R1
2106  004326  002420                          BLT     5$
2107  004330  006316                          ASL     (SP)            ;*2
2108  004332  011646                          MOV     (SP),-(SP)      ;SAVE FOR LATER
2109  004334  006316                          ASL     (SP)            ;*4
2110  004336  006316                          ASL     (SP)            ;*8.
```

```
2111  004340  062616                  ADD     (SP)+,(SP)      ;*10.
2112  004342  102412                  BVS     5$              ;OVERFLOW ISN'T ALLOWED
2113  004344  042701  000060          BIC     #60,R1          ;CLEAR THE UPPER BITS
2114  004350  060116                  ADD     R1,(SP)         ;ADD THE NUMBER
2115  004352  102406                  BVS     5$              ;OVERFLOW ISN'T ALLOWED
2116  004354  000755                  BR      2$              ;LOOP
2117  004356  012666  000002  4$:     MOV     (SP)+,2(SP)     ;SAVE THE RESULT
2118  004362  062716  000002          ADD     #2,(SP)         ;INCREMENT THE RETURN ADDRESS
2119  004366  000410                  BR      8$              ;EXIT
2120  004370  005726          5$:     TST     (SP)+           ;CLEAN PARTIAL NUMBER FROM STACK
2121  004372  105010                  CLRB    (R0)            ;SET A TERMINATOR
2122  004374  104401                  TYPE                    ;TYPE THE INPUT UP TO BAD CHAR
2123  004376  000000          6$:     .WORD   0               ;POINTER GOES HERE
2124  004400  104401  001160          TYPE    ,$QUES          ;'?' 'CR' 'LF'
2125  004404  000732                  BR      1$              ;TRY AGAIN
2126  004406  012616          7$:     MOV     (SP)+,(SP)      ;RESTORE THE PC
2127  004410  000207          8$:     RTS     PC              ;RETURN
2128
2129              001                 .IF B
2130                                  ;;*****************************************************************
2131                                  .IFF
2132                                  .NLIST
2133                                  .REPT
2134                                  .LIST
2135                                  ;;*****************************************************************
2136                                  .NLIST
2137                                  .ENDR
2138                                  .LIST
2139              000                 .ENDC
2140
2141                                  .SBTTL  MACRO ROUTINES
2142
2143                                  .SBTTL  ERROR HANDLER ROUTINE
2144
2145              001                 .IF B
2146                                  ;;*****************************************************************
2147                                  .IFF
2148                                  .NLIST
2149                                  .REPT
2150                                  .LIST
2151                                  ;;*****************************************************************
2152                                  .NLIST
2153                                  .ENDR
2154                                  .LIST
2155              000                 .ENDC
2156                                  ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
2157                                  ;*SAVE THE ERROR ITEM NUMBER AND THE ADDRESS OF THE ERROR CALL
2158              001                 .IF B $ERRTYP
2159                                  .IIF NE 20000&$SWR,;*AND TYPE OUT THE PC OF THE ERROR INSTRUCTION
2160                                  .IFF
2161                                  ;*AND GO TO $ERRTYP ON ERROR
2162              000                 .ENDC
2163                                  .IIF NE 123000&$SWR,;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
2164                                  .IIF NE 100000&$SWR,;*SW15=1    HALT ON ERROR
2165                                  .IIF NE 20000&$SWR,;*SW13=1     INHIBIT ERROR TYPEOUTS
2166                                  .IIF NE 2000&$SWR,;*SW10=1      BELL ON ERROR
```

```
                                        .IIF NE 1000&$SWR :*SW09=1      LOOP ON ERROR
                                        ;*CALL
                                        ;*      ERROR   N       ;;ERROR=EMT AND N=ERROR ITEM NUMBER

004412                                  $ERROR:
004412  104407                          .IIF NE $SETUP&100,     CKSWR                   ;;TEST FOR CHANGE IN SOFT-SWR
    001                                 .IF NB <<MOV    R1,DRIVE>,<MOV  R3,ATTN>>
004414  010137  001166                          MOV     R1,DRIVE
004420  010337  001170                          MOV     R3,ATTN
    000                                 .ENDC
004424  105237  001103                  7$:     INCB    $ERFLG          ;;SET THE ERROR FLAG
004430  001775                          BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
004432  013777  001102  174502          MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER AND ERROR FLAG
    001                                 .IF EQ  2000&$SWR       ;SW10
004440  005237  001112                          INC     $ERTTL          ;;INC THE ERROR COUNT
                                        .IFF
                                                BIT     #BIT10,@SWR     ;;BELL ON ERROR?
                                                BEQ     1$              ;;NO - SKIP
                                                TYPE    ,$BELL          ;;RING BELL
                                        1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
    000                                 .ENDC
004444  011637  001116                          MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
004450  162737  000002  001116                  SUB     #2,$ERRPC
004456  117737  174434  001114                  MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
    001                                 .IF NE  20000&$SWR      ;SW13
004464  032777  020000  174446                  BIT     #BIT13,@SWR     ;;SKIP TYPEOUT IF SET
004472  001004                                  BNE     20$             ;;SKIP TYPEOUTS
                                        .IFTF
    002                                 .IF DF $40CAT
                                                CMP     (SP),#1002      ;;IF RETURN PC LESS THAN 1002
                                                BHI     12$             ;;ERROR IS ILLEGAL TRAP
                                        ;;PROCESS UNEXPECTED TRAP OR INTERRUPT
                                                MOV     4(SP),$ERRPC    ;;GET PC AT TIME OF FALSE TRAP
                                                SUB     #2,$ERRPC       ;;ADJUST PC
                                                TYPE    ,10$            ;;TYPE HEADER
                                                TYPOCT  $ERRPC          ;;TYPE PC AT TIME OF ERROR
                                                TYPE    ,11$
                                                SUB     #4,(SP)         ;;GET FALSE TRAP VECTOR ADDR
                                                MOV     (SP),$ERRPC
                                                TYPOCT  $ERRPC
                                                TYPE    ,$CRLF
                                                CMP     (SP)+,(SP)+     ;;POP FALSE TRAP VECTOR PC&ADDR
                                                BR      20$
                                        10$:    .ASCIZ  <200>'PC= '
                                        11$:    .ASCIZ  '  UNEXPECTED TRAP TO '
                                                .EVEN
                                        12$:
    001                                         .ENDC
    002                                 .IF NB  $ERRTYP
004474  004737  004520                          JSR     PC,$ERRTYP      ;;GO TO USER ERROR ROUTINE
    001                                 .ENDC
                                        .IFT
    002                                 .IF B $ERRTYP
                                                TYPE    ,$CRLF
                                                TYPOCT  $ERRPC,<ERROR ADDRESS>
    001                                 .ENDC
```

```
                                        TYPE    ,$CRLF
                                .ENDC
                                20$:
                                .IF DF $MAIL
                                        CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
                                        BNE     2$              ;;NO,SKIP APT ERROR REPORT
                                        MOVB    $ITEMB,21$      ;;SET ITEM NUMBER AS ERROR NUMBER
                                        JSR     PC,$ATY4        ;;REPORT FATAL ERROR TO APT
                                21$:    .BYTE   0
                                        .BYTE   0
                                22$:    BR      22$             ;;APT ERROR LOOP
                                .ENDC
                                .IF NE $SWR&100000      ;SW15
                                2$:     TST     @SWR            ;;HALT ON ERROR
                                        BPL     3$              ;;SKIP IF CONTINUE
                                        HALT                    ;;HALT ON ERROR!
                                .IIF NE $SETUP&100,     CKSWR                   ;;TEST FOR CHANGE IN SOFT-SWR
                                .IF NE $SWR&1000        ;SW09
                                3$:     BIT     #BIT09,@$SWR    ;;LOOP ON ERROR SWITCH SET?
                                        BEQ     4$              ;;BR IF NO
                                        MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
                                4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
                                        BEQ     5$              ;;BR IF NONE
                                        MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
                                5$:
                                .IFF
                                3$:
                                .ENDC
                                .IFF
                                .IF NE $SWR&1000        ;SW09
                                2$:     BIT     #BIT09,@$SWR    ;;LOOP ON ERROR?
                                        BEQ     3$              ;;BR IF NO
                                        MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
                                3$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
                                        BEQ     4$              ;;BR IF NONE
                                        MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
                                4$:
                                .IFF
                                2$:
                                .ENDC
                                .ENDC
                                .IF NE $SETUP&20        ;BIT04--(.$EOP)
                                        CMP     #$ENDAD,@#42    ;;ACT-11 AUTO-ACCEPT?
                                        BNE     6$              ;;BRANCH IF NO
                                        HALT                    ;;YES
                                6$:
                                .ENDC
                                .IF B <>
                                        RTI                     ;;RETURN
                                .IFF
                                .IRP LASTIN,<>
                                        LASTIN
                                .ENDM
                                .ENDC
                                .IIF NDF $ERTTL,$ERTTL:
                                .IIF EQ .-$ERTTL,$ERTTL:        .WORD   0               ;:ERROR COUNT
```

```
                        .IIF NDF $TSTNM,$TSTNM:
                        .IIF EQ .-$TSTNM,$TSTNM:        .BYTE   0               ;;TEST NUMBER
                        .IIF NDF $ERFLG,$ERFLG:
                        .IIF EQ .-$ERFLG,$ERFLG:        .BYTE   0               ;;ERROR FLAG
                        .IIF NE .&1,.EVEN
                        .IF NE $SWR&1000;SW09
                        .IIF NDF $ESCAPE,$ESCAPE:
                        .IIF EQ .-$ESCAPE,$ESCAPE: .WORD        0               ;;ESCAPE ON ERROR ADDRESS
                        .ENDC
                        .IIF NDF $ERRPC,$ERRPC:
                        .IIF EQ .-$ERRPC,$ERRPC:        .WORD   0               ;;LAST ERROR INSTRUCTION EXECUTE
                        .IF NE $SWR&2000;SW10
                        .IIF NDF $BELL,$BELL:
                        .IIF EQ .-$BELL,$BELL:  .ASCIZ  <207><377><377> ;;ASCII CODE FOR BELL
                        .ENDC
                        .IIF NDF $ITEMB,$ITEMB:
                        .IIF EQ .-$ITEMB,$ITEMB:        .WORD   0               ;;ITEM BYTE
                        .IIF NDF $QUES,$QUES:
                        .IIF EQ .-$QUES,$QUES:  .ASCII  "?"             ;;QUESTION MARK
                        .IIF NDF $CRLF,$CRLF:
                        .IIF EQ .-$CRLF,$CRLF:  .ASCII  <15>            ;;CARRAIGE RETURN
                        .IIF NDF $LF,$LF:
                        .IIF EQ .-$LF,$LF:      .ASCIZ  <12>            ;;LINEFEED
                        .IIF NE 1&.     .EVEN
                        .SBTTL  ERROR MESSAGE TYPEOUT ROUTINE

                        .IF B
                        ;;*****************************************************************
                        .IFF
                        .NLIST
                        .REPT
                        .LIST
                        ;;*****************************************************************
                        .NLIST
                        .ENDR
                        .LIST
                        .ENDC
                        ;*THIS ROUTINE USES THE "ITEM CONTROL BYTE" ($ITEMB) TO DETERMINE WHICH
                        ;*ERROR IS TO BE REPORTED. IT THEN OBTAINS, FROM THE "ERROR TABLE" ($ERRTB),
                        ;*AND REPORTS THE APPROPRIATE INFORMATION CONCERNING THE ERROR.

004520                  $ERRTYP:
004520  104401  001161          TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
004524  010046                  MOV     R0,-(SP)        ;;SAVE R0
004526  005000                  CLR     R0              ;;PICKUP THE ITEM INDEX
004530  153700  001114          BISB    @#$ITEMB,R0
004534  001004                  BNE     1$              ;;IF ITEM NUMBER IS ZERO, JUST
                                                        ;;TYPE THE PC OF THE ERROR
004536  013746  001116          MOV     $ERRPC,-(SP)    ;;SAVE $ERRPC FOR TYPEOUT
                        .IIF NB <ERROR ADDRESS>,                ;;ERROR ADDRESS
004542  104402                  TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
                           001  .IF B 1
                                BR      6$              ;;GET OUT
                        .IFF
004544  000445                  BR      10$             ;;GET OUT
                           000  .ENDC
```

```
                                1$:     DEC     R0              ;;ADJUST THE INDEX SO THAT IT WILL
                                        ASL     R0              ;;      WORK FOR THE ERROR TABLE
                                        ASL     R0
                                        ASL     R0
                                        ADD     #$ERRTB,R0      ;;FORM TABLE POINTER
                                        MOV     (R0)+,2$        ;;PICKUP "ERROR MESSAGE" POINTER
                                        BEQ     3$              ;;SKIP TYPEOUT IF NO POINTER
                                        TYPE                    ;;TYPE THE "ERROR MESSAGE"
                                2$:     .WORD   0               ;;"ERROR MESSAGE" POINTER GOES HERE
                                        TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
                                3$:     MOV     @(R0)+,4$       ;;PICKUP "DATA HEADER" POINTER
                                        BEQ     5$              ;;SKIP TYPEOUT IF 0
                                        TYPE                    ;;TYPE THE "DATA HEADER"
                                4$:     .WORD   0               ;;"DATA HEADER" POINTER GOES HERE
                                        TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
                                .IF B 1
                                5$:     MOV     (R0),R0         ;;PICKUP "DATA TABLE" POINTER
                                        BNE     7$              ;;GO TYPE THE DATA
                                6$:     MOV     (SP)+,R0        ;;RESTORE R0
                                        TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
                                        RTS     PC              ;;RETURN
                                7$:     TYPOCT  @(R0)+          ;;TYPE AN OCTAL NUMBER
                                        TST     (R0)+           ;;IS THERE ANOTHER NUMBER?
                                        BEQ     6$              ;;BR IF NO
                                        TYPE    ,8$             ;;TYPE TWO(2) SPACES
                                        BR      7$              ;;LOOP
                                8$:     .ASCIZ  /  /            ;;TWO(2) SPACES
                                        .EVEN
                                .IFF
                                5$:     MOV     R1,-(SP)        ;;SAVE R1
                                        MOV     (R0)+,R1        ;;PICKUP "DATA TABLE" POINTER
                                        BEQ     9$              ;;BR IF NO DATA TO BE TYPED
                                        MOV     (R0)+,R0        ;;PICKUP "DATA FORMAT" POINTER
                                6$:     TSTB    (R0)+           ;;"OCTAL" OR "DECIMAL"
                                        BNE     7$              ;;BR IF DECIMAL
                                        MOV     @(R1)+,-(SP)    ;;SAVE @(R1)+ FOR TYPEOUT
                                .IIF NB <>,                     ;;
                                        TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
                                        BR      8$
                                7$:
                                        MOV     @(R1)+,-(SP)    ;;SAVE @(R1)+ FOR TYPEOUT
                                .IIF NB <>,                     ;;
                                        TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
                                8$:     TST     (R1)            ;;IS THERE ANOTHER NUMBER?
                                        BEQ     9$              ;;BR IF NO
                                        TYPE    ,11$            ;;TYPE TWO(2) SPACES
                                        BR      6$              ;;LOOP

                                9$:     MOV     (SP)+,R1        ;;RESTORE R1
                                10$:    MOV     (SP)+,R0        ;;RESTORE R0
                                        TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
                                        RTS     PC              ;;RETURN
                                11$:    .ASCIZ  /  /            ;;TWO(2) SPACES
                                        .EVEN
                                .ENDC
                                .SBTTL  TYPE ROUTINE
```

```
2391
2392                    001                     .IF B
2393                                            ;;*****************************************************************
2394                                            .IFF
2395                                            .NLIST
2396                                            .REPT
2397                                            .LIST
2398                                            ;;*****************************************************************
2399                                            .NLIST
2400                                            .ENDR
2401                                            .LIST
2402                    000                     .ENDC
2403                                            ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
2404                                            ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
2405                                            ;*NOTE1:        $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
2406                                            ;*NOTE2:        $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
2407                                            ;*NOTE3:        $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
2408                                            ;*
2409                                            ;*CALL:
2410                                            ;*1) USING A TRAP INSTRUCTION
2411                                            ;*      TYPE    ,MESADR         ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
2412                                            ;*OR
2413                                            ;*      TYPE
2414                                            ;*      MESADR
2415                                            ;*
2416
2417  004674  105737  001157            $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
2418  004700  100002                            BPL     1$              ;;BR IF YES
2419  004702  000000                            HALT                    ;;HALT HERE IF NO TERMINAL
2420  004704  000407                            BR      3$              ;;LEAVE
2421  004706  010046                    1$:     MOV     R0,-(SP)        ;;SAVE R0
2422  004710  017600  000002                    MOV     @2(SP),R0       ;;GET ADDRESS OF ASCIZ STRING
2423                    001                     .IF DF $MAIL
2424                                            CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
2425                                            BNE     62$             ;;NO,GO CHECK FOR APT CONSOLE
2426                                            BITB    #APTSPOOL,$ENVM ;;SPOOL MESSAGE TO APT
2427                                            BEQ     62$             ;;NO,GO CHECK FOR CONSOLE
2428                                            MOV     R0,61$          ;;SETUP MESSAGE ADDRESS FOR APT
2429                                            JSR     PC,$ATY3        ;;SPOOL MESSAGE TO APT
2430                                    61$:    .WORD   0               ;;MESSAGE ADDRESS
2431                                    62$:    BITB    #APTCSUP,$ENVM  ;;APT CONSOLE SUPPRESSED
2432                                            BNE     60$             ;;YES,SKIP TYPE OUT
2433                    000                     .ENDC
2434  004714  112046                    2$:     MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
2435  004716  001005                            BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
2436  004720  005726                            TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
2437  004722  012600                    60$:    MOV     (SP)+,R0        ;;RESTORE R0
2438  004724  062716  000002            3$:     ADD     #2,(SP)         ;;ADJUST RETURN PC
2439  004730  000002                            RTI                     ;;RETURN
2440  004732  122716  000011            4$:     CMPB    #HT,(SP)        ;;BRANCH IF <HT>
2441  004736  001430                            BEQ     8$
2442  004740  122716  000200                    CMPB    #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
2443  004744  001006                            BNE     5$
2444  004746  005726                            TST     (SP)+           ;;POP  <CR><LF> EQUIV
2445  004750  104401                            TYPE                    ;;TYPE A CR AND LF
2446  004752  001161                            $CRLF
```

```
2447  004754  105037  005110              CLRB    $CHARCNT        ;;CLEAR CHARACTER COUNT
2448  004760  000755                      BR      2$              ;;GET NEXT CHARACTER
2449  004762  004737  005044  5$:         JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
2450  004766  123726  001156  6$:         CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
2451  004772  001350                      BNE     2$              ;;IF NO GO GET NEXT CHAR.
2452  004774  013746  001154              MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
2453                                                              ;;AND THE NULL CHAR.
2454  005000  105366  000001  7$:         DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
2455  005004  002770                      BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
2456  005006  004737  005044              JSR     PC,$TYPEC       ;;GO TYPE A NULL
2457  005012  105337  005110              DECB    $CHARCNT        ;;DO NOT COUNT AS A COUNT
2458  005016  000770                      BR      7$              ;;LOOP
2459
2460                                  ;HORIZONTAL TAB PROCESSOR
2461
2462  005020  112716  000040  8$:         MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
2463  005024  004737  005044  9$:         JSR     PC,$TYPEC       ;;TYPE A SPACE
2464  005030  132737  000007  005110      BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
2465  005036  001372                      BNE     9$              ;;TAB STOP
2466  005040  005726                      TST     (SP)+           ;;POP SPACE OFF STACK
2467  005042  000724                      BR      2$              ;;GET NEXT CHARACTER
2468  005044  105777  174100  $TYPEC:     TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
2469  005050  100375                      BPL     $TYPEC
2470  005052  116677  000002  174072      MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.
2471  005060  122766  000015  000002      CMPB    #CR,2(SP)       ;;IS CHARACTER A CARRIAGE RETURN?
2472  005066  001003                      BNE     1$              ;;BRANCH IF NO
2473  005070  105037  005110              CLRB    $CHARCNT        ;;YES--CLEAR CHARACTER COUNT
2474  005074  000406                      BR      $TYPEX          ;;EXIT
2475  005076  122766  000012  000002  1$:  CMPB    #LF,2(SP)       ;;IS CHARACTER A LINE FEED?
2476  005104  001402                      BEQ     $TYPEX          ;;BRANCH IF YES
2477  005106  105227                      INCB    (PC)+           ;;COUNT THE CHARACTER
2478  005110  000000  $CHARCNT:.WORD     0                       ;;CHARACTER COUNT STORAGE
2479  005112  000207  $TYPEX:  RTS       PC
2480
2481                  .IIF NDF HT,HT= 11                          ;;CODE FOR HORIZONTAL TAB
2482                  .IIF NDF LF,LF= 12                          ;;CODE FOR LINE FEED
2483                  .IIF NDF CR,CR= 15                          ;;CODE FOR CARRIAGE RETURN
2484                  .IIF NDF CRLF,CRLF=     200                 ;;CODE FOR CARRIAGE RETURN-LINE FEED
2485                  .IIF NDF $TPS,$TPS:
2486                  .IIF EQ .-$TPS,$TPS:    .WORD   177564      ;;TTY PRINTER STATUS REG. ADDRESS
2487                  .IIF NDF $TPB,$TPB:
2488                  .IIF EQ .-$TPB,$TPB:    .WORD   177566      ;;TTY PRINTER BUFFER REG. ADDRESS
2489                  .IIF NDF $NULL,$NULL:
2490                  .IIF EQ .-$NULL,$NULL:  .BYTE   0           ;;CONTAINS NULL CHARACTER FOR FILLS
2491                  .IIF NDF $FILLS,$FILLS:
2492                  .IIF EQ .-$FILLS,$FILLS:        .BYTE   2           ;;CONTAINS # OF FILLER CHARACTER
2493                  .IIF NDF $FILLC,$FILLC:
2494                  .IIF EQ .-$FILLC,$FILLC:        .BYTE   12          ;;INSERT FILL CHARS. AFTER A "LI
2495                  .IIF NDF $TPFLG,$TPFLG:
2496                  .IIF EQ .-$TPFLG,$TPFLG:        .BYTE   0           ;;"TERMINAL AVAILABLE" FLAG (BIT
2497                  .IIF NDF $QUES,$QUES:
2498                  .IIF EQ .-$QUES,$QUES:  .ASCII  "?"         ;;QUESTION MARK
2499                  .IIF NDF $CRLF,$CRLF:
2500                  .IIF EQ .-$CRLF,$CRLF:  .ASCII  <15>        ;;CARRAIGE RETURN
2501                  .IIF NDF $LF,$LF:
2502                  .IIF EQ .-$LF,$LF:      .ASCIZ  <12>        ;;LINEFEED
```

```
                        .IIF NE 1&.     .EVEN
                        .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE
                
                001     .IF B
                        ;;*****************************************************************
                        .IFF
                        .NLIST
                        .REPT
                        .LIST
                        ;;*****************************************************************
                        .NLIST
                        .ENDR
                        .LIST
                000     .ENDC
                        ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
                        ;*OCTAL (ASCII) NUMBER AND TYPE IT.
                        ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
                        ;*CALL:
                        ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                        ;*      TYPOS                   ;;CALL FOR TYPEOUT
                        ;*      .BYTE   N               ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
                        ;*      .BYTE   M               ;;M=1 OR 0
                        ;*                                      ;;1=TYPE LEADING ZEROS
                        ;*                                      ;;0=SUPPRESS LEADING ZEROS
                        ;*
                        ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
                        ;*$TYPOS OR $TYPOC
                        ;*CALL:
                        ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                        ;*      TYPON                   ;;CALL FOR TYPEOUT
                        ;*
                        ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
                        ;*CALL:
                        ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                        ;*      TYPOC                   ;;CALL FOR TYPEOUT
                
005114  017646  000000          $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
005120  116637  000001  005337          MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
005126  112637  005341                  MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
005132  062716  000002                  ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
005136  000406                          BR      $TYPON
005140  112737  000001  005337  $TYPOC: MOVB    #1,$OFILL       ;;SET THE ZERO FILL SWITCH
005146  112737  000006  005341          MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
005154  112737  000005  005336  $TYPON: MOVB    #5,$OCNT        ;;SET THE ITERATION COUNT
005162  010346                          MOV     R3,-(SP)        ;;SAVE R3
005164  010446                          MOV     R4,-(SP)        ;;SAVE R4
005166  010546                          MOV     R5,-(SP)        ;;SAVE R5
005170  113704  005341                  MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
005174  005404                          NEG     R4
005176  062704  000006                  ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
005202  110437  005340                  MOVB    R4,$OMODE       ;;SAVE IT FOR USE
005206  113704  005337                  MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
005212  016605  000012                  MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
005216  005003                          CLR     R3              ;;CLEAR THE OUTPUT WORD
005220  006105                  1$:     ROL     R5              ;;ROTATE MSB INTO "C"
005222  000404                          BR      3$              ;;GO DO MSB
```

```
2559  005224  006105                2$:     ROL     R5              ;;FORM THIS DIGIT
2560  005226  006105                        ROL     R5
2561  005230  006105                        ROL     R5
2562  005232  010503                        MOV     R5,R3
2563  005234  006103                3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
2564  005236  105337  005340                DECB    $OMODE          ;;TYPE THIS DIGIT?
2565  005242  100016                        BPL     7$              ;;BR IF NO
2566  005244  042703  177770              BIC     #177770,R3      ;;GET RID OF JUNK
2567  005250  001002                        BNE     4$              ;;TEST FOR 0
2568  005252  005704                        TST     R4              ;;SUPPRESS THIS 0?
2569  005254  001403                        BEQ     5$              ;;BR IF YES
2570  005256  005204                4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
2571  005260  052703  000060              BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
2572  005264  052703  000040        5$:     BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
2573  005270  110337  005334              MOVB    R3,8$           ;;SAVE FOR TYPING
2574  005274  104401  005334              TYPE    ,8$             ;;GO TYPE THIS DIGIT
2575  005300  105337  005336        7$:     DECB    $OCNT           ;;COUNT BY 1
2576  005304  003347                        BGT     2$              ;;BR IF MORE TO DO
2577  005306  002402                        BLT     6$              ;;BR IF DONE
2578  005310  005204                        INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
2579  005312  000744                        BR      2$              ;;GO DO THE LAST DIGIT
2580  005314  012605                6$:     MOV     (SP)+,R5        ;;RESTORE R5
2581  005316  012604                        MOV     (SP)+,R4        ;;RESTORE R4
2582  005320  012603                        MOV     (SP)+,R3        ;;RESTORE R3
2583  005322  016666  000002  000004       MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
2584  005330  012616                        MOV     (SP)+,(SP)
2585  005332  000002                        RTI                     ;;RETURN
2586  005334     000                8$:     .BYTE   0               ;;STORAGE FOR ASCII DIGIT
2587  005335     000                        .BYTE   0               ;;TERMINATOR FOR TYPE ROUTINE
2588  005336     000                $OCNT:  .BYTE   0               ;;OCTAL DIGIT COUNTER
2589  005337     000                $OFILL: .BYTE   0               ;;ZERO FILL SWITCH
2590  005340  000000                $OMODE: .WORD   0               ;;NUMBER OF DIGITS TO TYPE
2591                                .SBTTL  CONVERT BINARY TO DECIMAL AND TYPE ROUTINE
2592
2593                 001            .IF B
2594                                ;;*****************************************************************
2595                                .IFF
2596                                .NLIST
2597                                .REPT
2598                                .LIST
2599                                ;;*****************************************************************
2600                                .NLIST
2601                                .ENDR
2602                                .LIST
2603                 000            .ENDC
2604                                ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 5-DIGIT
2605                                ;*SIGNED DECIMAL (ASCII) NUMBER AND TYPE IT. DEPENDING ON WHETHER THE
2606                                ;*NUMBER IS POSITIVE OR NEGATIVE A SPACE OR A MINUS SIGN WILL BE TYPED
2607                                ;*BEFORE THE FIRST DIGIT OF THE NUMBER. LEADING ZEROS WILL ALWAYS BE
2608                                ;*REPLACED WITH SPACES.
2609                                ;*CALL:
2610                                ;*      MOV     NUM,-(SP)       ;;PUT THE BINARY NUMBER ON THE STACK
2611                                ;*      TYPDS                   ;;GO TO THE ROUTINE
2612
2613  005342                        $TYPDS:
2614  005342  010046                       MOV     R0,-(SP)        ;;PUSH R0 ON STACK
```

```
2615  005344  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
2616  005346  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
2617  005350  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
2618  005352  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
2619  005354  012746  020200                  MOV     #20200,-(SP)    ;;SET BLANK SWITCH AND SIGN
2620  005360  016605  000020                  MOV     20(SP),R5       ;;GET THE INPUT NUMBER
2621  005364  100004                          BPL     1$              ;;BR IF INPUT IS POS.
2622  005366  005405                          NEG     R5              ;;MAKE THE BINARY NUMBER POS.
2623  005370  112766  000055  000001          MOVB    #'-,1(SP)       ;;MAKE THE ASCII NUMBER NEG.
2624  005376  005000                  1$:     CLR     R0              ;;ZERO THE CONSTANTS INDEX
2625  005400  012703  005556                  MOV     #$DBLK,R3       ;;SETUP THE OUTPUT POINTER
2626  005404  112723  000040                  MOVB    #' ,(R3)+       ;;SET THE FIRST CHARACTER TO A BLANK
2627  005410  005002                  2$:     CLR     R2              ;;CLEAR THE BCD NUMBER
2628  005412  016001  005546                  MOV     $DTBL(R0),R1    ;;GET THE CONSTANT
2629  005416  160105                  3$:     SUB     R1,R5           ;;FORM THIS BCD DIGIT
2630  005420  002402                          BLT     4$              ;;BR IF DONE
2631  005422  005202                          INC     R2              ;;INCREASE THE BCD DIGIT BY 1
2632  005424  000774                          BR      3$
2633  005426  060105                  4$:     ADD     R1,R5           ;;ADD BACK THE CONSTANT
2634  005430  005702                          TST     R2              ;;CHECK IF BCD DIGIT=0
2635  005432  001002                          BNE     5$              ;;FALL THROUGH IF 0
2636  005434  105716                          TSTB    (SP)            ;;STILL DOING LEADING 0'S?
2637  005436  100407                          BMI     7$              ;;BR IF YES
2638  005440  106316                  5$:     ASLB    (SP)            ;;MSD?
2639  005442  103003                          BCC     6$              ;;BR IF NO
2640  005444  116663  000001  177777          MOVB    1(SP),-1(R3)    ;;YES--SET THE SIGN
2641  005452  052702  000060          6$:     BIS     #'0,R2          ;;MAKE THE BCD DIGIT ASCII
2642  005456  052702  000040          7$:     BIS     #' ,R2          ;;MAKE IT A SPACE IF NOT ALREADY A DIGIT
2643  005462  110223                          MOVB    R2,(R3)+        ;;PUT THIS CHARACTER IN THE OUTPUT BUFFER
2644  005464  005720                          TST     (R0)+           ;;JUST INCREMENTING
2645  005466  020027  000010                  CMP     R0,#10          ;;CHECK THE TABLE INDEX
2646  005472  002746                          BLT     2$              ;;GO DO THE NEXT DIGIT
2647  005474  003002                          BGT     8$              ;;GO TO EXIT
2648  005476  010502                          MOV     R5,R2           ;;GET THE LSD
2649  005500  000764                          BR      6$              ;;GO CHANGE TO ASCII
2650  005502  105726                  8$:     TSTB    (SP)+           ;;WAS THE LSD THE FIRST NON-ZERO?
2651  005504  100003                          BPL     9$              ;;BR IF NO
2652  005506  116663  177777  177776          MOVB    -1(SP),-2(R3)   ;;YES--SET THE SIGN FOR TYPING
2653  005514  105013                  9$:     CLRB    (R3)            ;;SET THE TERMINATOR
2654  005516  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
2655  005520  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
2656  005522  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
2657  005524  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
2658  005526  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
2659  005530  104401  005556                  TYPE    ,$DBLK          ;;NOW TYPE THE NUMBER
2660  005534  016666  000002  000004          MOV     2(SP),4(SP)     ;;ADJUST THE STACK
2661  005542  012616                          MOV     (SP)+,(SP)
2662  005544  000002                          RTI                     ;;RETURN TO USER
2663  005546  023420                  $D1BL:  10000.
2664  005550  001750                          1000.
2665  005552  000144                          100.
2666  005554  000012                          10.
2667  005556  000004                  $DBLK:  .BLKW   4
2668                                  .SBTTL  TTY INPUT ROUTINE
2669
2670              001                 .IF B
```

```
                                ;;*****************************************************************
                                .IFF
                                .NLIST
                                .REPT
                                .LIST
                                ;;*****************************************************************
                                .NLIST
                                .ENDR
                                .LIST
                                .ENDC
                        000     .IIF NDF $TKS,$TKS:
                                .IIF EQ .-$TKS,$TKS:    .WORD   177560          ;;TTY KBD STATUS
                                .IIF NDF $TKB,$TKB:
                                .IIF EQ .-$TKB,$TKB:    .WORD   177562          ;;TTY KBD BUFFER
                                .ENABL  LSB
                        001     .IF NB 7
005566  000000                $TKCNT: .WORD   0               ;;NUMBER OF ITEMS IN QUEUE
005570  000000                $TKQIN: .WORD   0               ;;INPUT POINTER
005572  000000                $TKQOUT: .WORD  0               ;;OUTPUT POINTER
005574  000007                $TKQSRT: .BLKB  7               ;;TTY KEYBOARD QUEUE
        005603                $TKQEND=.
        005604                .IIF NE <.&1>,.EVEN

                                ;*TK INITIALIZE ROUTINE
                                ;*THIS ROUTINE WILL INITIALIZE THE TTY KEYBOARD INPUT QUEUE
                                ;*SETUP THE INTERRUPT VECTOR AND TURN ON THE KEYBOARD INTERRUPT
                                ;
                                ;*CALL:
                                ;*      JSR     PC,$TKINT
                                ;*      RETURN
                                ;

005604  005037  005566          $TKINT: CLR     $TKCNT          ;;CLEAR COUNT OF ITEMS IN QUEUE
005610  012737  005574  005570          MOV     #$TKQSRT,$TKQIN ;;MOVE THE STARTING ADDRESS OF THE
005616  013737  005570  005572          MOV     $TKQIN,$TKQOUT  ;;QUEUE INTO THE INPUT & OUTPUT POINTERS.
005624  012737  005654  000060          MOV     #$TKSRV,@#TKVEC ;;INITIALIZE THE KEYBOARD VECTOR
005632  012737  000200  000062          MOV     #200,@#TKVEC+2  ;;"BR" LEVEL 4
005640  005777  173302                  TST     @$TKB           ;;CLEAR DONE FLAG
005644  012777  000100  173272          MOV     #100,@$TKS      ;;ENABLE TTY KEYBOARD INTERRUPT
005652  000207                  RTS     PC              ;;RETURN TO CALLER

                                ;*TK SERVICE ROUTINE
                                ;*THIS ROUTINE WILL SERVICE THE TTY KEYBOARD INTERRUPT
                                ;*BY READING THE CHARACTER FROM THE INPUT BUFFER AND PUTTING
                                ;*IT IN THE QUEUE.
                        002     .IF NB START1
                                ;*IF THE CHARACTER IS A "CONTROL-C" (↑C) $TKINT IS CALLED AND
                                ;*UPON RETURN EXIT IS MADE TO THE "CONTROL-C" RESTART ADDRESS (START1)
                        001     .ENDC

005654  117746  173266          $TKSRV: MOVB    @$TKB,-(SP)     ;;PICKUP THE CHARACTER
005660  042716  177600                  BIC     #↑C177,(SP)     ;;STRIP THE JUNK
                        002     .IF NB START1
005664  021627  000003                  CMP     (SP),#3         ;;IS IT A CONTROL C?
005670  001007                  BNE     1$              ;;BRANCH IF NO
005672  104401  006773                  TYPE    ,$CNTLC         ;;TYPE A CONTROL-C (↑C)
005676  004737  005604                  JSR     PC,$TKINT       ;;INIT THE KEYBOARD
```

```
2727  005702  005726                          TST     (SP)+           ;;CLEAN UP STACK
2728  005704  000137  001460                  JMP     START1          ;;CONTROL C RESTART
2729              001                   .ENDC
2730              002                   .IF NE $SETUP&100
2731  005710  021627  000007            1$:  CMP     (SP),#7         ;;IS IT A CONTROL G?
2732  005714  001004                        BNE     2$              ;;BRANCH IF NO
2733  005716  022737  000176  001140        CMP     #SWREG,SWR      ;;IS SOFT-SWR SELECTED?
2734  005724  001500                        BEQ     6$              ;;GO TO SWR CHANGE
2735              001                   .ENDC
2736
2737  005726                        .IIF NE $SETUP&100,2$:
2738                                .IIF EQ $SETUP&100,1$:
2739  005726  022737  000007  005566        CMP     #7,$TKCNT       ;;IS THE QUEUE FULL?
2740  005734  001004                        BNE     3$              ;;BRANCH IF NO
2741  005736  104401  006767                TYPE    ,$BELL          ;;RING THE TTY BELL
2742  005742  005726                        TST     (SP)+           ;;CLEAN CHARACTER OFF OF STACK
2743  005744  000451                        BR      5$              ;;EXIT
2744  005746  021627  000023            3$:  CMP     (SP),#23        ;;IS IT A CONTROL-S?
2745  005752  001021                        BNE     32$             ;;BRANCH IF NO
2746  005754  005077  173164                CLR     @$TKS           ;;DISABLE TTY KEYBOARD INTERRUPTS
2747  005760  005726                        TST     (SP)+           ;;CLEAN CHAR OFF STACK
2748  005762  105777  173156            31$: TSTB    @$TKS           ;;WAIT FOR A CHAR
2749  005766  100375                        BPL     31$             ;;LOOP UNTIL ITS THERE
2750  005770  117746  173152                MOVB    @$TKB,-(SP)     ;;GET THE CHARACTER
2751  005774  042716  177600                BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII
2752  006000  022627  000021                CMP     (SP)+,#21       ;;IS IT A CONTROL-Q?
2753  006004  001366                        BNE     31$             ;;BRANCH IF NO
2754  006006  012777  000100  173130        MOV     #100,@$TKS      ;;REENABLE TTY KEYBOARD INTERRUPTS
2755  006014  000002                        RTI                     ;;RETURN
2756  006016  005237  005566            32$: INC     $TKCNT          ;;COUNT THIS CHARACTER
2757  006022  021627  000140                CMP     (SP),#140       ;;IS IT UPPER CASE?
2758  006026  002405                        BLT     4$              ;;BRANCH IF YES
2759  006030  021627  000175                CMP     (SP),#175       ;;IS IT A SPECIAL CHAR?
2760  006034  003002                        BGT     4$              ;;BRANCH IF YES
2761  006036  042716  000040                BIC     #40,(SP)        ;;MAKE IT UPPER CASE
2762  006042  112677  177522            4$: MOVB    (SP)+,@$TKQIN   ;;AND PUT IT IN QUEUE
2763  006046  005237  005570                INC     $TKQIN          ;;UPDATE THE POINTER
2764  006052  023727  005570  005603        CMP     $TKQIN,#$TKQEND ;;GO OFF THE END?
2765  006060  001003                        BNE     5$              ;;BRANCH IF NO
2766  006062  012737  005574  005570        MOV     #$TKQSRT,$TKQIN ;;RESET THE POINTER
2767  006070  000002                    5$: RTI                     ;;RETURN
2768              000                   .ENDC
2769
2770              001                   .IF NE $SETUP&100
2771              002                   .IF B
2772                                    ;;*****************************************************************
2773                                    .IFF
2774                                    .NLIST
2775                                    .REPT
2776                                    .LIST
2777                                    ;;*****************************************************************
2778                                    .NLIST
2779                                    .ENDR
2780                                    .LIST
2781              001                   .ENDC
2782              002                   .IF NB 7
```

```
2783                                    ;*SOFTWARE SWITCH REGISTER CHANGE ROUTINE.
2784                                    ;*ROUTINE IS ENTERED  FROM THE TRAP HANDLER, AND WILL
2785                                    ;*SERVICE THE TEST FOR CHANGE IN SOFTWARE SWITCH REGISTER TRAP
2786                                    ;*CALL WHEN OPERATING IN TTY INTERRUPT MODE.
2787  006072  022737  000176  001140  $CKSWR: CMP     #SWREG,SWR      ;;IS THE SOFT-SWR SELECTED
2788  006100  001124                          BNE     1S$             ;;EXIT IF NOT
2789  006102  105777  173036                  TSTB    @$TKS           ;;IS A CHAR WAITING?
2790  006106  100121                          BPL     1S$             ;;IF NOT, EXIT
2791  006110  117746  173032                  MOVB    @$TKB,-(SP)     ;;YES
2792  006114  042716  177600                  BIC     #^C177,(SP)     ;;MAKE IT  7-BIT ASCII
2793  006120  021627  000007                  CMP     (SP),#7         ;;IS IT A CONTROL-G?
2794  006124  001300                          BNE     2S              ;;IF NOT, PUT IT IN THE TTY QUEUE
2795                                                                  ;;AND EXIT
2796
2797             003                  .IF B
2798                                  ;;**************************************************************
2799                                  .IFF
2800                                  .NLIST
2801                                  .REPT
2802                                  .LIST
2803                                  ;;**************************************************************
2804                                  .NLIST
2805                                  .ENDR
2806                                  .LIST
2807             002                  .ENDC
2808                                  ;*CONTROL IS PASSED TO THIS POINT FROM EITHER THE TTY INTERRUPT SERVICE
2809                                  ;*ROUTINE OR FROM THE SOFTWARE SWITCH REGISTER TRAP CALL, AS A RESULT OF A
2810                                  ;*CONTROL-G BEING TYPED, AND THE SOFTWARE SWITCH REGISTER BEING SELECTED.
2811  006126  123727  001134  000001  6$:      CMPB    $AUTOB,#1       ;;ARE WE RUNNING IN AUTO-MODE?
2812  006134  001674                          BEQ     2S              ;;BRANCH IF YES
2813  006136  005726                          TST     (SP)+           ;;CLEAR CONTROL-G OFF STACK
2814  006140  004737  005604                  JSR     PC,$TKINT       ;;FLUSH THE TTY INPUT QUEUE
2815  006144  005077  172774                  CLR     @$TKS           ;;DISABLE TTY KEYBOARD INTERRUPTS
2816  006150  112737  000001  001135          MOVB    #1,$INTAG       ;;SET INTERRUPT MODE INDICATOR
2817
2818                                  .IFF
2819                                  ;*SOFTWARE SWITCH REGISTER CHANGE ROUTINE.
2820                                  ;*ROUTINE IS ENTERED FROM THE TRAP HANDLER, AND WILL
2821                                  ;*SERVICE THE TEST FOR CHANGE IN SOFTWARE SWITCH REGISTER TRAP CALL
2822                                  ;*WHEN OPERATING IN TTY FLAG MODE.
2823                                  $CKSWR: CMP     #SWREG,SWR      ;;IS THE SOFT-SWR SELECTED?
2824                                          BNE     1S$             ;;BRANCH IF NO
2825                                          TSTB    @$TKS           ;;CHAR THERE?
2826                                          BPL     1S$             ;;IF NO, DON'T WAIT AROUND
2827                                          MOVB    @$TKB,-(SP)     ;;SAVE THE CHAR
2828                                          BIC     #^C177,(SP)     ;;STRIP-OFF THE ASCII
2829                                          CMP     #7,(SP)+        ;;IS IT A CONTROL G?
2830                                          BNE     1S$             ;;NO, RETURN TO USER
2831                                          CMPB    $AUTOB,#1       ;;ARE WE RUNNING IN AUTO-MODE?
2832                                          BEQ     1S$             ;;BRANCH IF YES
2833
2834                                  .IFTF
2835  006156  104401  007005                  TYPE    ,$CNTLG         ;;ECHO THE CONTROL-G (^G)
2836  006162  104401  007012          $GTSWR: TYPE    ,$MSWR          ;;TYPE CURRENT CONTENTS
2837  006166  013746  000176                  MOV     $WREG,-(SP)     ;;SAVE SWREG FOR TYPEOUT
2838                                  .IIF NB ,,                      ;;
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2839  006172  104402                        TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
2840  006174  104401  007023                TYPE    ,$MNEW          ;;PROMPT FOR NEW SWR
2841  006200  005046                19$:     CLR     -(SP)           ;;CLEAR COUNTER
2842  006202  005046                        CLR     -(SP)           ;;THE NEW SWR
2843  006204  105777  172734        7$:     TSTB    @$TKS           ;;CHAR THERE?
2844  006210  100375                        BPL     7$              ;;IF NOT TRY AGAIN
2845
2846  006212  117746  172730                MOVB    @$TKB,-(SP)     ;;PICK UP CHAR
2847  006216  042716  177600                BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII
2848
2849              003                       .IF NB START1
2850  006222  021627  000003                CMP     (SP),#3         ;;IS IT A CONTROL-C?
2851  006226  001015                        BNE     9$              ;;BRANCH IF NOT
2852  006230  104401  006773                TYPE    ,$CNTLC         ;;YES, ECHO CONTROL-C (^C)
2853  006234  062706  000006                ADD     #6,SP           ;;CLEAN UP STACK
2854  006240  123727  001135  000001        CMPB    $INTAG,#1       ;;REENABLE TTY KEYBOARD INTERRUPTS?
2855  006246  001003                        BNE     8$              ;;BRANCH IF NO
2856  006250  012777  000100  172666        MOV     #100,@$TKS      ;;ALLOW TTY KEYBOARD INTERRUPTS
2857  006256  000137  001460        8$:     JMP     START1          ;;CONTROL-C RESTART
2858              002                       .ENDC
2859
2860
2861  006262  021627  000025        9$:     CMP     (SP),#25        ;;IS IT A CONTROL-U?
2862  006266  001005                        BNE     10$             ;;BRANCH IF NOT
2863  006270  104401  007000                TYPE    ,$CNTLU         ;;YES, ECHO CONTROL-U (^U)
2864  006274  062706  000006        20$:    ADD     #6,SP           ;;IGNORE PREVIOUS INPUT
2865  006300  000737                        BR      19$             ;;LET'S TRY IT AGAIN
2866
2867
2868  006302  021627  000015        10$:    CMP     (SP),#15        ;;IS IT A <CR>?
2869  006306  001022                        BNE     16$             ;;BRANCH IF NO
2870  006310  005766  000004                TST     4(SP)           ;;YES, IS IT THE FIRST CHAR?
2871  006314  001403                        BEQ     11$             ;;BRANCH IF YES
2872  006316  016677  000002  172614        MOV     2(SP),@SWR      ;;SAVE NEW SWR
2873  006324  062706  000006        11$:    ADD     #6,SP           ;;CLEAR UP STACK
2874  006330  104401  001161        14$:    TYPE    ,$CRLF          ;;ECHO <CR> AND <LF>
2875  006334  123727  001135  000001        CMPB    $INTAG,#1       ;;RE-ENABLE TTY KBD INTERRUPTS?
2876  006342  001003                        BNE     15$             ;;BRANCH IF NOT
2877  006344  012777  000100  172572        MOV     #100,@$TKS      ;;RE-ENABLE TTY KBD INTERRUPTS
2878  006352  000002        15$:    RTI                             ;;RETURN
2879  006354  004737  005044        16$:    JSR     PC,$TYPEC       ;;ECHO CHAR
2880  006360  021627  000060                CMP     (SP),#60        ;;CHAR < 0?
2881  006364  002420                        BLT     18$             ;;BRANCH IF YES
2882  006366  021627  000067                CMP     (SP),#67        ;;CHAR > 7?
2883  006372  003015                        BGT     18$             ;;BRANCH IF YES
2884  006374  042726  000060                BIC     #60,(SP)+       ;;STRIP-OFF ASCII
2885  006400  005766  000002                TST     2(SP)           ;;IS THIS THE FIRST CHAR
2886  006404  001403                        BEQ     17$             ;;BRANCH IF YES
2887  006406  006316                        ASL     (SP)            ;;NO, SHIFT PRESENT
2888  006410  006316                        ASL     (SP)            ;;    CHAR OVER TO MAKE
2889  006412  006316                        ASL     (SP)            ;;    ROOM FOR NEW ONE.
2890  006414  005266  000002        17$:    INC     2(SP)           ;;KEEP COUNT OF CHAR
2891  006420  056616  177776                BIS     -2(SP),(SP)     ;;SET IN NEW CHAR
2892  006424  000667                        BR      7$              ;;GET THE NEXT ONE
2893  006426  104401  001160        18$:    TYPE    ,$QUES          ;;TYPE ?<CR><LF>
2894  006432  000720                        BR      20$             ;;SIMULATE CONTROL-U
```

```
2895                    001                     .ENDC
2896                    000                     .ENDC
2897                                            .DSABL  LSB
2898
2899
2900                    001                     .IF B
2901                                            ;;*****************************************************************
2902                                            .IFF
2903                                            .NLIST
2904                                            .REPT
2905                                            .LIST
2906                                            ;;*****************************************************************
2907                                            .NLIST
2908                                            .ENDR
2909                                            .LIST
2910                    000                     .ENDC
2911                    001                     .IF NB ?
2912                                            .IFTF
2913                                            ;*THIS ROUTINE WILL INPUT A SINGLE CHARACTER FROM THE TTY
2914                                            ;*CALL:
2915                                            .IFT
2916                                            ;*      RDCHR                   ;;GET A CHARACTER FROM THE QUEUE
2917                                            .IFF
2918                                            ;*      RDCHR                   ;;INPUT A SINGLE CHARACTER FROM THE TTY
2919                                            .IFTF
2920                                            ;*      RETURN HERE             ;;CHARACTER IS ON THE STACK
2921                                            ;*                              ;;WITH PARITY BIT STRIPPED OFF
2922                                            ;
2923
2924                                            .IFT
2925  006434  011646                           $RDCHR: MOV     (SP),-(SP)      ;;PUSH DOWN THE PC AND
2926  006436  016666  000004  000002                    MOV     4(SP),2(SP)     ;;THE PS
2927  006444  005066  000004                           CLR     4(SP)           ;;GET READY FOR A CHARACTER
2928                    002                     .IF IDN <#0>,#0
2929  006450  005046                                   CLR     -(SP)           ;;PUT NEW PS ON STACK
2930                                            .IFF
2931                                                      MOV     #0,-(SP)        ;;PUT NEW PS ON STACK
2932                    001                     .ENDC
2933  006452  012746  006460                           MOV     #64$,-(SP)      ;;PUT NEW PC ON  STACK
2934  006456  000002                                   RTI                     ;;POP NEW PC AND PS
2935  006460                                  64$:
2936  006460  005737  005566                  1$:     TST     $TKCNT          ;;WAIT ON A CHARACTER
2937  006464  001775                                   BEQ     1$
2938  006466  005337  005566                          DEC     $TKCNT          ;;DECREMENT THE COUNTER
2939  006472  117766  177074  000004                  MOVB    @$TKQOUT,4(SP)  ;;GET ONE CHARACTER
2940  006500  005237  005572                          INC     $TKQOUT         ;;UPDATE THE POINTER
2941  006504  023727  005572  005603                  CMP     $TKQOUT,#$TKQEND ;;DID IT GO OFF OF THE END?
2942  006512  001003                                   BNE     2$              ;;BRANCH IF NO
2943  006514  012737  005574  005572                  MOV     #$TKQSRT,$TKQOUT ;;RESET THE POINTER
2944  006522  000002                          2$:     RTI                     ;;RETURN
2945                                            .IFF
2946                                           $RDCHR: MOV     (SP),-(SP)      ;;PUSH DOWN THE PC
2947                                                   MOV     4(SP),2(SP)     ;;SAVE THE PS
2948                                           1$:     TSTB    @$TKS           ;;WAIT FOR
2949                                                   BPL     1$              ;;A CHARACTER
2950                                                   MOVB    @$TKB,4(SP)     ;;READ THE TTY
```

```
                                        BIC     #^C<177>,4(SP)  ;;GET RID OF JUNK IF ANY
                                        CMP     4(SP),#23       ;;IS IT A CONTROL-S?
                                        BNE     3$              ;;BRANCH IF NO
                                2$.     TSTB    @$TKS           ;;WAIT FOR A CHARACTER
                                        BPL     2$              ;;LOOP UNTIL ITS THERE
                                        MOVB    @$TKB,-(SP)     ;;GET CHARACTER
                                        BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII
                                        CMP     (SP)+,#21       ;;IS IT A CONTROL-Q?
                                        BNE     2$              ;;IF NOT DISCARD IT
                                        BR      1$              ;;YES, RESUME
                                3$:     CMP     4(SP),#140      ;;IS IT UPPER CASE?
                                        BLT     4$              ;;BRANCH IF YES
                                        CMP     4(SP),#175      ;;IS IT A SPECIAL CHAR?
                                        BGT     4$              ;;BRANCH IF YES
                                        BIC     #40,4(SP)       ;;MAKE IT UPPER CASE
                                4$:     RTI                     ;;GO BACK TO USER
                        000             .ENDC
                        001             .IF NB 7
                                        .IFF
                                        .NLIST
                                        $RDSZ=8.
                                        .LIST
                        000             .ENDC
                        001             .IF GT $RDSZ-1
                        002             .IF 8
                                        ;;*****************************************************************
                                        .IFF
                                        .NLIST
                                         REPT
                                        .LIST
                                        ;;*****************************************************************
                                        .NLIST
                                        .ENDR
                                        .LIST
                            001         .ENDC
                                        ;*THIS ROUTINE WILL INPUT A STRING FROM THE TTY
                                        ;*CALL:
                                        ;*      RDLIN                   ;;INPUT A STRING FROM THE TTY
                                        ;*      RETURN HERE             ;;ADDRESS OF FIRST CHARACTER WILL BE ON THE STACK
                                        ;*                              ;;TERMINATOR WILL BE A BYTE OF ALL 0'S

006524  010346                         $RDLIN: MOV     R3,-(SP)        ;;SAVE R3
                    002                 .IF NB <X>
006526  005046                          CLR     -(SP)                   ;;CLEAR THE RUBOUT KEY
                    001                 .ENDC
006530  012703  006760                  1$:     MOV     #$TTYIN,R3      ;;GET ADDRESS
                    002                 .IF B <7>
                                        2$:     CMP     #$TTYIN+8.,R3   ;;BUFFER FULL?
                                        .IFF
006534  022703  006767                  2$:     CMP     #$TTYIN+7,R3    ;;BUFFER FULL?
                    001                 .ENDC
006540  101456                          BLOS    4$                      ;;BR IF YES
006542  104410                          RDCHR                           ;;GO READ ONE CHARACTER FROM THE TTY
006544  112613                          MOVB    (SP)+,(R3)              ;;GET CHARACTER
                    002                 .IF B 7
                    003                 .IF NB START1
```

```
3007                                                    CMPB    #3,(R3)         ;;IS IT A CONTROL-C?
3008                                                    BNE     10$             ;;BRANCH IF NO
3009                                                    TYPE    ,$CNTLC         ;;TYPE A CONTROL-C (↑C)
3010                                            .IIF NB <X>,    TST     (SP)+           ;;CLEAN RUBOUT KEY OFF OF THE STACK
3011                                                    MOV     (SP)+,R3        ;;RESTORE R3
3012                                                    JMP     START           ;;GOTO CONTROL-C RESTART
3013                    002                     .ENDC
3014                    001                     .ENDC
3015  006546  122713    000177                10$:     CMPB    #177,(R3)       ;;IS IT A RUBOUT
3016                    002                     .IF NB <X>
3017  006552  001022                                    BNE     5$              ;;BR IF NO
3018  006554  005716                                    TST     (SP)            ;;IS THIS THE FIRST RUBOUT?
3019  006556  001007                                    BNE     6$              ;;BR IF NO
3020  006560  112737    000134    006756              MOVB    #'\,9$          ;;TYPE A BACK SLASH
3021  006566  104401    006756                        TYPE    ,9$
3022  006572  012716    177777                        MOV     #-1,(SP)        ;;SET THE RUBOUT KEY
3023  006576  005303                        6$:     DEC     R3              ;;BACKUP BY ONE
3024  006600  020327    006760                        CMP     R3,#$TTYIN      ;;STACK EMPTY?
3025  006604  103434                                  BLO     4$              ;;BR IF YES
3026  006606  111337    006756                        MOVB    (R3),9$         ;;SETUP TO TYPEOUT THE DELETED CHAR.
3027  006612  104401    006756                        TYPE    ,9$             ;;GO TYPE
3028  006616  000746                                  BR      2$              ;;GO READ ANOTHER CHAR.
3029  006620  005716                        5$:     TST     (SP)            ;;RUBOUT KEY SET?
3030  006622  001406                                  BEQ     7$              ;;BR IF NO
3031  006624  112737    000134    006756              MOVB    #'\,9$          ;;TYPE A BACK SLASH
3032  006632  104401    006756                        TYPE    ,9$
3033  006636  005016                                  CLR     (SP)            ;;CLEAR THE RUBOUT KEY
3034  006640  122713    000025                7$:     CMPB    #25,(R3)        ;;IS CHARACTER A CTRL U?
3035  006644  001003                                  BNE     8$              ;;BR IF NO
3036  006646  104401    007000                        TYPE    ,$CNTLU         ;;TYPE A CONTROL "U"
3037  006652  000726                                  BR      1$              ;;GO START OVER
3038  006654  122713    000022                8$:     CMPB    #22,(R3)        ;;IS CHARACTER A "↑R"?
3039  006660  001011                                  BNE     3$              ;;BRANCH IF NO
3040  006662  105013                                  CLRB    (R3)            ;;CLEAR THE CHARACTER
3041  006664  104401    001161                        TYPE    ,$CRLF          ;;TYPE A "CR" & "LF"
3042  006670  104401    006760                        TYPE    ,$TTYIN         ;;TYPE THE INPUT STRING
3043  006674  000717                                  BR      2$              ;;GO PICKUP ANOTHER CHACTER
3044                                            .IFF
3045                                                    BNE     3$              ;;SKIP IF NOT
3046                    001                     .ENDC
3047  006676  104401    001160                4$:     TYPE    ,$QUES          ;;TYPE A '?'
3048  006702  000712                                  BR      1$              ;;CLEAR THE BUFFER AND LOOP
3049  006704  111337    006756                3$:     MOVB    (R3),9$         ;;ECHO THE CHARACTER
3050  006710  104401    006756                        TYPE    ,9$
3051  006714  122723    000015                        CMPB    #15,(R3)+       ;;CHECK FOR RETURN
3052  006720  001305                                  BNE     2$              ;;LOOP IF NOT RETURN
3053  006722  105063    177777                        CLRB    -1(R3)          ;;CLEAR RETURN (THE 15)
3054  006726  104401    001162                        TYPE    ,$LF            ;;TYPE A LINE FEED
3055  006732  005726                                  .IIF NB <X>,    TST     (SP)+           ;;CLEAN RUBOUT KEY FROM THE STACK
3056  006734  012603                                  MOV     (SP)+,R3        ;;RESTORE R3
3057  006736  011646                                  MOV     (SP),-(SP)      ;;ADJUST THE STACK AND PUT ADDRESS OF THE
3058  006740  016666    000004    000002              MOV     4(SP),2(SP)     ;;      FIRST ASCII CHARACTER ON IT
3059  006746  012766    006760    000004              MOV     #$TTYIN,4(SP)
3060  006754  000002                                  RTI                     ;;RETURN
3061  006756     000                        9$:     .BYTE   0               ;;STORAGE FOR ASCII CHAR. TO TYPE
3062  006757     000                                .BYTE   0               ;;TERMINATOR
```

```
                        002                     .IF B <7>
                                                $TTYIN: .BLKB   8.              ;;RESERVE 8 BYTES FOR TTY INPUT
                                                .IFF
006760  000007                                  $TTYIN: .BLKB   7               ;;RESERVE 7 BYTES FOR TTY INPUT
                        001                     .ENDC
                                                .IIF NDF $QUES,$QUES:
                                                .IIF EQ .-$QUES,$QUES:  .ASCII  "?"     ;;QUESTION MARK
                                                .IIF NDF $CRLF,$CRLF:
                                                .IIF EQ .-$CRLF,$CRLF:  .ASCII  <15>    ;CARRIAGE RETURN
                                                .IIF NDF $LF,$LF:
                                                .IIF EQ .-$LF,$LF:      .ASCIZ  <12>    ;;LINE FEED
                        000                     .ENDC
                        001                     .IF NB 7
                                                .IIF NDF $BELL,$BELL:
006767          207     177777          000     .IIF EQ .-$BELL,$BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
                        000                     .ENDC
                        001                     .IF NB START1
                                                .IIF NDF $CNTLC,$CNTLC:
006773          136     006503  000012          .IIF EQ .-$CNTLC,$CNTLC:        .ASCIZ  /↑C/<15><12>    ;;CONTROL "C"
                        000                     .ENDC
007000  052536  005015          000             $CNTLU: .ASCIZ  /↑U/<15><12>    ;;CONTROL "U"
007005          136     006507  000012          $CNTLG: .ASCIZ  /↑G/<15><12>    ;;CONTROL "G"
007012  005015  053523  020122                  $MSWR:  .ASCIZ  <15><12>/SWR = /
007020  020075          000
007023          040     047040  053505          $MNEW:  .ASCIZ  /  NEW = /
007030  036440  000040
                        001                     .IF NE $SETUP & 100
                                                .IIF NDF $AUTOB,$AUTOB:
                                                .IIF EQ .-$AUTOB,$AUTOB:        .BYTE   0       ;;AUTO MODE FLAG
                                                .IIF NDF $INTAG,$INTAG:
                                                .IIF EQ .-$INTAG,$INTAG:        .BYTE   0       ;;INTERRUPT MODE FLAG
                        000                     .ENDC
                                                .IIF NE 1&.,.EVEN
                                                .SBTTL  RANDOM NUMBER GENERATOR ROUTINE
                        001                     .IF B
                                                ;;*****************************************************************
                                                .IFF
                                                .NLIST
                                                .REPT
                                                .LIST
                                                ;;*****************************************************************
                                                .NLIST
                                                .ENDR
                                                .LIST
                        000                     .ENDC
                                                ;*THIS ROUTINE IS A DOUBLE PRECISION PSEUDO RANDOM NUMBER GENERATOR
                                                ;*WITH A RANGE OF 0 TO 2(+33)-1.
                                                ;*CALL:
                                                ;*      JSR     PC,$RAND        ;;CALL THE ROUTINE
                                                ;*      RETURN                  ;;RETURN HERE THE RANDOM
                                                ;*                              ;;NUMBER WILL BE IN
                                                ;*                              ;;$HINUM,$LONUM

007034                                          $RAND:
007034  010046                                          MOV     RO,-(SP)        ;;PUSH R0 ON STACK
```

```
3119  007036  010146                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
3120  007040  010246                  MOV     R2,-(SP)        ;;PUSH R2 ON STACK
3121  007042  013700  007134          MOV     $LONUM,R0       ;;SET R0 WITH LOW
3122  007046  013701  007132          MOV     $HINUM,R1       ;;SET R1 WITH HIGH
3123  007052  012702  177771          MOV     #-7,R2          ;;SET SHIFT COUNT
3124  007056  006300            1$:   ASL     R0              ;;SHIFT R0 LEFT AND
3125  007060  006101                  ROL     R1              ;;ROTATE CARRY INTO R1 AND
3126  007062  005202                  INC     R2              ;;CHECK FOR DONE
3127  007064  001374                  BNE     1$              ;;CONTINUE SHIFT LOOP
3128  007066  063700  007134          ADD     $LONUM,R0       ;;ADD NUMBER TO MAKE X 129
3129  007072  005501                  ADC     R1              ;;PROPOGATE CARRY
3130  007074  063701  007132          ADD     $HINUM,R1       ;;ADD NUMBER TO MAKE X 129
3131  007100  062700  001057          ADD     #1057,R0        ;;ADD LOW CONSTANT
3132  007104  005501                  ADC     R1              ;;PROPOGATE CARRY
3133  007106  062701  047401          ADD     #47401,R1       ;;ADD HIGH CONSTANT
3134  007112  010037  007134          MOV     R0,$LONUM       ;;SAVE R0
3135  007116  010137  007132          MOV     R1,$HINUM       ;;SAVE R1
3136  007122  012602                  MOV     (SP)+,R2        ;;POP STACK INTO R2
3137  007124  012601                  MOV     (SP)+,R1        ;;POP STACK INTO R1
3138  007126  012600                  MOV     (SP)+,R0        ;;POP STACK INTO R0
3139  007130  000207                  RTS     PC              ;;RETURN
3140  007132  176543            $HINUM: .WORD   176543
3141  007134  123456            $LONUM: .WORD   123456
3142                            .SBTTL  INTEGER DIVIDE ROUTINE
3143
3144              001           .IF B
3145                            ;;*****************************************************************
3146                            .IFF
3147                            .NLIST
3148                            .REPT
3149                            .LIST
3150                            ;;********************************* ***************************
3151                            .NLIST
3152                            .ENDR
3153                            .LIST
3154              000           .ENDC
3155                            ;*THIS ROUTINE WILL DIVIDE A 32-BIT TWO'S COMPLEMENT INTEGER
3156                            ;*DIVIDEND BY A 16-BIT TWO'S COMPLEMENT INTEGER DIVISOR GIVING
3157                            ;*A 16-BIT TWO'S COMPLEMENT INTEGER QUOTIENT AND A 16-BIT REMAINDER.
3158                            ;*DIVISION WILL BE PERFORMED SO THAT THE REMAINDER IS OF THE
3159                            ;*SAVE SIGN AS THE DIVIDEND.
3160                            ;*CALL:
3161                            ;*      MOV     LOW DIVIDEND,-(SP) ;;THE HIGH DIVIDEND MUST BE < 1/2
3162                            ;*      MOV     HIGH DIVIDEND,-(SP);    AS LARGE AS THE DIVISOR
3163                            ;*      MOV     DIVISOR,-(SP)
3164                            ;*      JSR     PC,$DIV
3165                            ;*      RETURN                  ;;QUOTIENT & REMAINDER ARE ON THE STACK
3166                            ;*      "V"=0   IMPLIES NO ERROR
3167                            ;*      "V"=1   IMPLIES ERROR OCCURRED
3168                            ;*              "C"=0   DIVIDE OVERFLOW OCCURRED
3169                            ;*              "C"=1   ATTEMPTED TO DIVIDE BY ZERO
3170                            ;*
3171                            ;*
3172                            ;*      STACK   NO ERROR        OVERFLOW        DIVIDE BY ZERO
3173                            ;*      -----   --------        --------        --------------
3174                            ;*      TOP     REMAINDER       ALL ZEROS       ALL ONES
```

```
                                        ;*      +2      QUOTIENT        ALL ZEROS       ALL ONES

007136                                  $DIV:
007136  104400                          TRAP                            ;;PUSH OLD PSW AND PC ON STACK
                001                     .IF NB
                                        MOV     (SP)+,  ;;SAVE THE PSW IN
                000                     .ENDC
007140  042716  000017                  BIC     #17,(SP)                ;;STRIP AWAY CONDITION CODES
007144  010046                          MOV     R0,-(SP)                ;;PUSH R0 ON STACK
007146  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
007150  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
007152  010346                          MOV     R3,-(SP)                ;;PUSH R3 ON STACK
007154  005046                          CLR     -(SP)                   ;;SAVE A PLACE FOR SIGNS
007156  012746  000021                  MOV     #17.,-(SP)              ;;SETUP THE ITERATION COUNTER
007162  016601  000024                  MOV     24(SP),R1               ;;PICKUP THE DIVIDEND
007166  016600  000022                  MOV     22(SP),R0
007172  100005                          BPL     1$                      ;;CHECK THE SIGN
007174  105366  000003                  DECB    3(SP)                   ;;KEEP TRACK OF THE SIGN
007200  005400                          NEG     R0                      ;;AND NEGATE THE ORIGINAL
007202  005401                          NEG     R1                      ;;NUMBER
007204  005600                          SBC     R0
007206  016602  000020          1$:     MOV     20(SP),R2               ;;PICKUP THE DIVISOR
007212  002407                          BLT     2$                      ;;CHECK THE SIGN
007214  003011                          BGT     3$                      ;;DIVISOR OF 0 IS A NO-NO
007216  052766  000003  000014          BIS     #3,14(SP)               ;;SET "V" & "C"
007224  012700  177777                  MOV     #-1,R0                  ;;SET REMAINDER TO ALL ONES
007230  000424                          BR      7$                      ;;EXIT
007232  005266  000002          2$:     INC     2(SP)                   ;;KEEP TRACK OF DIVISORS SIGN
007236  000401                          BR      4$
007240  005402                  3$:     NEG     R2                      ;;NEGATE THE ORIGINAL NUMBER
007242  000241                  4$:     CLC                             ;;CLEAR "C"
007244  000405                          BR      6$                      ;;START FORMING QUOTIENT
007246  006100                  5$:     ROL     R0                      ;;POSITION MSB'S
007250  010003                          MOV     R0,R3                   ;;COPY
007252  060203                          ADD     R2,R3                   ;;COMPARE DIVIDEND & DIVISOR
007254  103001                          BCC     6$                      ;;BR IF DIVIDEND > DIVISOR
007256  010300                          MOV     R3,R0                   ;;REMAINDER AFTER THIS LOOP
007260  006101                  6$:     ROL     R1                      ;;QUOTIENT BIT ENTERS HERE
007262  005316                          DEC     (SP)                    ;;DONE?
007264  001370                          BNE     5$                      ;;BR IF NO
007266  005701                          TST     R1                      ;;OVERFLOW?
007270  100005                          BPL     8$                      ;;BR IF NO
007272  052766  000002  000014          BIS     #2,14(SP)               ;;SET "V" IN RETURN STATUS WORD
007300  005000                          CLR     R0                      ;;SET REMAINDER TO ALL ZEROS
007302  010001                  7$:     MOV     R0,R1                   ;;COPY REMAINDER INTO QUOTIENT
007304  005726                  8$:     TST     (SP)+                   ;;CLEAR COUNTER FROM STACK
007306  005716                          TST     (SP)                    ;;REMAINDER SIGN CORRECTION NEEDED?
007310  002004                          BGE     9$                      ;;BR IF NO
007312  005400                          NEG     R0                      ;;NEGATE REMAINDER
007314  105066  000001                  CLRB    1(SP)                   ;;CLEAR SIGN
007320  005316                          DEC     (SP)                    ;;BUT DON'T FORGET QUOTIENT
007322  005726                  9$:     TST     (SP)+                   ;;QUOTIENT SIGN CORRECTION NEEDED?
007324  001401                          BEQ     10$                     ;;BR IF NO
007326  005401                          NEG     R1                      ;;NEGATE QUOTIENT
007330  010166  000020          10$:    MOV     R1,20(SP)               ;;RETURN QUOTIENT AND
007334  010066  000016                  MOV     R0,16(SP)               ;;REMAINDER TO USER
```

```
                                        MOV     (SP)+,R3        ;;POP STACK INTO R3
                                        MOV     (SP)+,R2        ;;POP STACK INTO R2
                                        MOV     (SP)+,R1        ;;POP STACK INTO R1
                                        MOV     (SP)+,R0        ;;POP STACK INTO R0
                                        MOV     (SP)+,2(SP)     ;;SETUP TO RETURN CONDITION CODES
                                        RTI                     ;;RETURN
                                .SBTTL  SAVE AND RESTORE R0-R5 ROUTINES

                        001             .IF B
                                ;;**********************************************************************
                                .IFF
                                .NLIST
                                .REPT
                                .LIST
                                ;;**********************************************************************
                                .NLIST
                                .ENDR
                                .LIST
                        000             .ENDC
                                ;*SAVE R0-R5
                                ;*CALL:
                                ;*      SAVREG
                                ;*UPON RETURN FROM $SAVREG THE STACK WILL LOOK LIKE:
                                ;*
                                ;*TOP---(+16)
                                ;* +2---(+18)
                                ;* +4---R5
                                ;* +6---R4
                                ;* +8---R3
                                ;*+10---R2
                                ;*+12---R1
                                ;*+14---R0

007356                          $SAVREG:
007356  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
007360  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
007362  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
007364  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
007366  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
007370  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
007372  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PS OF MAIN FLOW
007376  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PC OF MAIN FLOW
007402  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PS OF CALL
007406  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PC OF CALL
007412  000002                          RTI

                                ;*RESTORE R0-R5
                                ;*CALL:
                                ;*      RESREG

007414                          $RESREG:
007414  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PC OF CALL
007420  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PS OF CALL
007424  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PC OF MAIN FLOW
007430  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PS OF MAIN FLOW
007434  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
007436  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
```

```
3287  007440  012603                        MOV     (SP)+,R3        ;;POP STACK INTO R3
3288  007442  012602                        MOV     (SP)+,R2        ;;POP STACK INTO R2
3289  007444  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
3290  007446  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
3291  007450  000002                        RTI
3292                                .SBTTL  TRAP DECODER
3293
3294             001                .IF B
3295                                ;;**************************************************************
3296                                .IFF
3297                                .NLIST
3298                                .REPT
3299                                .LIST
3300                                ;;**************************************************************
3301                                .NLIST
3302                                .ENDR
3303                                .LIST
3304             000                .ENDC
3305                                ;*THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE "TRAP" INSTRUCTION
3306                                ;*AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
3307                                ;*OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL
3308                                ;*GO TO THAT ROUTINE.
3309
3310             001                .IF B
3311  007452  010046                $TRAP:  MOV     R0,-(SP)        ;;SAVE R0
3312                                .IFF
3313                                $TRAP:  MOV     2(SP),-(SP)     ;;ASSUME THE STATUS OF
3314                                        BIC     #20,(SP)        ;;  THE CALLER--DO NOT ALLOW
3315                                        MOV     #1$,-(SP)       ;;  T-BIT TRAPS
3316                                        RTI                     ;;SET THE NEW STATUS
3317                                1$:     MOV     R0,-(SP)        ;;SAVE R0
3318             000                .ENDC
3319  007454  016600  000002                MOV     2(SP),R0        ;;GET TRAP ADDRESS
3320  007460  005740                        TST     -(R0)           ;;BACKUP BY 2
3321  007462  111000                        MOVB    (R0),R0         ;;GET RIGHT BYTE OF TRAP
3322             001                .IF NB
3323                                        BPL     $TRAP1          ;;NON-USER TRAP,BELOW 200
3324                                        BIC     #^C177,R0       ;;STRIP AWAY THE JUNK
3325                                        JMP     (PC)            ;;USER TRAP,ABOVE 177, GO TO
3326                                        .WORD                   ;;  USER TRAP HANDLER-
3327                                $TRAP1:
3328             000                .ENDC
3329             001                .IF NB
3330                                        CMP     #$TERM,R0       ;;CHECK FOR OUT OF BOUNDS
3331                                        BGT     .+6             ;;BR IF OK
3332                                        HALT                    ;;OUT OF BOUNDS
3333                                        BR      .-2             ;;HANGUP
3334             000                .ENDC
3335  007464  006300                        ASL     R0              ;;POSITION FOR INDEXING
3336  007466  016000  007506                MOV     $TRPAD(R0),R0   ;;INDEX TO TABLE
3337  007472  000200                        RTS     R0              ;;GO TO ROUTINE
3338
3339
3340                                ;;THIS IS USE TO HANDLE THE "GETPRI" MACRO
3341
3342  007474  011646                $TRAP2: MOV     (SP),-(SP)      ;;MOVE THE PC DOWN
```

```
3343  007476  016666  000004  000002          MOV     4(SP),2(SP)     ;;MOVE THE PSW DOWN
3344  007504  000002                          RTI                     ;;RESTORE THE PSW
3345
3346                                  .MACRO  SETTRAP A,B,MSG
3347                                          $$SET   A,B,\<TRAP+$TRP>,\$TRP,<MSG>
3348                                  .NLIST
3349                                 $TRP=$TRP+1
3350                                  .LIST
3351                                  .ENDM   SETTRAP
3352                                  .MACRO  $$SET   A,B,C,D,COMNT
3353                                  .IF EQ $TRP-1
3354                                  .SBTTL  TRAP TABLE
3355
3356                                  ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3357                                  ;*BY THE "TRAP" INSTRUCTION.
3358
3359                                  ;       ROUTINE
3360                                  ;       -------
3361                                 $TRPAD: .WORD   $TRAP2
3362                                  .ENDC
3363                                  .IIF NDF GNS,.NLIST
3364                                          A=      C
3365                                  .IIF NDF GNS,.LIST
3366                                          B       ;;CALL=A        TRAP+D(C)       COMNT
3367                                  .ENDM   $$SET
3368                                  .MACRO  TRMTRP
3369                                 $TERM=.-$TRPAD
3370                                  .ENDM   TRMTRP
3371            001                   .IF DF $TYPE
3372            002                   .IF EQ $TRP-1
3373                                  .SBTTL  TRAP TABLE
3374
3375                                  ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3376                                  ;*BY THE "TRAP" INSTRUCTION.
3377
3378                                  ;       ROUTINE
3379                                  ;       -------
3380  007506  007474                 $TRPAD: .WORD   $TRAP2
3381              001                 .ENDC
3382  007510  004674                         $TYPE   ;;CALL=TYPE     TRAP+1(104401)  TTY TYPEOUT ROUTINE
3383              000                 .ENDC
3384              001                 .IF DF $TYPOC
3385              002                 .IF EQ $TRP-1
3386                                  .SBTTL  TRAP TABLE
3387
3388                                  ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3389                                  ;*BY THE "TRAP" INSTRUCTION.
3390
3391                                  ;       ROUTINE
3392                                  ;       -------
3393                                 $TRPAD: .WORD   $TRAP2
3394              001                 .ENDC
3395  007512  005140                         $TYPOC  ;;CALL=TYPOC    TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
3396              002                 .IF EQ $TRP-1
3397                                  .SBTTL  TRAP TABLE
3398
```

```
3399                                    ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3400                                    ;*BY THE "TRAP" INSTRUCTION.
3401
3402                                    ;       ROUTINE
3403                                    ;       -------
3404                                    $TRPAD: .WORD   $TRAP2
3405        001                         .ENDC
3406  007514  005114                           $TYPOS  ;;CALL=TYPOS    TRAP+3(104403)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
3407        002                         .IF EQ $TRP-1
3408                                    .SBTTL  TRAP TABLE
3409
3410                                    ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3411                                    ;*BY THE "TRAP" INSTRUCTION.
3412
3413                                    ;       ROUTINE
3414                                    ;       -------
3415                                    $TRPAD: .WORD   $TRAP2
3416        001                         .ENDC
3417  007516  005154                           $TYPON  ;;CALL=TYPON    TRAP+4(104404)  TYPE OCTAL NUMBER (AS PER LAST CALL)
3418        000                         .ENDC
3419        001                         .IF DF $TYPDS
3420        002                         .IF EQ $TRP-1
3421                                    .SBTTL  TRAP TABLE
3422
3423                                    ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3424                                    ;*BY THE "TRAP" INSTRUCTION.
3425
3426                                    ;       ROUTINE
3427                                    ;       -------
3428                                    $TRPAD: .WORD   $TRAP2
3429        001                         .ENDC
3430  007520  005342                           $TYPDS  ;;CALL=TYPDS    TRAP+5(104405)  TYPE DECIMAL NUMBER (WITH SIGN)
3431        000                         .ENDC
3432        001                         .IF DF $TYPBN
3433                                            SETTRAP TYPBN,$TYPBN,^/TYPE BINARY (ASCII) NUMBER/
3434        000                         .ENDC
3435
3436        001                         .IF DF $GTSWR
3437        002                         .IF EQ $TRP-1
3438                                    .SBTTL  TRAP TABLE
3439
3440                                    ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
3441                                    ;*BY THE "TRAP" INSTRUCTION.
3442
3443                                    ;       ROUTINE
3444                                    ;       -------
3445                                    $TRPAD: .WORD   $TRAP2
3446        001                         .ENDC
3447  007522  006162                           $GTSWR  ;;CALL=GTSWR    TRAP+6(104406)  GET SOFT-SWR SETTING
3448        000                         .ENDC
3449
3450        001                         .IF DF $CKSWR
3451        002                         .IF EQ $TRP-1
3452                                    .SBTTL  TRAP TABLE
3453
3454                                    ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
```

```
                                ;*BY THE "TRAP" INSTRUCTION.
                                ;
                                ;       ROUTINE
                                ;       -------
                                $TRPAD: .WORD   $TRAP2
                                .ENDC
                                        $CKSWR  ;;CALL=CKSWR    TRAP+7(104407)  TEST FOR CHANGE IN SOFT-SWR
                                .ENDC
                                .IF DF $RDCHR
                                .IF EQ $TRP-1
                                .SBTTL  TRAP TABLE

                                ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
                                ;*BY THE "TRAP" INSTRUCTION.

                                ;       ROUTINE
                                ;       -------
                                $TRPAD: .WORD   $TRAP2
                                .ENDC
                                        $RDCHR  ;;CALL=RDCHR    TRAP+10(104410) TTY TYPEIN CHARACTER ROUTINE
                                .ENDC
                                .IF DF $RDLIN
                                .IF EQ $TRP-1
                                .SBTTL  TRAP TABLE

                                ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
                                ;*BY THE "TRAP" INSTRUCTION.

                                ;       ROUTINE
                                ;       -------
                                $TRPAD: .WORD   $TRAP2
                                .ENDC
                                        $RDLIN  ;;CALL=RDLIN    TRAP+11(104411) TTY TYPEIN STRING ROUTINE
                                .ENDC
                                .IF DF $RDOCT
                                        SETTRAP RDOCT,$RDOCT,↑/READ AN OCTAL NUMBER FROM TTY/
                                .ENDC
                                .IF DF $RDDEC
                                        SETTRAP RDDEC,$RDDEC,↑/READ A DECIMAL NUMBER FROM TTY/
                                .ENDC
                                .IF DF $SAVREG
                                .IF EQ $TRP-1
                                .SBTTL  TRAP TABLE

                                ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
                                ;*BY THE "TRAP" INSTRUCTION.

                                ;       ROUTINE
                                ;       -------
                                $TRPAD: .WORD   $TRAP2
                                .ENDC
                                        $SAVREG ;;CALL=SAVREG   TRAP+12(104412) SAVE R0-R5 ROUTINE
                                .IF EQ $TRP-1
                                .SBTTL  TRAP TABLE

                                ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
```

```
                                ;*BY THE "TRAP" INSTRUCTION.
                                ;
                                ;       ROUTINE
                                ;       -------
                                $TRPAD: .WORD   $TRAP2
                                .ENDC
                                        $RESREG ;;CALL=RESREG   TRAP+13(104413) RESTORE R0-R5 ROUTINE
                                .ENDC
                                .IF DF  $R2A
                                        SETTRAP R2AZ,$R2AZ
                                        SETTRAP R2AZ.,$R2AZ.
                                        SETTRAP R2AZQ,$R2AZQ
                                .ENDC
                                .MACRO  ERRCAL  N,M
                                .IF DF $ESCAPE
                                        JSR     R0,ES.SAV       ;SAVE THE ADDRESS IN '$ESCAPE'
                                .ENDC
                                        ERROR   N               ;'M
                                .ENDM   ERRCAL


                                .SBTTL  SINGLE/DUAL PORT RH11/RP04/5/6 DRIVER (REV 1.0)

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                                ;MAYNARD, MA 01754
                                ;AUTHOR(S): JIM LACEY/CHUCK HESS

                                .IF B
                                ;;*****************************************************************
                                .IFF
                                .NLIST
                                .REPT
                                .LIST
                                ;;*****************************************************************
                                .NLIST
                                .ENDR
                                .LIST
                                .ENDC

                                ;STORAGE FOR RPDS1, RPER1, RPER2, AND RPER3 ON AN ERROR "2"
                                        ;RPERRS   = RPDS1
                                        ;RPERRS+2 = RPER1
                                        ;RPERRS+4 = RPER2
                                        ;RPERRS+6 = RPER3

007536  000000  000000  000000  RPERRS: .WORD   0,0,0,0
007544  000000

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

007546  000             DRVACT: .BYTE   0               ;DRIVE 0
007547  000                     .BYTE   0               ;DRIVE 1
```

```
3567  007550  000                     .BYTE   0               ;DRIVE 2
3568  007551  000                     .BYTE   0               ;DRIVE 3
3569  007552  000                     .BYTE   0               ;DRIVE 4
3570  007553  000                     .BYTE   0               ;DRIVE 5
3571  007554  000                     .BYTE   0               ;DRIVE 6
3572  007555  000                     .BYTE   0               ;DRIVE 7
3573
3574                          ;TABLE OF DRIVE STATUS INDICATORS (DRVSTA=8 BYTES)
3575                                  ;DRVSTA=0 IF DRIVE IS OFFLINE OR NONEXSITENT
3576                                  ;DRVSTA>0 IF DRIVE IS ONLINE
3577                                  ;DRVSTA<0 IF DRIVE IS UNSAFE
3578
3579  007556  000             DRVSTA: .BYTE   0               ;DRIVE 0
3580  007557  000                     .BYTE   0               ;DRIVE 1
3581  007560  000                     .BYTE   0               ;DRIVE 2
3582  007561  000                     .BYTE   0               ;DRIVE 3
3583  007562  000                     .BYTE   0               ;DRIVE 4
3584  007563  000                     .BYTE   0               ;DRIVE 5
3585  007564  000                     .BYTE   0               ;DRIVE 6
3586  007565  000                     .BYTE   0               ;DRIVE 7
3587
3588                          ;TABLE OF DRIVE TYPES (DRVTYP=8 BYTES)
3589                                  ;DRVTYP=0 IF DRIVE IS NONEXISTENT (DRVSTA=0, ALSO)
3590                                  ;DRVTYP=1 IF DRIVE IS RP04
3591                                  ;DRVTYP=2 IF DRIVE IS RP05
3592                                  ;DRVTYP=4 IF DRIVE IS RP06
3593                                  ;DRVTYP=-1 IF NOT RP04/5/6
3594
3595  007566  000             DRVTYP: .BYTE   0               ;DRIVE 0
3596  007567  000                     .BYTE   0               ;DRIVE 1
3597  007570  000                     .BYTE   0               ;DRIVE 2
3598  007571  000                     .BYTE   0               ;DRIVE 3
3599  007572  000                     .BYTE   0               ;DRIVE 4
3600  007573  000                     .BYTE   0               ;DRIVE 5
3601  007574  000                     .BYTE   0               ;DRIVE 6
3602  007575  000                     .BYTE   0               ;DRIVE 7
3603
3604                          ;TABLE OF DUAL PORT INITIALIZATION INDICATORS
3605                                  ;DPINT=0 IF INITIALIZATION IS NOT ACTIVE ON THE DRIVE
3606                                  ;DPINT<0 IF INITIALIZATION IS IN PROGRESS
3607
3608  007576  000             DPINT:  .BYTE   0               ;DRIVE 0
3609  007577  000                     .BYTE   0               ;DRIVE 1
3610  007600  000                     .BYTE   0               ;DRIVE 2
3611  007601  000                     .BYTE   0               ;DRIVE 3
3612  007602  000                     .BYTE   0               ;DRIVE 4
3613  007603  000                     .BYTE   0               ;DRIVE 5
3614  007604  000                     .BYTE   0               ;DRIVE 6
3615  007605  000                     .BYTE   0               ;DRIVE 7
3616
3617                          ;TABLE OF PENDING DUAL PORT REQUESTS
3618                                  ;DPRQS=0 IF THAT A DUAL PORT REQUEST IS NOT PENDING FOR THAT DRIVE
3619                                  ;DPRQS<0 IF THAT A DUAL PORT REQUEST IS PENDING FOR THAT DRIVE
3620
3621  007606  000             DPRQS:  .BYTE   0               ;DRIVE 0
3622  007607  000                     .BYTE   0               ;DRIVE 1
```

```
3623  007610  000                       .BYTE   0               ;DRIVE 2
3624  007611  000                       .BYTE   0               ;DRIVE 3
3625  007612  000                       .BYTE   0               ;DRIVE 4
3626  007613  000                       .BYTE   0               ;DRIVE 5
3627  007614  000                       .BYTE   0               ;DRIVE 6
3628  007615  000                       .BYTE   0               ;DRIVE 7
3629
3630                            ;TRANSFER WAIT FLAG (TRNSWT=1 WORD)
3631                                    ;THIS IS A ONE WORD QUEUE. IT WILL CONTAIN THE ADDRESS OF
3632                                    ;"DPB" OF THE I/O OPERATION.
3633
3634  007616  000000                TRNSWT: .WORD   0
3635
3636                            ;SEARCH WAIT KEYS (SRCHWT=1 WORD)
3637                                    ;THIS IS A ONE WORD QUEUE THAT WILL CONTAIN A KEY FOR EACH OF
3638                                    ;THE DRIVES THAT ARE PERFORMING A SEARCH COMMAND FOR THE I/O
3639                                    ;REQUEST THAT IS AT THE TOP OF THEIR REQUEST QUEUE.
3640                                    ;EACH DRIVE IS ASSIGNED ONE BIT, STARTING AT BIT00 FOR DRIVE 0.
3641
3642  007620  000000                SRCHWT: .WORD   0
3643
3644                            ;RP04/5/6 DRIVER ACTIVE FLAG (ACTDRV=1 BYTE)
3645                                    ;ACTDRV=0 IF DRIVER IS INACTIVE
3646                                    ;ACTDRV>0 IF DRIVER IS ACTIVE
3647
3648  007622  000                   ACTDRV: .BYTE   0
3649
3650                            ;SOFTWARE TIMER ROUTINE ACTIVE FLAG (ACTSTR=1 BYTE)
3651                                    ;ACTSTR=0 IF SOFTWARE TIMER ROUTINE IS INACTIVE
3652                                    ;ACTSTR>0 IF SOFTWARE TIMER ROUTINE IS ACTIVE
3653
3654  007623  000                   ACTSTR: .BYTE   0
3655
3656                            ;UNLOAD FLAG (ULDFLG=8 BYTES)
3657                                    ;ULDFLG=0 IF NO UNLOAD COMMAND
3658                                    ;ULDFLG>0 IF UNLOAD COMMAND IN PROGRESS
3659                                    ;ULDFLG<0 IF UNLOAD COMMAND IN WAIT QUEUE
3660
3661  007624  000                   ULDFLG: .BYTE   0               ;DRIVE 0
3662  007625  000                           .BYTE   0               ;DRIVE 1
3663  007626  000                           .BYTE   0               ;DRIVE 2
3664  007627  000                           .BYTE   0               ;DRIVE 3
3665  007630  000                           .BYTE   0               ;DRIVE 4
3666  007631  000                           .BYTE   0               ;DRIVE 5
3667  007632  000                           .BYTE   0               ;DRIVE 6
3668  007633  000                           .BYTE   0               ;DRIVE 7
3669
3670                            ;LOOK AHEAD COUNT (LACNT=8 BYTES)
3671                                    ;LACNT WILL INDICATE THE NUMBER OF LOOK AHEADS PERFORMED
3672
3673  007634  000                   LACNT:  .BYTE   0               ;DRIVE 0
3674  007635  000                           .BYTE   0               ;DRIVE 1
3675  007636  000                           .BYTE   0               ;DRIVE 2
3676  007637  000                           .BYTE   0               ;DRIVE 3
3677  007640  000                           .BYTE   0               ;DRIVE 4
3678  007641  000                           .BYTE   0               ;DRIVE 5
```

```
3679  007642  000                     .BYTE   0               ;DRIVE 6
3680  007643  000                     .BYTE   0               ;DRIVE 7
3681
3682                                  ;SAVE REGISTERS FLAG (SAVEFG =1 WORD)
3683                                          ;SAVEFG <0 IF SAVE THE RH11/RP04/5/6 REGISTERS WHEN THE
3684                                          ;OPERATION IS COMPLETED AS PER (DPB+14).
3685                                          ;SAVEFG=0 IF SAVE THE RH11/RP04/5/6 REGISTERS, AS PER
3686                                          ;(DPB+14), AFTER AN ERROR.
3687
3688  007644  000000                  SAVEFG: .WORD   0
3689
3690                                  ;SEEK FLAG (SEEKFG=1 WORD)
3691                                          ;SEEKFG=0 IF WHEN THE DISK ADDRESS ISN'T IN THE WINDOW
3692                                          ;FOR A DATA TRANSFER START A SEARCH COMMAND
3693                                          ;SEEKFG<0 IF DATA TRANSFER WILL DO IMPLIED SEEKS,
3694                                          ;DISREGARD THE WINDOW
3695
3696  007646  000000                  SEEKFG: .WORD   0
3697
3698                                  ;TIMEOUT TABLE (TIMER=8 WORDS)
3699                                          ;THIS TABLE CONTAINS THE TIME ALLOWED FOR AN OPERATION
3700
3701  007650  177777                  TIMER:  .WORD   -1      ;DRIVE 0
3702  007652  177777                          .WORD   -1      ;DRIVE 1
3703  007654  177777                          .WORD   -1      ;DRIVE 2
3704  007656  177777                          .WORD   -1      ;DRIVE 3
3705  007660  177777                          .WORD   -1      ;DRIVE 4
3706  007662  177777                          .WORD   -1      ;DRIVE 5
3707  007664  177777                          .WORD   -1      ;DRIVE 6
3708  007666  177777                          .WORD   -1      ;DRIVE 7
3709
3710                                  ;DATA TRANSFER UNDERWAY INDICATOR (DTUW=1 WORD)
3711                                          ;DTUW<0 IF NO DATA TRANSFER UNDERWAY
3712                                          ;DTUW=+N (WHERE N=0 TO 7) IMPLIES DATA TRANSFER UNDERWAY ON DRIVE N
3713
3714  007670  177777                  DTUW:   .WORD   -1
3715
3716                                  ;ATTENTION BITS TABLE (ATABIT=8 BYTES)
3717                                          ;THIS TABLE CONTAINS THE CORRESPONDING BIT TO EACH DRIVES
3718                                          ;ATTENTION BIT
3719
3720  007672  001                     ATABIT: .BYTE   1       ;DRIVE 0
3721  007673  002                             .BYTE   2       ;DRIVE 1
3722  007674  004                             .BYTE   4       ;DRIVE 2
3723  007675  010                             .BYTE   10      ;DRIVE 3
3724  007676  020                             .BYTE   20      ;DRIVE 4
3725  007677  040                             .BYTE   40      ;DRIVE 5
3726  007700  100                             .BYTE   100     ;DRIVE 6
3727  007701  200                             .BYTE   200     ;DRIVE 7
3728
3729                                  ;RP04/5/6 TO RH11 "MASSBUS CONTROL BUS PARITY ERRORS" (MCPE) ALLOWED BEFORE
3730                                  ;CALLING IT FATAL (MCPEMX=1 WORD)
3731
3732  007702  000003                  MCPEMX: .WORD   3
3733
3734                                  ;STORAGE FOR RPADR (THE FIRST ADDRESS  776700) OF THE RH11/RP04/5/6,,
```

```
                                        ;RPVEC (THE VECTOR ADDRESS (254)), AND RPVEC+2 (THE BR LEVEL (5)).
                                        
007704  176700                          RPADR:  .WORD   176700
007706  000254  000240                  RPVEC:  .WORD   254,5*32.
                                        
                                        ;MAXIMUM NUMBER OF LOOK AHEADS ALLOWED IS 4 (MXLACT=1 WORD)
                                        
007712  000004                          MXLACT: .WORD   4
                                        ;MAXIMUM DELTA DELAY IS 8 SECTORS (MXDLTA=1 WORD)
                                        
007714  001000                          MXDLTA: .WORD   8.*64.
                                        ;MINIMUM DELTA DELAY IS 2 SECTORS (MNDLTA=1 WORD)
                                        
007716  000200                          MNDLTA: .WORD   2*64.
                                        ;MAXIMUM SEARCH FOR I/O WINDOW IS 5 SECTORS (MXWNDW=1 WORD)
                                        
007720  000005                          MXWNDW: .WORD   5
                                        
                                        ;DEFINITIONS OF THE RH11/RP04/5/6 ADDRESS INDEXES
                                        
        000000                          RPCS1=0                 ;CONTROL AND STATUS REGISTER #1 (DRIVE REG. 00)
        000002                          RPWC=2                  ;WORD COUNT REGISTER (NOT A DRIVE REG)
        000004                          RPBA=4                  ;UNIBUS ADDRESS REGISTER (NOT A DRIVE REG)
        000006                          RPDA=6                  ;DESIRED SECTOR/TRACK ADDRESS REGISTER (DRIVE REG. 05)
        000010                          RPCS2=10                ;CONTROL AND STATUS REGISTER #2 (NOT A DRIVE REG)
        000012                          RPDS=12                 ;DRIVE STATUS REGISTER (DRIVE REG 01)
        000014                          RPER1=14                ;ERROR REGISTER #1 (DRIVE REG. 02)
        000016                          RPAS=16                 ;ATTENTION SUMMARY PSEUDO REGISTER (DRIVE REG. 04)
        000020                          RPLA=20                 ;LOOK AHEAD REGISTER (DRIVE REG. 07)
        000022                          RPDB=22                 ;DATA BUFFER REGISTER (NOT A DRIVE REG.)
        000024                          RPMR=24                 ;MAINTAINABILITY REGISTER (DRIVE REG. 03)
        000026                          RPDT=26                 ;DRIVE TYPE REGISTER (DRIVE REG. 06)
        000030                          RPSN=30                 ;SERIAL NUMBER REGISTER (DRIVE REG. 10)
        000032                          RPOF=32                 ;OFFSET REGISTER (DRIVE REG. 11)
        000034                          RPCA=34                 ;DESIRED CYLINDER ADDRESS REGISTER (DRIVE REG. 12)
        000036                          RPCC=36                 ;CURRENT CYLINDER ADDRESS REGISTER (DRIVE REG. 13)
        000040                          RPER2=40                ;ERROR REGISTER #2 (DRIVE REG. 14)
        000042                          RPER3=42                ;ERROR REGISTER #3 (DRIVE REG. 15)
        000044                          RPEC1=44                ;ECC POSITION REGISTER (DRIVE REG. 16)
        000046                          RPEC2=46                ;ECC PATTERN REGISTER (DRIVE REG.  17)
                                        
                                        ;RH11/RP04/5/6 DRIVER INITIALIZATION CODE
                                                ;THIS ROUTINE WILL DETERMINE WHICH RP04/5/6 DRIVES ARE
                                                ;AVAILABLE FOR TESTING AND SET THE DRVSTA INDICATOR
                                                ;TO THE PROPER STATE FOR EACH DRIVE.
                                                ;NOTE: THIS ROUTINE CALLS DRVINT
                                        ;
                                        ;CALL
                                        ;
                                        ;       JSR     PC,RPINIT
                                        ;       RETURN
                                        ;
                                        ;NOTE: THE 'P' OR '_' CLOCK MUST BE STARTED
                                        ;
007722  104412                          RPINIT: SAVREG                  ;SAVE R0 - R5
007724  013746  177776                          MOV     @#PS,-(SP)      ;SAVE THE PRESENT PROCESSOR STATUS
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3791  007730  012737  000240  177776          MOV     #(5*32.),@#PS   ;CHANGE THE PRIORITY TO 5
3792  007736  004737  015662                  JSR     PC,CLRQUE       ;CLEAR ALL REQUEST QUEJES
3793  007742  012701  007536                  MOV     #RPERRS,R1      ;FIRST ADDRESS TO BE CLEARED
3794  007746  012702  007646                  MOV     #SEEKFG,R2      ;LAST ADDRESS TO BE CLEARED
3795  007752  005021                  1$:     CLR     (R1)+           ;CLEAR
3796  007754  020102                          CMP     R1,R2           ;ARE WE DONE?
3797  007756  101775                          BLOS    1$              ;BRANCH IF NO
3798  007760  012702  007670                  MOV     #DTUW,R2        ;LAST ADDRESS
3799  007764  012721  177777          2$:     MOV     #-1,(R1)+       ;INITIALIZE
3800  007770  020102                          CMP     R1,R2           ;DONE?
3801  007772  101774                          BLOS    2$              ;LOOP IF NO
3802  007774  005037  007556                  CLR     DRVSTA          ;SET ALL DRIVES TO OFFLINE
3803  010000  005037  007560                  CLR     DRVSTA+2
3804  010004  005037  007562                  CLR     DRVSTA+4
3805  010010  005037  007564                  CLR     DRVSTA+6
3806  010014  013703  00[illegible]06          MOV     RPVEC,R3        ;SETUP THE RH11/RP04/5/6 VECTOR
3807  010020  012723  012566                  MOV     #ISR,(R3)+
3808  010024  013713  007710                  MOV     RPVEC+2,(R3)
3809  010030  013704  007704                  MOV     RPADR,R4        ;FIRST ADDRESS OF RH11/RP04
3810  010034  012764  000040  000010          MOV     #BIT05,RPCS2(R4)  ;MASSBUS INIT
3811  010042  005001                          CLR     R1              ;START WITH DRIVE 0
3812  010044  004037  010134          3$:     JSR     R0,DRVINT       ;INIT THE DRIVE
3813  010050  000401                          BR      4$              ;'DVA' NOT SET OR PARIT- ERROR
3814  010052  000402                          BR      5$              ;NORMAL RETURN
3815  010054  105061  007556          4$:     CLRB    DRVSTA(R1)      ;SET DRIVE STATUS TO OFFLINE
3816  010060  005201                  5$:     INC     R1              ;GO TO NEXT DRIVE
3817  010062  042701  177770                  BIC     #^C7,R1         ;MASK OUT UNUSED BITS
3818  010066  001366                          BNE     3$              ;BR IF MORE DRIVES TO GO
3819  010070  012701  000007                  MOV     #7,R1           ;START WITH DRIVE 7
3820  010074  005037  177776                  CLR     @#PS            ;CLEAR THE PROCESSOR STATUS
3821  010100  105761  007576          6$:     TSTB    DPINT(R1)       ;WAITING FOR DRIVE TO SWITCH PORTS ?
3822  010104  001405                          BEQ     8$              ;BR NOT WAITING
3823  010106  004737  015316                  JSR     PC,SET.IE       ;SET INTERRUPT
3824  010112  105761  007576          7$:     TSTB    DPINT(R1)       ;DRIVE SWITCHED PORTS ?
3825  010116  001375                          BNE     7$              ;BR IF NOT
3826  010120  005301                  8$:     DEC     R1              ;GO TO THE NEXT DRIVE
3827  010122  100366                          BPL     6$              ;CHECK NEXT DRIVE
3828  010124  012637  177776                  MOV     (SP)+,@#PS      ;RESTORE THE PROCESSOR STATUS
3829  010130  104413                          RESREG                  ;RESTORE R0 - R5
3830  010132  000207                          RTS     PC              ;BYE-BYE
3831
3832                                  ;DRIVE INITILIZATION ROUTINE
3833                                          ;THIS ROUTINE DETERMINES IF A DRIVE EXIST AND IF IT IS
3834                                          ;AN RP04/5/6. IF IT IS, A "READ-IN PRESET" IS ISSUED AND FMT22
3835                                          ;IS SET TO A "1". THEN MOL, DPR, DRY, AND VV ARE CHECKED TO
3836                                          ;INSURE THEY ARE ALL ON A "1". AND DEPENDING ON THEIR STATE,
3837                                          ;DRVSTA IS SET TO THE PROPER CONDITION.
3838                                  ;CALL
3839                                  ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
3840                                  ;       MOV     RPADR,R4        ;UNIBUS ADDRESS OF RH11 RP04 5/6 (RPCS1
3841                                  ;       JSR     R0,DRVINT       ;CALLED BY A JSR
3842                                  ;       RETURN1                 ;ERROR OCCURRED (PARITY)
3843                                  ;       RETURN2                 ;NORMAL RETURN
3844                                  ;
3845
3846  010134  010546                  DRVINT: MOV     R5,-(SP)        ;SAVE R5
```

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3847  010136  105061  007556                  CLRB    DRVSTA(R1)          ;START DRIVE STATUS AS OFFLINE
3848  010142  105061  007566                  CLRB    DRVTYP(R1)          ;CLEAR THE DRIVE TYPE INDICATOR
3849  010146  105061  007624                  CLRB    ULDFLG(R1)          ;CLEAR THE UNLOAD FLAG
3850  010152  010164  000010                  MOV     R1,RPCS2(R4)        ;SELECT A DRIVE
3851  010156  112764  000111  000000          MOVB    #111,RPCS1(R4)      ;DO A DRIVE CLEAR COMMAND (& SEIZE DRIVE)
3852  010164  032764  010000  000010          BIT     #BIT12,RPCS2(R4)    ;NONEXISTENT DRIVE?
3853  010172  001403                          BEQ     1$                  ;NO---BRANCH
3854  010174  004737  015316                  JSR     PC,SET.IE           ;GO SET "IE" WITHOUT A "TRE"
3855  010200  000520                          BR      6$                  ;LEAVE THIS ROUTINE
3856  010202  105061  007556          1$:     CLRB    DRVSTA(R1)          ;SET DRIVE STATUS TO OFFLINE
3857  010206  032764  004000  000000          BIT     #BIT11,RPCS1(R4)    ;SEE IF DRIVE AVAILABLE
3858  010214  001514                          BEQ     7$                  ;BR IF DRIVE NOT AVAILABLE
3859  010216  004037  014636                  JSR     R0,RD.RP            ;READ THE DRIVE TYPE REG.
3860  010222  000026                          RPDT
3861  010224  010466                          8$                          ;ERROR RETURN ADDRESS
3862  010226  012605                          MOV     (SP)+,R5            ;PUT DRIVE TYPE IN R5
3863  010230  112761  000001  007566          MOVB    #1,DRVTYP(R1)       ;SET RP04 INDICATOR
3864  010236  022705  020020                  CMP     #20020,R5           ;IS IT A SINGLE PORT RP04?
3865  010242  001431                          BEQ     2$                  ;BRANCH IF YES
3866  010244  022705  024020                  CMP     #24020,R5           ;IS IT A DUAL PORT RP04?
3867  010250  001426                          BEQ     2$                  ;BR IF YES
3868  010252  112761  000002  007566          MOVB    #2,DRVTYP(R1)       ;SET RP05 INDICATOR
3869  010260  022705  020021                  CMP     #20021,R5           ;SINGLE PORT RP05 ?
3870  010264  001420                          BEQ     2$                  ;BR IF YES
3871  010266  022705  024021                  CMP     #24021,R5           ;DUAL PORT RP05 ?
3872  010272  001415                          BEQ     2$                  ;BR IF YES
3873  010274  112761  000004  007566          MOVB    #4,DRVTYP(R1)       ;SET RP06 INDICATOR
3874  010302  022705  020022                  CMP     #20022.R5           ;SINGLE PORT RP06 ?
3875  010306  001407                          BEQ     2$                  ;BR IF YES
3876  010310  022705  024022                  CMP     #24022,R5           ;DUAL PORT RP06 ?
3877  010314  001404                          BEQ     2$                  ;BR IF YES
3878  010316  112761  177777  007566          MOVB    #-1,DRVTYP(R1)      ;SET INDICATOR TO 'OTHER'
3879  010324  000446                          BR      6$                  ;EXIT
3880  010326  012746  000121          2$:     MOV     #121,-(SP)          ;DO A "READ-IN PRESET"
3881  010332  004037  015012                  JSR     R0,WRT.RP
3882  010336  000000                          RPCS1
3883  010340  010466                          8$
3884  010342  012746  010000                  MOV     #BIT12,-(SP)        ;SET FMT22=1
3885  010346  004037  015012                  JSR     R0,WRT.RP
3886  010352  000032                          RPOF
3887  010354  010466                          6$
3888  010356  004037  014636                  JSR     R0,RD.RP            ;READ RPDS1
3889  010362  000012                          RPDS1
3890  010364  010466                          8$
3891  010366  012605                          MOV     (SP)+,R5            ;AND SAVE IT IN R5
3892  010370  100015                          BPL     4$                  ;BRANCH IF ATA=0
3893  010372  116164  007672  000016          MOVB    ATABIT(R1),RPAS(R4) ;CLEAR ATTENTION BIT
3894  010400  004037  014636                  JSR     R0,RD.RP            ;FIND OUT WHY ATA=1
3895  010404  000014                          RPER1
3896  010406  010466                          8$
3897  010410  006126                          ROL     (SP)+               ;IS IT UNSAFE?
3898  010412  100004                          BPL     4$                  ;BR IF NOT
3899  010414  112761  177777  007556          MOVB    #-1,DRVSTA(R1)      ;SET UNSAFE INDICATOR
3900  010422  000407                          BR      6$                  ;EXIT
3901  010424  005105                  4$:     COM     R5                  ;CHECK MOL, DPR, DRY, AND VV
3902  010426  042705  167077                  BIC     #^C<BIT12!BIT08!BIT07!BIT06>,R5
                                                .
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3903  010432  001003                        BNE     6$                ;BRANCH IF MOL, DPR, DRY, OR VV IS CLEAR
3904  010434  112761  000001  007556        MOVB    #1,DRVSTA(R1)     ;SET DRIVE STATUS TO ONLINE
3905  010442  005720                6$:     TST     (R0)+             ;STEP OVER THE ERROR RETURN
3906  010444  000410                        BR      8$                ;EXIT
3907  010446  006301                7$:     ASL     R1                ;CHANGE INDEX TO ADDRESS WORDS
3908  010450  012761  003720  007650        MOV     #2000.,TIMER(R1)  ;START 2 SEC TIMER
3909  010456  006201                        ASR     R1                ;RESTORE R1
3910  010460  105161  007576                COMB    DPINT(R1)         ;SET PORT INITIALIZE INIDICATOR
3911  010464  005720                        TST     (R0)+
3912  010466  012605                8$:     MOV     (SP)+,R5          ;RESTORE R5
3913  010470  000200                        RTS     R0                ;EXIT
3914
3915                                ;REQUEST PRE-PROCESSOR-HANDLES SUBSYSTEM REQUEST
3916                                ;
3917                                ;CALL
3918                                ;
3919                                ;       JSR     R0,@#RP04         ;CALL THE RP04/5/6 DRIVER
3920                                ;       PNTADR                    ;ADDRESS OF POINTER OF DRIVES PARAMETER BLOCK
3921                                ;       RETURN1                   ;RETURN HERE IF QUEUE IS FULL
3922                                ;       RETURN2                   ;RETURN HERE IF REQUEST IS IN QUEUE OR THERE
3923                                                                  ;IS AN ERROR CONDITION
3924
3925  010472  013746  177776        RP04:   MOV     @#PS,-(SP)        ;SAVE THE CALLING STATUS
3926  010476  013737  007710  177776        MOV     RPVEC+2,@#PS      ;DON'T ALLOW ANY RP04/5/6 INTERRUPTS
3927  010504  112737  000001  007622        MOVB    #1,ACTDRV         ;SET "ACTIVE DRIVER" FLAG
3928  010512  104412                        SAVREG                    ;SAVE R0 - R5
3929  010514  011002                        MOV     (R0),R2           ;PICKUP THE DRIVE PARAMETER BLOCK POINTER
3930  010516  005062  000016                CLR     16(R2)            ;CLEAR THE STATUS/ERROR INDICATOR
3931  010522  111201                        MOVB    (R2),R1           ;PICKUP THE DRIVE NUMBER
3932  010524  013704  007704                MOV     RPADR,R4          ;UNIBUS ADDRESS OF RPCS1
3933  010530  105761  007556                TSTB    DRVSTA(R1)        ;CHECK DRIVES STATUS
3934  010534  003014                        BGT     1$                ;BRANCH IF ONLINE
3935  010536  105761  007624                TSTB    ULDFLG(R1)        ;UNLOAD COMMAND IN QUEUE?
3936  010542  001036                        BNE     3$                ;BRANCH IF YES
3937  010544  105761  007576                TSTB    DPINT(R1)         ;TRYING TO INIT THE DRIVE
3938  010550  001042                        BNE     5$                ;BR IF YES
3939  010552  004037  010134                JSR     R0,DRVINT         ;GO INIT. THE DRIVE
3940  010556  000434                        BR      4$                ;ERROR RETURN
3941  010560  105761  007556                TSTB    DRVSTA(R1)        ;IS DRIVE STATUS ONLINE?
3942  010564  003445                        BLE     6$                ;BR IF NOT
3943  010566  105761  007606        1$:     TSTB    DPRQS(R1)         ;OUTSTANDING PORT REQUEST FOR THE DRIVE ?
3944  010572  001031                        BNE     5$                ;BR IF YES
3945  010574  010164  000010                MOV     R1,RPCS2(R4)      ;SELECT THE DRIVE
3946  010600  004037  015760                JSR     R0,DRVQUE         ;PUT THIS REQUEST IN QUEUE
3947  010604  000460                        BR      9$                ;QUEUE IS FULL
3948  010606  122762  000103  000002        CMPB    #103,2(R2)        ;IS THIS REQ. FOR AN UNLOAD?
3949  010614  001003                        BNE     2$                ;BR IF NO
3950  010616  112761  177777  007624        MOVB    #-1,ULDFLG(R1)    ;SET THE "UNLOAD IN QUEUE" FLAG
3951  010624  105761  007546        2$:     TSTB    DRVACT(R1)        ;IS THIS DRIVE ACTIVE?
3952  010630  001043                        BNE     8$                ;BR IF YES
3953  010632  004737  010764                JSR     PC,OPT            ;CALL THE OPTIMIZER
3954  010636  000440                        BR      8$
3955  010640  012762  120000  000016  3$:   MOV     #BIT15!BIT13,16(R2) ;SET THE "UNLOAD IN QUEUE" ERROR FLAG
3956  010646  000434                        BR      8$                ;EXIT
3957  010650  004737  012074        4$:     JSR     PC,CI7            ;GO HANDLE THE PARITY ERROR
3958  010654  000431                        BR      8$
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 3959  010656  004037  015760          5$:     JSR     R0,DRVQUE       ;PUT REQUEST IN QUEUE
 3960  010662  000431                          BR      9$              ;QUEUE IS FULL
 3961  010664  032714  000100                  BIT     #BIT06,(R4)     ;IS 'IE' SET ALREADY ?
 3962  010670  001023                          BNE     8$              ;BR IF IT IS
 3963  010672  004737  015316                  JSR     PC,SET.IE       ;SET INTERRUPT
 3964  010676  000420                          BR      8$              ;RETURN, REQUEST IN QUEUE
 3965  010700  105761  007556          6$:     TSTB    DRVSTA(R1)      ;SEE IF DRIVE OFFLINE OR UNSAFE
 3966  010704  002412                          BLT     7$              ;BR IF UNSAFE
 3967  010706  012762  140000  000016          MOV     #BIT15!BIT14,16(R2)  ;SET OFFLINE ERROR INDICATOR
 3968  010714  105761  007566                  TSTB    DRVTYP(R1)      ;SEE IF OFFLINE OR NONEXISTENT
 3969  010720  001007                          BNE     8$              ;BR IF OFFLINE
 3970  010722  012762  100002  000016          MOV     #BIT15!BIT01,16(R2)  ;REPORT DRIVE NONEXISTENT
 3971  010730  000403                          BR      8$              ;GO TO EXIT
 3972  010732  012762  110000  000016  7$:     MOV     #BIT15!BIT12,16(R2)  ;DRIVE IS UNSAFE
 3973  010740  104413                  8$:     RESREG                  ;RESTORE R0 - R5
 3974  010742  005720                          TST     (R0)+           ;SETUP FOR NORMAL RETURN
 3975  010744  000401                          BR      10$             ;FINISH UP, THEN EXIT
 3976  010746  104413                  9$:     RESREG                  ;RESTORE R0 - R5
 3977  010750  005720                  10$:    TST     (R0)+           ;CORRECT THE RETURN ADDRESS
 3978  010752  105037  007622                  CLRB    ACTDRV          ;CLEAR "ACTIVE DRIVER" FLAG
 3979  010756  012637  177776                  MOV     (SP)+,@#PS      ;RETURN "PS" TO USER LEVEL
 3980  010762  000200                          RTS     R0              ;RETURN TO CALLER
 3981
 3982                                  ;OPTIMIZER-CALLED FOR A PARTICULAR DRIVE
 3983                                  ;
 3984                                  ;CALL
 3985                                  ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
 3986                                  ;       JSR     PC,OPT          ;SETUP A COMMAND
 3987                                  ;
 3988  010764  104412                  OPT:    SAVREG                  ;SAVE R0 - R5
 3989  010766  013746  177776                  MOV     @#PS,-(SP)      ;SAVE PROC. STATUS
 3990  010772  146137  007672  007620          BICB    ATABIT(R1),SRCHWT       ;CLEAR "SEARCH WAIT" KEY
 3991  011000  004737  016034                  JSR     PC,GETREQ       ;GET "DPB" POINTER OF REQUEST
 3992  011004  005702                          TST     R2              ;IS THERE A REQUEST IN QUEUE?
 3993  011006  001505                          BEQ     7$              ;NO--BRANCH TO EXIT
 3994  011010  032764  004000  000000          BIT     #BIT11,RPCS1(R4)        ;IS DVA SET?
 3995  011016  001407                          BEQ     10$             ;BRANCH IF NOT
 3996  011020  032764  000100  000012          BIT     #BIT6,RPDS1(R4) ;IS VV SET ?
 3997  011026  001003                          BNE     10$             ;BR IF IT IS
 3998  011030  004037  010134          9$:     JSR     R0,DRVINT       ;SEE IF DRIVE STILL ONLINE ?
 3999  011034  000470                          BR      6$              ;PARITY OR 'DVA' NOT SET
 4000  011036  105761  007556          10$:    TSTB    DRVSTA(R1)      ;IS DRIVE ONLINE?
 4001  011042  003014                          BGT     1$              ;YES--BRANCH
 4002  011044  004737  016056                  JSR     PC,POPQUE       ;NO--REMOVE REQUEST FROM QUEUE
 4003  011050  012762  140000  000016          MOV     #BIT15!BIT14,16(R2)  ;SET OFFLINE STATUS/ERROR INDICATOR
 4004  011056  105761  007556                  TSTB    DRVSTA(R1)      ;IS DRIVE UNSAFE ?
 4005  011062  100064                          BPL     8$              ;BR TO EXIT IF NOT
 4006  011064  012762  110000  000016          MOV     #BIT15!BIT12,16(R2)  ;SET UNSAFE STATUS/ERROR INDICATOR
 4007  011072  000460                          BR      8$              ;BRANCH TO EXIT
 4008  011074  012746  000111          1$:     MOV     #111,-(SP)      ;LOAD COMMAND ONTO THE STACK
 4009  011100  004037  015012                  JSR     R0,WRT.RP       ;LOAD THE REGISTER
 4010  011104  000000                          RPCS1                   ;REGISTER INCREMENT
 4011  011106  011216                          6$                      ;ERROR RETURN ADDRESS
 4012  011110  032714  004000                  BIT     #BIT11,(R4)     ;DRIVE AVAILABLE ?
 4013  011114  001427                          BEQ     5$              ;BR IF NOT
 4014  011116  122762  000150  000002          CMPB    #150,2(R2)      ;IS THE REQUEST FOR I/O?
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4015  011124  002403                        BLT     2$                      ;YES--BRANCH
4016  011126  004737  011460                JSR     PC,CI4                  ;CALL THE COMMAND INITIATOR
4017  011132  000440                        BR      8$                      ;BRANCH TO EXIT
4018  011134  005737  007670        2$:     TST     DTUW                    ;DATA TRANSFER UNDERWAY?
4019  011140  002012                        BGE     4$                      ;YES--GO START A SEARCH
4020  011142  005737  007646                TST     SEEKFG                  ;DO IMPLIED SEEKS?
4021  011146  100404                        BMI     3$                      ;YES---BRANCH
4022  011150  004037  012430                JSR     R0,LA                   ;NO--DO LOOK AHEAD
4023  011154  000427                        BR      8$                      ;RETURN HERE ON A PARITY ERROR
4024  011156  000403                        BR      4$                      ;GO START A SEARCH
4025  011160  004737  011244        3$:     JSR     PC,CI1                  ;START A DATA TRANSFER
4026  011164  000423                        BR      8$
4027  011166  004737  011352        4$:     JSR     PC,CI3                  ;START A SEARCH
4028  011172  000420                        BR      8$                      ;GO TO THE EXIT
4029  011174  112761  177777  007606  5$:     MOVB    #-1,DPRQS(R1)           ;SET PORT REQUEST INDICATOR
4030  011202  010103                        MOV     R1,R3                   ;SET UP TO ADDRESS WORDS
4031  011204  006303                        ASL     R3                      ;CONVERT TO WORD INDEX
4032  011206  012763  023420  007650        MOV     #10000.,TIMER(R3)       ;START 10 SEC TIMER
4033  011214  000402                        BR      7$                      ;EXIT
4034  011216  004737  012074        6$:     JSR     PC,CI7                  ;PROCESS THE PARITY ERROR
4035  011222  032714  000100        7$:     BIT     #BIT06,(R4)             ;SEE IF 'IE' ALREADY SET
4036  011226  001002                        BNE     8$                      ;BR IF SET
4037  011230  004737  015316                JSR     PC,SET.IE               ;SET "IE" WITHOUT A "TRE"
4038  011234  012637  177776        8$:     MOV     (SP)+,@#PS              ;RESTORE PROC. STATUS
4039  011240  104413                        RESREG                          ;RESTORE R0 - R5
4040  011242  000207                        RTS     PC
4041
4042                                  ;COMMAND INITIATOR
4043                                  ;
4044                                  ;CALL
4045                                  ;       MOV     #DRVNUM,R1              ;DRIVE NUMBER
4046                                  ;       MOV     #DPB,R2                 ;ADDRESS OF DPB
4047                                  ;       JSR     PC,CI?                  ;CI?= CI1,CI3, OR CI4
4048                                  ;                                       ;WHERE:
4049                                  ;                                       ;CI1=DATA TRANSFER
4050                                  ;                                       ;CI2=SEARCH REQUESTED BY DATA XFER
4051                                  ;                                       ;CI4=NOT DATA TRANSFER
4052
4053  011244  004737  016056        CI1:    JSR     PC,POPQUE               ;REMOVE REQUEST FROM "DRIVES WAIT" QUEUE
4054  011250  010237  007616                MOV     R2,TRNSWT               ;PUT REQ. IN TRANSFER WAIT QUEUE
4055  011254  010203                        MOV     R2,R3                   ;DPB ADDRESS TO R3
4056  011256  013704  007704                MOV     RPADR,R4                ;RPCS1 ADDRESS
4057  011262  010164  000010                MOV     R1,RPCS2(R4)            ;SELECT DRIVE
4058  011266  062703  000004                ADD     #4,R3                   ;DESIRED WORD COUNT
4059  011272  062704  000002                ADD     #2,R4                   ;RPWC ADDRESS
4060  011276  012324                        MOV     (R3)+,(R4)+             ;LOAD WORD COUNT
4061  011300  012324                        MOV     (R3)+,(R4)+             ;LOAD BUFFER ADDRESS
4062  011302  012346                        MOV     (R3)+,-(SP)             ;LOAD SECTOR AND TRACK
4063  011304  004037  015012                JSR     R0,WRT.RP               ;CALL THE LOAD(WRITE) ROUTINE
4064  011310  000006                        RPDA                            ;INDEX OF REGISTER TO LOAD
4065  011312  012074                        CI7                             ;ERROR RETURN ADDRESS
4066  011314  012346                        MOV     (R3)+,-(SP)             ;LOAD CYLINDER ADDRESS
4067  011316  004037  015012                JSR     R0,WRT.RP
4068  011322  000034                        RPCA
4069  011324  012074                        CI7
4070  011326  016246  000002                MOV     2(R2),-(SP)             ;LOAD "COMMAND+GO", "A17&A16", AND "PSE"
```

```
 4071  011332  004037  015012                    JSR     RO,WRT.RP
 4072  011336  000000                            RPCS1
 4073  011340  012074                            CI7
 4074  011342  010137  007670                    MOV     R1,DTUW         ;SET "DATA TRANSFER UNDERWAY"
 4075  011346  000137  012036                    JMP     CI5
 4076  011352  013704  007704          CI3:      MOV     RPADR,R4        ;RPCS1 ADDRESS
 4077  011356  010164  000010                    MOV     R1,RPCS2(R4)    ;SELECT DRIVE
 4078  011362  016246  000012                    MOV     12(R2),-(SP)    ;DESIRED CYLINDER ADDRESS
 4079  011366  004037  015012                    JSR     RO,WRT.RP
 4080  011372  000034                            RPCA
 4081  011374  012074                            CI7
 4082  011376  116203  000010                    MOVB    10(R2),R3       ;PICKUP SECTOR ADDRESS
 4083  011402  163703  007720                    SUB     MXWNDW,R3       ;BACKUP BY MAX. SEARCH FOR I/O WINDOW
 4084  011406  002002                            BGE     1$
 4085  011410  062703  000026                    ADD     #22.,R3
 4086  011414  010346                  1$:       MOV     R3,-(SP)        ;COMBINE THE ADJUSTED SECTOR WITH
 4087  011416  116266  000011  000001            MOVB    11(R2),1(SP)    ;THE DESIRED TRACK
 4088  011424  004037  015012                    JSR     RO,WRT.RP       ;LOAD DESIRED TRACK & SECTOR
 4089  011430  000006                            RPDA
 4090  011432  012074                            CI7
 4091  011434  012746  000131                    MOV     #131,-(SP)      ;START A SEARCH
 4092  011440  004037  015012                    JSR     RO,WRT.RP
 4093  011444  000000                            RPCS1
 4094  011446  012074                            CI7
 4095  011450  156137  007672  007620            BISB    ATABIT(R1),SRCHWT       ;SET "SEARCH WAIT" KEY
 4096  011456  000567                            BR      CI5
 4097  011460  013704  007704          CI4:      MOV     RPADR,R4        ;RPCS1 ADDRESS
 4098  011464  010164  000010                    MOV     R1,RPCS2(R4)    ;SELECT DRIVE
 4099  011470  116203  000002                    MOVB    2(R2),R3        ;PICK UP THE REQUESTED COMMAND
 4100  011474  122703  000131                    CMPB    #131,R3         ;IS IT A SEARCH COMMAND?
 4101  011500  001007                            BNE     1$              ;BRANCH IF NO
 4102  011502  016246  000010                    MOV     10(R2),-(SP)    ;LOAD DESIRED TRACK & SECTOR
 4103  011506  004037  015012                    JSR     RO,WRT.RP
 4104  011512  000006                            RPDA
 4105  011514  012074                            CI7
 4106  011516  000403                            BR      2$              ;GO LOAD CYLINDER
 4107  011520  122703  000105          1$:       CMPB    #105,R3         ;IS IT A SEEK COMMAND
 4108  011524  001007                            BNE     3$              ;BRANCH IF NO
 4109  011526  016246  000012          2$:       MOV     12(R2),-(SP)    ;LOAD DESIRED CYLINDER
 4110  011532  004037  015012                    JSR     RO,WRT.RP
 4111  011536  000034                            RPCA
 4112  011540  012074                            CI7
 4113  011542  000546                            BR      CI6
 4114  011544  122703  000115          3$:       CMPB    #115,R3         ;IS IT AN "OFFSET" COMMAND?
 4115  011550  001013                            BNE     4$              ;BR IF NO
 4116  011552  004037  014636                    JSR     RO,RD.RP        ;MERGE THE OFFSET VALUE INTO RPOF
 4117  011556  000032                            RPOF                    ;BUT DON'T CHANGE THE UPPER
 4118  011560  012074                            CI7
 4119  011562  116216  000001                    MOVB    1(R2),(SP)      ;BYTE WHEN LOADING THE
 4120  011566  004037  015012                    JSR     RO,WRT.RP       ;REGISTER (RPOF)
 4121  011572  000032                            RPOF
 4122  011574  012074                            CI7
 4123  011576  000530                            BR      CI6             ;GO START THE COMMAND
 4124  011600  122703  000107          4$:       CMPB    #107,R3         ;IS IT A "RECALIBRATE" COMMAND?
 4125  011604  001525                            BEQ     CI6             ;BRANCH IF YES
 4126  011606  122703  000117                    CMPB    #117,R3         ;IS IT A RETURN TO CENTER?
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 4127  011612  001522                        BEQ     CI6             ;BRANCH IF YES
 4128  011614  122703  000103                CMPB    #103,R3         ;IS IT AN "UNLOAD" COMMAND?
 4129  011620  001016                        BNE     5$              ;BRANCH IF NO
 4130  011622  112761  000001  007546        MOVB    #1,DRVACT(R1)   ;SET THE DRIVE ACTIVE INDICATOR
 4131  011630  105061  007556                CLRB    DRVSTA(R1)      ;PUT DRIVE STATUS TO OFFLINE
 4132  011634  112761  000001  007624        MOVB    #1,ULDFLG(R1)   ;SET "UNLOAD IN PROGRESS" FLAG
 4133  011642  010346                        MOV     R3,-(SP)        ;START THE "UNLOAD" COMMAND
 4134  011644  004037  015012                JSR     R0,WRT.RP
 4135  011650  000000                        RPCS1
 4136  011652  012074                        CI7
 4137  011654  000207                        RTS     PC              ;RETURN TO USER
 4138  011656  122703  000143        5$:     CMPB    #143,R3         ;IS IT A "SET FORMAT" COMMAND?
 4139  011662  001014                        BNE     6$              ;BRANCH IF NO
 4140  011664  004037  014636                JSR     R0,RD.RP        ;READ THE OFFSET REGISTER
 4141  011670  000032                        RPOF
 4142  011672  012074                        CI7
 4143  011674  116266  000001  000001        MOVB    1(R2),1(SP)     ;COMBINE "FMT22","ECI", AND "HCI"
 4144  011702  004037  015012                JSR     R0,WRT.RP       ;LOAD "FMT22", "ECI", AND/OR "HCI".
 4145  011706  000032                        RPOF
 4146  011710  012074                        CI7
 4147  011712  000436                        BR      12$
 4148  011714  122703  000141        6$:     CMPB    #141,R3         ;IS IT A "GET REGISTER" COMMAND?
 4149  011720  001023                        BNE     10$             ;BRANCH IF NO
 4150  011722  016203  000006        7$:     MOV     6(R2),R3        ;POINTS TO 1ST ADDRESS OF WHERE
 4151                                                                ;TO PUT THE REGISTER(S)
 4152  011726  116237  000010  011744        MOVB    10(R2),9$       ;INIT. THE INDEX FOR THE FIRST REG.
 4153  011734  116205  000011                MOVB    11(R2),R5       ;INDEX OF LAST REG. TO MOVE
 4154  011740  004037  014636        8$:     JSR     R0,RD.RP        ;READ RP04/5/6 REGISTER
 4155  011744  000000                9$:     RPCS1                   ;INDEX OF REG. TO READ
 4156  011746  012074                        CI7
 4157  011750  012623                        MOV     (SP)+,(R3)+     ;GET THE CONTENTS OF RH11/RP04/5/6 REG.
 4158  011752  023705  011744                CMP     9$,R5           ;LAST REG. BEEN READ?
 4159  011756  001414                        BEQ     12$             ;GET OUT IF YES
 4160  011760  062737  000002  011744        ADD     #2,9$           ;INCREASE THE INDEX BY 2
 4161  011766  000764                        BR      8$              ;LOOP--MORE TO READ
 4162  011770  122703  000145        10$:    CMPB    #145,R3         ;IS IT A "SELECT DRIVE" COMMAND?
 4163  011774  001405                        BEQ     12$             ;BRANCH IF YES
 4164  011776  010346                11$:    MOV     R3,-(SP)        ;LOAD THE COMMAND
 4165  012000  004037  015012                JSR     R0,WRT.RP
 4166  012004  000000                        RPCS1
 4167  012006  012074                        CI7
 4168  012010  004737  016056        12$:    JSR     PC,POPQUE       ;REMOVE REQ. FROM QUEUE
 4169  012014  052762  000200  000016        BIS     #BIT07,16(R2)   ;SET THE "DONE" BIT
 4170  012022  005737  007644                TST     SAVEFG          ;SAVE THE RH11/RP04/5/6 REGISTERS?
 4171  012026  100002                        BPL     13$             ;BRANCH IF NO
 4172  012030  004737  015200                JSR     PC,SVRH11       ;YES--GO SAVE THE REGISTERS
 4173  012034  000207                13$:    RTS     PC              ;RETURN TO USER
 4174  012036  006301                CI5:    ASL     R1
 4175  012040  012761  001750  007650        MOV     #1000.,TIMER(R1)        ;SET A ONE SECOND TIMER
 4176  012046  006201                        ASR     R1
 4177  012050  112761  000001  007546        MOVB    #1,DRVACT(R1)   ;SET THE DRIVE ACTIVE
 4178  012056  000207                        RTS     PC              ;RETURN TO THE USER
 4179  012060  010346                CI6:    MOV     R3,-(SP)        ;LOAD THE COMMAND
 4180  012062  004037  015012                JSR     R0,WRT.RP
 4181  012066  000000                        RPCS1
 4182  012070  012074                        CI7
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                                                BR      CI5
                                CI7:            BIT     #BIT12,RPCS2(R4)  ;DRIVE NON-EXISTENT ?
                                                BNE     CI8               ;BR IF YES
                                1$:             TST     R2                ;ANYTHING IN QUEUE ?
                                                BEQ     CI7B              ;BR IF NOT
                                                MOV     #BIT15!BIT11,16(R2)     ;SET "PARITY" ERROR INDICATOR
                                                JSR     PC,SVRH11         ;GO SAVE THE RH11/RP04/5/6 REGISTERS
                                CI7B:           MOV     #111,-(SP)        ;DO A "DRIVE CLEAR"
                                                JSR     R0,WRT.RP
                                                RPCS1
                                                CI8
                                                JSR     PC,EMPTYQ         ;EMPTY THE QUEUE
                                                CLRB    ULDFLG(R1)        ;CLEAR THE UNLOAD IN QUEUE FLAG
                                                CLRB    DRVACT(R1)        ;DRIVE IS IDLE
                                                CMP     R1,DTUW           ;IF THIS DRIVE HAD AN I/O REQUEST
                                                BNE     1$                ;IN PROGRESS CLEAR ALL OF THE FLAGS
                                                CLR     TRNSWT
                                                MOV     #-1,DTUW
                                1$:             RTS     PC
                                CI8:            SAVREG                    ;SAVE R0 - R5
                                                BIT     #BIT12,RPCS2(R4)  ;IS 'NED' SET ?
                                                BNE     1$                ;BR IF YES
                                                CLR     R1
                                                CLR     R3
                                1$:             TSTB    DRVACT(R1)        ;DRIVE ACTIVE?
                                                BEQ     5$                ;BRANCH IF NO
                                                MOV     TRNSWT,R2         ;GET THE "TRANSFER WAIT" QUEUE
                                                CMP     R1,DTUW           ;DID THIS DRIVE HAVE AN I/O IN PROGRESS?
                                                BEQ     2$                ;BRANCH IF YES
                                                JSR     PC,GETREQ         ;GET THE DPB POINTER
                                2$:             TST     R2                ;QUEUE ENTRY FOR DRIVE ?
                                                BEQ     4$                ;BR IF NOT
                                                BIT     #BIT12,RPCS2(R4)  ;'NED' SET ?
                                                BEQ     3$                ;BR IF NOT
                                                MOV     #BIT15!BIT01,16(R2)  ;SET 'DRIVE NON-EXISTENT' INDICATOR
                                                BR      4$                ;CONTINUE
                                3$:             MOV     #BIT15!BIT10,16(R2) ;SET "NON-CLEARABLE PARITY" ERROR INDICATOR
                                                JSR     PC,SVRH11         ;SAVE RH11/RP04/5/6 REGISTERS
                                4$:             MOV     #-1,TIMER(R3)     ;STOP THE TIMER
                                                CLRB    DRVACT(R1)        ;SET "DRIVE ACTIVE" TO IDLE
                                                CMP     R1,DTUW           ;IS THIS DRIVE SETUP FOR A TRANSFER
                                                BNE     5$                ;BR IF NOT
                                                MOV     #-1,DTUW          ;RESET THE INDICATOR
                                                CLR     TRNSWT            ;CLEAR THE TRANSFER QUEUE
                                5$:             CLRB    ULDFLG(R1)        ;CLEAR UNLOAD FLAG
                                                BIT     #BIT12,RPCS2(R4)  ;'NED' SET ?
                                                BNE     6$                ;BR IF YES
                                                INC     R1                ;MOVE TO THE NEXT DRIVE
                                                ADD     #2,R3
                                                BIC     #^C7,R1
                                                BNE     1$                ;BRANCH IF MORE DRIVES
                                                MOV     #-1,DTUW          ;NO DATA TRANSFERS UNDERWAY
                                                CLR     TRNSWT            ;CLEAR THE 'TRANSFER WAIT' QUEUE
                                                JSR     PC,CLRQUE         ;CLEAR ALL OF THE REQUEST QUEUES
                                                MOV     #BIT05,RPCS2(R4)  ;DO A MASSBUS INIT.
                                                BR      7$                ;CONTINUE
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 4239  012404  004737  015740          6$:     JSR     PC,EMPTYQ       ;CLEAR THE DRIVE'S QUEUE
 4240  012410  105061  007556                  CLRB    DRVSTA(R1)      ;SET DRIVE TO OFFLINE
 4241  012414  105061  007566                  CLRB    DRVTYP(R1)      ;CLEAR THE DRIVE TYPE INDICATOR
 4242  012420  004737  015316          7$:     JSR     PC,SET.IE       ;SET "IE" WITHOUT "TRE"
 4243  012424  104413                          RESREG                  ;RESTORE R0 - R5
 4244  012426  000207                          RTS     PC              ;RETURN
 4245
 4246                                  ;LOOK AHEAD ROUTINE
 4247                                  ;
 4248                                  ;CALL
 4249                                  ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER
 4250                                  ;       MOV     #DPB,R2         ;POINT TO DPB
 4251                                  ;       JSR     R0,LA           ;GO CHECK THE WINDOW
 4252                                  ;       RETURN1                 ;ERROR RETURN
 4253                                  ;       RETURN2                 ;START A SEARCH
 4254                                  ;       RETURN3                 ;START A DATA TRANSFER
 4255
 4256  012430  013704  007704          LA:     MOV     RPADR,R4        ;GET RPCS1'S ADDRESS
 4257  012434  010164  000010                  MOV     R1,RPCS2(R4)    ;SELECT DRIVE
 4258  012440  004037  014636                  JSR     R0,RD.RP        ;READ CURRENT CYLINDER
 4259  012444  000036                          RPCC
 4260  012446  012560                          4$                      ;ERROR RETURN ADDRESS
 4261  012450  022662  000012                  CMP     (SP)+,12(R2)    ;IS CURRENT CYLINDER=DESIRED
 4262                                                                  ;CYLINDER?
 4263  012454  001037                          BNE     3$              ;EXIT IF NO
 4264  012456  105261  007634                  INCB    LACNT(R1)       ;INCREMENT THE LOOK AHEAD COUNT
 4265  012462  126137  007634  007712          CMPB    LACNT(R1),MXLACT ;EXCEED MAX?
 4266  012470  003026                          BGT     2$              ;BRANCH IF YES
 4267  012472  116203  000010                  MOVB    10(R2),R3       ;GET DESIRED SECTOR ADDRESS AND
 4268  012476  000303                          SWAB    R3              ;MULT. BY 64--ALIGN WITH
 4269  012500  006203                          ASR     R3              ;LOOK AHEAD REGISTER
 4270  012502  006203                          ASR     R3
 4271  012504  012737  000340  177776          MOV     #340,@#PS       ;PRIORITY LEVEL "7"
 4272  012512  004037  014636                  JSR     R0,RD.RP        ;READ LOOK AHEAD REGISTER
 4273  012516  000020                          RPLA
 4274  012520  012560                          4$
 4275  012522  162603                          SUB     (SP)+,R3        ;CALCULATE THE DELTA
 4276  012524  002002                          BGE     1$
 4277  012526  062703  002600                  ADD     #(22.*64.),R3   ;MAKE THE DELTA POSITIVE
 4278  012532  023703  007714          1$:     CMP     MXDLTA,R3       ;CHECK THE DELTA TO SEE
 4279  012536  002406                          BLT     3$              ;IF IT IS WITHIN THE
 4280  012540  023703  007716                  CMP     MNDLTA,R3       ;WINDOW---IF YES, ZERO
 4281  012544  002003                          BGE     3$              ;THE LOOK AHEAD COUNT
 4282  012546  105061  007634          2$:     CLRB    LACNT(R1)       ;AND TAKE THE I/O EXIT
 4283  012552  005720                          TST     (R0)+
 4284  012554  005720                  3$:     TST     (R0)+           ;ADJUST THE RETURN ADDRESS
 4285  012556  000402                          BR      5$              ;EXIT
 4286  012560  004737  012074          4$:     JSR     PC,CI7          ;PROCESS THE ERROR
 4287  012564  000200                  5$:     RTS     R0              ;RETURN
 4288
 4289                                  ;INTERRUPT SERVICE ROUTINE
 4290
 4291  012566  112737  000001  007622  ISR:    MOVB    #1,ACTDRV       ;SET "ACTIVE DRIVER" FLAG
 4292  012574  104412                          SAVREG                  ;SAVE R0 - R5
 4293  012576  013704  007704                  MOV     RPADR,R4        ;ADDRESS OF RHSCS1
 4294  012602  013701  007670                  MOV     DTUW,R1         ;GET "DATA TRANSFER UNDERWAY" INDICATOR
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 4295  012606  002403                        BLT     1$                      ;BRANCH IF NO DATA TRANSFER UNDERWAY
 4296  012610  004737  012632                JSR     PC,TD                   ;CALL TRANSFER DONE
 4297  012614  000402                        BR      2$                      ;EXIT
 4298  012616  004737  012772        1$:     JSR     PC,SC                   ;CALL SPECIAL CONDITIONS
 4299  012622  104413                2$:     RESREG                          ;RESTORE R0 - R5
 4300  012624  105037  007622                CLRB    ACTDRV                  ;CLEAR "ACTIVE DRIVER" FLAG
 4301  012630  000002                        RTI                             ;RETURN
 4302
 4303                                        ;TRANSFER DONE ROUTINE
 4304
 4305  012632  105061  007546        TD:     CLRB    DRVACT(R1)              ;SET DRIVE ACTIVE INDICATOR TO IDLE
 4306  012636  012737  177777  007670        MOV     #-1,DTUW                ;NO DATA TRANSFERS UNDERWAY
 4307  012644  006301                        ASL     R1
 4308  012646  012761  177777  007650        MOV     #-1,TIMER(R1)           ;CANCEL TIMEOUT
 4309  012654  006201                        ASR     R1
 4310  012656  013702  007616                MOV     TRNSWT,R2               ;GET "DPB" ADDRESS FROM THE
 4311  012662  005037  007616                CLR     TRNSWT                  ;TRANSFER WAIT QUEUE--CLEAR QUEUE
 4312  012666  052762  000200  000016        BIS     #BIT07,16(R2)           ;SET DONE
 4313  012674  010164  000010                MOV     R1,RPCS2(R4)            ;SELECT THE DRIVE
 4314  012700  004037  014636                JSR     R0,RD.RP                ;TRANSFER ERROR(TRE=1)?
 4315  012704  000000                        RPCS1
 4316  012706  012074                        CI7
 4317  012710  006126                        ROL     (SP)+
 4318  012712  100413                        BMI     3$                      ;BR IF YES
 4319  012714  005737  007644                TST     SAVEFG                  ;SAVE THE RH11/RP04/5/6 REGISTERS?
 4320  012720  100002                        BPL     1$                      ;BRANCH IF NO
 4321  012722  004737  015200                JSR     PC,SVRH11               ;YES--SAVE THE REGISTERS
 4322                  001           IF NB
 4323                                 $:     JSR     PC,WC                   ;SEE IF WRITE CHECK TO BE PUT IN QUEUE
 4324                                        JSR     PC,GETREQ               ;GET DPB POINTER
 4325                                        TST     R2                      ;ENTRY FOR DRIVE ?
 4326                                        BEQ     2$                      ;BR IF NOT
 4327                                        JSR     PC,OPT                  ;CALL OPTIMIZER
 4328                                 .IFF
 4329  012726  004737  010764               1$:     JSR     PC,OPT          ;CALL OPTIMIZER
 4330                  000           .ENDC
 4331  012732  000417                        BR      SC                      ;CHECK OTHER DRIVES
 4332  012734  012714  000113        2$:     MOV     #113,(R4)               ;RELEASE THE DRIVE
 4333  012740  000414                        BR      SC                      ;CHECK FOR OTHER DRIVES
 4334  012742  052762  100100  000016  3$:     BIS     #BIT15!BIT06,16(R2) ;SET DATA ERROR FLAG
 4335  012750  004737  015740                JSR     PC,EMPTYQ               ;EMPTY THE "DRIVE'S WAIT" QUEUE
 4336  012754  004737  015200                JSR     PC,SVRH11               ;SAVE THE RH11/RP04/5/6 REGISTERS
 4337  012760  012714  040111                MOV     #40111,(R4)             ;ISSUE A "DRIVE CLEAR"
 4338  012764  012714  000113                MOV     #113,(R4)               ;ISSUE A RELEASE TO THE DRIVE
 4339  012770  000400                        BR      SC                      ;CHECK FOR OTHER DRIVES
 4340
 4341                  001           .IF NB
 4342                                ;FORCED WRITE CHECK ROUTINE
 4343
 4344                                WC:     TST     AUTOCK                  ;AUTOMATIC WRITE CHECKS ?
 4345                                        BEQ     2$                      ;BR IF NOT
 4346                                        CMPB    #2,$CODE(R2)            ;LAST OPERATION WRITE DATA ?
 4347                                        BEQ     1$                      ;BR IF IT WAS
 4348                                        CMPB    #3,$CODE(R2)            ;LAST OPERATION WRITE HEADER & DATA ?
 4349                                        BNE     2$                      ;BR IF NOT
 4350                                1$:     JSR     R0,DRVQUE               ;PUT THE OPERATION IN THE QUEUE
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                                        BR      2$                      ;QUEUE IS FULL
                                        CLR     16(R2)                  ;CLEAR 'DONE' BIT IN DPB
                                        MOVB    $RPCS1(R2),$PREVO(R2)   ;SAVE WRITE OPERATION CODE
                                        MOV     $CYL(R2),$PREVA+2(R2)   ;SAVE CYLINDER
                                        MOV     $SEC(R2),$PREVA(R2)     ;SAVE SECTOR AND TRACK ADDRESSES
                                        BICB    #2,$CODE(R2)            ;CHANGE WRITE TO CHECK
                                        BICB    #20,$COMND(R2)          ;CHANGE DRIVER CODE TO WRITE CHECK
                                        BISB    #10,$COMND(R2)          ;FINISH CHANGING CODE TO WRITE CHECK
                                2$:     RTS     PC                      ;EXIT

                        000             .ENDC
                                        ;SPECIAL CONDITION ROUTINE

012772  116403  000016                SC:     MOVB    RPAS(R4),R3     ;READ "RPAS"
012776  001012                                BNE     2$              ;BRANCH IF ANY 'ATA' BITS SET
013000  004037  014636                        JSR     R0,RD.RP        ;READ CONTROL AND STATUS REGISTER
013004  000000                                RPCS1
013006  012174                                CIB
013010  106126                                ROLB    (SP)+           ;IS "IE"=1?
013012  100403                                BMI     1$              ;YES, NO DRIVES TO CHECK
                        001             .IF DF $ESCAPE
                                        JSR     R0,ES.SAV       ;SAVE THE ADDRESS IN '$ESCAPE'
                        000             .ENDC
013014  104001                                ERROR   1               ;REPORT AN ILLEGAL INTERRUPT
013016  004737  015316                        JSR     PC,SET.IE       ;SET INTERRUPT ENABLE
013022  000207                        1$:     RTS     PC              ;RETURN
013024  005046                        2$:     CLR     -(SP)           ;PROCESS ALL DRIVES THAT HAVE
013026  110316                                MOVB    R3,(SP)         ;AN "ATA"=1
013030  012703  000001                        MOV     #1,R3
013034  005001                                CLR     R1
013036  030316                        SC3:    BIT     R3,(SP)         ;ATA=1?
013040  001005                                BNE     SC5             ;YES--BRANCH
013042  005201                        SC4:    INC     R1              ;MOVE TO THE NEXT DRIVE
013044  106303                                ASLB    R3
013046  001373                                BNE     SC3             ;BRANCH IF MORE TO CHECK?
013050  005726                                TST     (SP)+           ;CLEAN OFF THE STACK
013052  000207                                RTS     PC              ;RETURN TO USER
013054  105761  007576                SC5:    TSTB    DPINT(R1)       ;INITIALIZING THE DRIVE ?
013060  001402                                BEQ     1$              ;BR IF NOT
013062  000137  013750                        JMP     SC13            ;PROCESS THE DRIVE
013066  105761  007606                1$:     TSTB    DPRQS(R1)       ;PORT REQUEST OUTSTANDING ?
013072  001402                                BEQ     2$              ;BR IF NOT
013074  000137  013750                        JMP     SC13            ;START THE OUTSTANDING COMMAND
013100  105761  007556                2$:     TSTB    DRVSTA(R1)      ;CHECK THE DRIVE STATUS
013104  003025                                BGT     5$              ;BRANCH IF ONLINE
013106  105761  007624                        TSTB    ULDFLG(R1)      ;UNLOAD IN PROGRESS?
013112  003422                                BLE     5$              ;BRANCH IF NOT
013114  004737  016034                        JSR     PC,GETREQ       ;GET DPB POINTER
013120  004737  015200                        JSR     PC,SVRH11       ;SAVE THE RH11/RP04/5/6 REGISTERS
013124  004737  013700                        JSR     PC,SC12         ;SAVE RPDS1, RPER1, RPER2, AND RPER3
                                                                        ;ALSO DO A DRIVE INIT (DRVINT)
013130  105761  007556                        TSTB    DRVSTA(R1)      ;DID DRIVE COME ONLINE?
013134  003416                                BLE     6$              ;NO---BRANCH
013136  032737  040000  007536                BIT     #BIT14,RPERRS   ;WAS THERE AN ERROR?
013144  001002                                BNE     3$              ;BR IF ERROR
013146  000137  013610                        JMP     SC11            ;NO ERROR
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4407  013152  013705  007540          3$:     MOV     RPERRS+2,R5     ;YES -- PICKUP RPER1 AND
4408  013156  000476                          BR      SC6A            ;GO PROCESS THE ERROR
4409  013160  105761  007546          5$:     TSTB    DRVACT(R1)      ;DRIVE ACTIVE WITH COMMAND OR ERROR RECOVERY ?
4410  013164  001027                          BNE     SC6             ;BR IF EITHER
4411  013166  004737  013700                  JSR     PC,SC12         ;SAVE RPDS1, RPER1, RPER2, AND RPER3
4412                                                                  ;ALSO DO A DRVINT
4413  013172  105761  007576          6$:     TSTB    DPINT(R1)       ;TRYING TO INIT THE DRIVE ?
4414  013176  001321                          BNE     SC4             ;BR IF YES, CHECK ON MORE DRIVES
4415  013200  105761  007556                  TSTB    DRVSTA(R1)      ;CHECK ON DRIVE'S STATUS
4416  013204  100412                          BMI     7$              ;BR IF UNSAFE
4417  013206  032737  020000  007544          BIT     #BIT13,RPERRS+6 ;ADDRESS PLUG CHANGED ?
4418  013214  001011                          BNE     8$              ;BR IF YES
4419  013216  012746  000113                  MOV     #113,-(SP       ;RELEASE COMMAND
4420  013222  004037  015012                  JSR     R0,WRT.RP       ;WRITE THE COMMAND INTO RPCS1
4421  013226  000000                          RPCS1                   ;REGISTER INDEX
4422  013230  013560                          SC8                     ;PARITY EXIT ADDRESS
4423  013232  011605                  7$:     MOV     (SP),R5         ;PICKUP (RPAS) BEFORE THE ERROR CALL
4424              001                         .IF DF $ESCAPE
4425                                          JSR     R0,ES.SAV       ;SAVE THE ADDRESS IN '$ESCAPE'
4426              000                         .ENDC
4427  013234  104002                          ERROR   2               ;REPORT THE UNEXPECTED ATTENTION
4428  013236  000701                          BR      SC4             ;GO CHECK FOR MORE ATA'S
4429  013240                          8$:
4430              001                         .IF DF $ESCAPE
4431                                          JSR     R0,ES.SAV       ;SAVE THE ADDRESS IN '$ESCAPE'
4432              000                         .ENDC
4433  013240  104005                          ERROR   5               ;REPORT THE ADDRESS PLUG CHANGE
4434  013242  000677                          BR      SC4             ;CHECK FOR MORE DRIVES
4435  013244  006301                  SC6:    ASL     R1              ;SETUP TO ADDRESS WORDS
4436  013246  012761  177777  007650          MOV     #-1,TIMER(R1)   ;STOP THE TIMER
4437  013254  006201                          ASR     R1              ;RESTORE THE DRIVE ADDRESS
4438  013256  004737  016034                  JSR     PC,GETREQ       ;GET THE DPB POINTER FROM THE QUEUE
4439  013262  010164  000010                  MOV     R1,RPCS2(R4)    ;SELECT DRIVE
4440  013266  004037  014636                  JSR     R0,RD.RP        ;READ THE RP04'S STATUS REG.
4441  013272  000012                          RPDS1
4442  013274  013560                          SC8
4443  013276  011605                          MOV     (SP),R5         ;AND PUT IT IN R5
4444  013300  006126                          ROL     (SP)+           ;WAS THERE AN ERROR?
4445  013302  100407                          BMI     1$              ;BR IF ERROR
4446  013304  105761  007546                  TSTB    DRVACT(R1)      ;CHECK DRIVE'S STATE
4447  013310  003137                          BGT     SC11            ;BR IF DRIVE ACTIVE WITH ORDER
4448  013312  052762  100210  000016          BIS     #BIT15!BIT07!BIT03,16(R2)  ;INFORM USER OF ERROR RECOVER COMPLETION
4449  013320  000470                          BR      SC7
4450  013322  004037  014636          1$:     JSR     R0,RD RP        ;READ ERROR REGISTER #1
4451  013326  000014                          RPER1
4452  013330  013560                          SC8
4453  013332  012605                          MOV     (SP)+,R5        ;AND SAVE IT IN R5
4454  013334  004737  015200                  JSR     PC,SVRH11       ;SAVE RH11/RP04/5/6 REGISTERS
4455  013340  012746  000111                  MOV     #111,-(SP)      ;ISSUE A DRIVE CLEAR
4456  013344  004037  015012                  JSR     R0,WRT.RP
4457  013350  000000                          RPCS1
4458  013352  013560                          SC8
4459  013354  006105                  SC6A:   ROL     R5              ;WAS "UNSAFE" CONDITION =1?
4460  013356  100406                          BMI     1$              ;BRANCH IF YES
4461  013360  005702                          TST     R2              ;ANYTHING IN QUEUE ?
4462  013362  001447                          BEQ     SC7             ;BR IF NOT
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4463  013364  052762  100240  000016          BIS     #BIT15!BIT07!BIT05,16(R2)       ;INFORM USER OF ERROR
4464  013372  000443                          BR      SC7
4465  013374  004037  014636          1$:     JSR     R0,RD.RP        ;READ DRIVE STATUS REG. #1
4466  013400  000012                          RPDS1
4467  013402  013560                          SC8
4468  013404  011605                          MOV     (SP),R5         ;SAVE RPDS1 IN R5
4469  013406  006126                          ROL     (SP)+           ;"ERR"=1?
4470  013410  100011                          BPL     2$              ;BR IF NO--UNSAFE CLEARED
4471  013412  112761  177777  007556          MOVB    #-1,DRVSTA(R1)  ;DRIVE IS UNSAFE
4472  013420  004737  015200                  JSR     PC,$VRH11       ;SAVE RH11/RP04/5/6 REGISTERS
4473  013424  052762  110000  000016          BIS     #BIT15!BIT12,16(R2)     ;INFORM USER OF UNSAFE ERROR
4474  013432  000423                          BR      SC7
4475  013434  032705  010000          2$:     BIT     #BIT12,R5       ;"MOL" = 1 ?
4476  013440  001015                          BNE     3$              ;BR IF YES
4477  013442  112761  177777  007546          MOVB    #-1,DRVACT(R1)  ;ACTIVE ERROR RECOVER
4478  013450  112761  000001  007556          MOVB    #1,DRVSTA(R1)   ;ONLINE
4479  013456  006301                          ASL     R1
4480  013460  012761  072460  007650          MOV     #30000.,TIMER(R1) ;START 30 SECOND TIMER
4481  013466  006201                          ASR     R1
4482  013470  000137  013042                  JMP     SC4
4483  013474  052762  100220  000016  3$.     BIS     #BIT15!BIT07!BIT04,16(R2)       ;INFORM USER OF ERROR
4484  013502  105061  007546          SC7:    CLRB    DRVACT(R1)      ;DRIVE IS IDLE
4485  013506  004737  015740                  JSR     PC,EMPTYQ       ;DUMP THE QUEUE
4486  013512  105761  007624                  TSTB    ULDFLG(R1)      ;UNLOAD IN PROGRESS OR QUEUE?
4487  013516  003002                          BGT     1$              ;BR IF NOT
4488  013520  105061  007624                  CLRB    ULDFLG(R1)      ;CLEAR UNLOAD FLAG
4489  013524  116164  007672  000016  1$:     MOVB    ATABIT(R1),RPAS(R4)     ;CLEAR ATTENTION BIT
4490  013532  105761  007556                  TSTB    DRVSTA(R1)      ;IS THE DRIVE UNSAFE ?
4491  013536  100406                          BMI     2$              ;BR IF IT IS
4492  013540  012746  000113                  MOV     #113,-(SP)      ;RELEASE COMMAND
4493  013544  004037  015012                  JSR     R0,WRT.RP       ;WRITE THE COMMAND INTO RPCS1
4494  013550  000000                          RPCS1                   ;REGISTER INDEX
4495  013552  013560                          SC8                     ;PARITY EXIT ADDRESS
4496  013554  000137  013042          2$:     JMP     SC4             ;CHECK FOR MORE DRIVES
4497  013560  105761  007546          SC8:    TSTB    DRVACT(R1)      ;IS DRIVE IDLE?
4498  013564  001405                          BEQ     1$              ;YES--BRANCH
4499  013566  004737  016034                  JSR     PC,GETREQ       ;GET DPB POINTER
4500  013572  004737  012074                  JSR     PC,CI7          ;PROCESS THE PARITY ERROR
4501  013576  000402                          BR      2$              ;CONTINUE
4502  013600  004737  012122          1$:     JSR     PC,CI7B         ;PROCESS THE UNCORRECTABLE PARITY ERROR
4503  013604  000137  013042          2$:     JMP     SC4             ;CHECK MORE DRIVES
4504  013610  105761  007624          SC11:   TSTB    ULDFLG(R1)      ;"UNLOAD IN PROGRESS"?
4505  013614  003402                          BLE     1$              ;BRANCH IF NO
4506  013616  105061  007624                  CLRB    ULDFLG(R1)      ;CLEAR UNLOAD FLAG
4507  013622  105061  007546          1$:     CLRB    DRVACT(R1)      ;SET DRIVE IDLE
4508  013626  136137  007672  007620          BITB    ATABIT(R1),SRCHWT       ;DOING A SEARCH OPERATION FOR
4509                                                                  ;AN I/O COMMAND?
4510  013634  001012                          BNE     2$              ;BRANCH IF YES
4511  013636  004737  016056                  JSR     PC,POPQUE       ;REMOVE REQUEST FROM QUEUE
4512  013642  052762  000200  000016          BIS     #BIT07,16(R2)   ;SET "DONE" BIT
4513  013650  005737  007644                  TST     SAVEFG          ;SAVE THE REGISTERS?
4514  013654  100002                          BPL     2$              ;BRANCH IF NO
4515  013656  004737  015200                  JSR     PC,SVRH11       ;YES--SAVE ALL OF THE RH11 RP04 5 6 REG'S
4516  013662  116164  007672  000016  2$:     MOVB    ATABIT(R1),RPAS(R4)     ;CLEAR ATTENTION BIT
4517  013670  004737  010764                  JSR     PC,OPT          ;START A REQUEST
4518  013674  000137  013042                  JMP     SC4             ;CHECK FOR MORE DRIVES
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 4519  013700  010164  000010          SC12:   MOV     R1,RPCS2(R4)    ;SELECT DRIVE
 4520  013704  016437  000012  007536          MOV     RPDS1(R4),RPERRS        ;SAVE THE FOUR REGISTERS THAT
 4521  013712  016437  000014  007540          MOV     RPER1(R4),RPERRS+2      ;WILL TELL US SOMETHING
 4522  013720  016437  000040  007542          MOV     RPER2(R4),RPERRS+4
 4523  013726  016437  000042  007544          MOV     RPER3(R4),RPERRS+6
 4524  013734  004037  010134                  JSR     R0,DRVINT               ;INIT. THE STATE OF THE DRIVE
 4525  013740  000401                          BR      1$                      ;TAKE ERROR EXIT
 4526  013742  000207                          RTS     PC                      ;RETURN
 4527  013744  005726                  1$:     TST     (SP)+                   ;POP PC OFF OF THE STACK
 4528  013746  000704                          BR      SC8                     ;PROCESS THE PARITY ERROR
 4529  013750  006301                  SC13:   ASL     R1                      ;SETUP TO ADDRESS WORDS
 4530  013752  012761  177777  007650          MOV     #-1,TIMER(R1)           ;STOP THE TIMER
 4531  013760  006201                          ASR     R1                      ;
 4532  013762  010164  000010                  MOV     R1,RPCS2(R4)            ;SELECT THE DRIVE
 4533  013766  116164  007672  000016          MOVB    ATABIT(R1),RPAS(R4)     ;CLEAR THE ATTENTION BIT
 4534  013774  032714  004000                  BIT     #BIT11,(R4)             ;DRIVE AVAILABLE ?
 4535  014000  001006                          BNE     1$                      ;BR IF AVAILABLE
 4536  014002  006301                          ASL     R1
 4537
 4538  014004  012761  023420  007650          MOV     #10000.,TIMER(R1)       ;START 10 SEC TIMER AGAIN
 4539
 4540  014012  006201                          ASR     R1
 4541  014014  000433                          BR      3$                      ;EXIT
 4542  014016  105761  007576          1$:     TSTB    DPINT(R1)               ;INITIALIZING THE DRIVE ?
 4543  014022  001424                          BEQ     2$                      ;BR IF NOT
 4544  014024  105061  007576                  CLRB    DPINT(R1)               ;CLEAR THE INIT INDICATOR
 4545  014030  004037  010134                  JSR     R0,DRVINT               ;GO INIT THE DRIVE
 4546  014034  000240                          NOP                             ;DUMMY PARITY ERROR RETURN
 4547  014036  105761  007556                  TSTB    DRVSTA(R1)              ;DRIVE ONLINE ?
 4548  014042  003014                          BGT     2$                      ;BR IF YES -- START ORDER
 4549  014044  005702                          TST     R2                      ;QUEUE ENTRY FOR THE DRIVE
 4550  014046  001416                          BEQ     3$                      ;BR IF NOT
 4551  014050  004737  016034                  JSR     PC,GETREQ               ;GET DPB ADDRESS
 4552  014054  052762  140000  000016          BIS     #BIT15!BIT14,16(R2)     ;INFORM USER THAT DRIVE OFF_LINE
 4553  014062  004737  015200                  JSR     PC,SVRH11               ;SAVE THE REGISTERS
 4554  014066  004737  015740                  JSR     PC,EMPTYQ               ;EMPTY THE REQUEST QUEUE
 4555  014072  000404                          BR      3$
 4556  014074  105061  007606          2$:     CLRB    DPRQS(R1)               ;CLEAR THE PORT REQUEST INDICATOR
 4557  014100  004737  010764                  JSR     PC,OPT                  ;START THE PENDING REQUEST
 4558  014104  000137  013042          3$:     JMP     SC4                     ;PROCESS OTHER DRIVES
 4559
 4560                                  ;RP04/5/6 TIMER ROUTINE
 4561                                  ;CALL
 4562                                  ;       MOV     #TIME,-(SP)             ;ELASPED TIME IN MILLISECONDS ON THE STACK
 4563                                  ;       JSR     PC,RPTMR                ;CALL RP04/5/6 TIME ROUTINE
 4564
 4565  014110  005737  007622          RPTMR:  TST     ACTDRV                  ;CHECK "ACTDRV & ACTSTR"
 4566  014114  001030                          BNE     4$                      ;IF NON ZERO EXIT
 4567  014116  112737  000001  007623          MOVB    #1,ACTSTR               ;SET "ACTSTR"
 4568  014124  104412                          SAVREG                          ;SAVE R0 - R5
 4569  014126  005001                          CLR     R1                      ;START WITH DRIVE 0
 4570  014130  005003                          CLR     R3
 4571  014132  005763  007650          1$:     TST     TIMER(R3)               ;IS THE TIMER RUNNING?
 4572  014136  002407                          BLT     2$                      ;BRANCH IF NO
 4573  014140  166663  000002  007650          SUB     2(SP),TIMER(R3)         ;COUNT THE INTERVAL
 4574  014146  003003                          BGT     2$                      ;BR IF NO SOFTWARE TIMEOUT
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 4575  014150  004737  014202                 JSR     PC,STO          ;CALL SOFTWARE TIMEOUT ROUTINE
 4576  014154  000405                         BR      3$              ;GO TO THE EXIT
 4577  014156  005201                 2$:     INC     R1              ;MOVE TO NEXT DRIVE
 4578  014160  005723                         TST     (R3)+
 4579  014162  022701  000010                 CMP     #8.,R1          ;OUT OF DRIVES?
 4580  014166  003361                         BGT     1$              ;BRANCH IF NO
 4581  014170  104413                 3$:     RESREG                  ;RESTORE R0 - R5
 4582  014172  105037  007623                 CLRB    ACTSTR          ;ZERO ACTIVE SOFTWARE TIMEOUT ROUTINE FLAG
 4583  014176  012616                 4$:     MOV     (SP)+,(SP)      ;ADJUST THE STACK
 4584  014200  000207                         RTS     PC              ;RETURN
 4585
 4586                                 ;SOFTWARE TIMEOUT ROUTINE
 4587                                 ;
 4588                                 ;NOTE:  THIS ROUTINE MUST BE ENTERED AT PRIORITY 6
 4589                                 ;       OR GREATER
 4590                                 ;
 4591                                 ;CALL:  STO
 4592                                 ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER
 4593                                 ;       JSR     PC,STO          ;CALL
 4594                                 ;       RETURN
 4595
 4596  014202  010146                 STO:    MOV     R1,-(SP)        ;SAVE R1
 4597  014204  010346                         MOV     R3,-(SP)        ;SAVE R3
 4598  014206  013704  007704                 MOV     RPADR,R4        ;GET ADDRESS OF "RPCS1"
 4599  014212  010164  000010                 MOV     R1,RPCS2(R4)    ;SELECT THE DRIVE
 4600  014216  004037  014636                 JSR     R0,RD.RP        ;READ "DRIVE STATUS REG"
 4601  014222  000012                         RPOS1
 4602  014224  014524                         STOS
 4603  014226  105726                         TSTB    (SP)+           ;IS "DRY"=1?
 4604  014230  100477                         BMI     STO2            ;BR IF YES
 4605  014232  105761  007576         STO1:   TSTB    DPINT(R1)       ;TRYING TO INTIALIZE THE DRIVE ?
 4606  014236  001074                         BNE     STO2            ;BR IF YES
 4607  014240  105761  007606                 TSTB    DPRQS(R1)       ;OUTSTANDING PORT REQUEST FOR THE DRIVE ?
 4608  014244  001071                         BNE     STO2            ;BR IF YES
 4609  014246  013702  007616                 MOV     TRNSWT,R2       ;PICKUP TRANSFER WAIT QUEUE
 4610  014252  020137  007670                 CMP     R1,DTUW         ;TRANSFER UNDERWAY ON THIS DRIVE?
 4611  014256  001402                         BEQ     1$              ;BRANCH IF YES
 4612  014260  004737  016034                 JSR     PC,GETREQ       ;GET DPB ADDRESS
 4613  014264  052762  101000  000016  1$:     BIS     #BIT15!BIT09,16(R2) ;SET THE ERROR FLAGS
 4614  014272  004737  015200                 JSR     PC,SVRH11       ;SAVE RH11/RP04/5/6 REGISTERS
 4615  014276  012764  000040  000010         MOV     #BIT05,RPCS2(R4) ;"INIT" THE MASS BUS
 4616  014304  105061  007546                 CLRB    DRVACT(R1)      ;DRIVE IS IDLE
 4617  014310  105061  007624                 CLRB    ULDFLG(R1)      ;CLEAR THE UNLOAD FLAG
 4618  014314  005001                         CLR     R1              ;START WITH DRIVE 0
 4619  014316  005003                         CLR     R3
 4620  014320  004037  010134         2$:     JSR     R0,DRVINT       ;INIT. THIS DRIVE
 4621  014324  000477                         BR      STO5            ;PARITY ERROR RETURN
 4622  014326  105761  007546                 TSTB    DRVACT(R1)      ;DRIVE IDLE BEFORE THE INIT.?
 4623  014332  001414                         BEQ     4$              ;YES--BRANCH
 4624  014334  013702  007616                 MOV     TRNSWT,R2       ;GET TRANSFER WAIT QUEUE
 4625  014340  023701  007670                 CMP     DTUW,R1         ;WAS THERE I/O ON THIS DRIVE?
 4626  014344  001402                         BEQ     3$              ;YES--BRANCH
 4627  014346  004737  016034                 JSR     PC,GETREQ       ;GET THE DPB POINTER FROM QUEUE
 4628  014352  052762  100400  000016  3$:     BIS     #BIT15!BIT08,16(R2) ;INFORM USER OF INIT.
 4629  014360  105061  007546                 CLRB    DRVACT(R1)      ;SET DRIVE ACTIVE TO IDLE
 4630  014364  105061  007624         4$:     CLRB    ULDFLG(R1)      ;NO UNLOAD
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4631  014370  012763  177777  007650          MOV     #-1,TIMER(R3)   ;STOP THE TIMER
4632  014376  005723                          TST     (R3)+           ;UPDATE THE INDEX
4633  014400  005201                          INC     R1              ;INCREMENT THE DRIVE NUMBER
4634  014402  022701  000010                  CMP     #8.,R1          ;LAST DRIVE BEEN CHECKED?
4635  014406  003344                          BGT     2$              ;NO--LOOP
4636  014410  012737  177777  007670          MOV     #-1,DTUW        ;NO DATA TRANSFERS UNDERWAY
4637  014416  005037  007616                  CLR     TRNSWT          ;CLEAR TRANSFER WAIT QUEUE
4638  014422  004737  015662                  JSR     PC,CLRQUE       ;CLEAR ALL REQUEST QUEUES
4639  014426  000500                          BR      ST09            ;EXIT
4640  014430  116405  000016          ST02:   MOVB    RPAS(R4),R5     ;READ ATTENTION REG
4641  014434  136105  007672                  BITB    ATABIT(R1),R5   ;IS ATTENTION FOR THIS DRIVE UP ?
4642  014440  001017                          BNE     ST03            ;YES--BRANCH
4643  014442  105761  007576                  TSTB    DPINT(R1)       ;TRYING TO INTIALIZE THE DRIVE ?
4644  014446  001031                          BNE     ST06            ;BR IF YES - DRIVE NOT ONLINE
4645  014450  105761  007606                  TSTB    DPRQS(R1)       ;OUTSTANDING PORT REQUEST FOR THE DRIVE ?
4646  014454  001045                          BNE     ST07            ;BR IF YES - NO RESPONSE TO REQUEST
4647  014456  020137  007670                  CMP     R1,DTUW         ;DATA TRANSFER UNDERWAY FOR THIS DRIVE
4648  014462  001263                          BNE     ST01            ;BR IF NO
4649  014464  004037  014636                  JSR     R0,RD.RP        ;YES--CHECK "RDY"
4650  014470  000000                          RPCS1
4651  014472  014524                          ST05
4652  014474  105726                          TSTB    (SP)+
4653  014476  100255                          BPL     ST01            ;BR IF "RDY"=0
4654  014500  105761  007576          ST03:   TSTB    DPINT(R1)       ;INITIALIZING THE DRIVE ?
4655  014504  001003                          BNE     1$              ;BR IF INIT PENDING
4656  014506  105761  007606                  TSTB    DPRQS(R1)       ;PORT REQUEST PENDING ?
4657  014512  001446                          BEQ     ST09            ;BR IF NOT
4658  014514  012763  177777  007650  1$:     MOV     #-1,TIMER(R3)   ;STOP THE TIMER
4659  014522  000442                          BR      ST09            ;EXIT
4660  014524  004737  012174          ST05:   JSR     PC,CI8          ;GO HANDLE THE PARITY ERROR
4661  014530  000437                          BR      ST09
4662  014532  105061  007576          ST06:   CLRB    DPINT(R1)       ;CLEAR THE INITIALIZE INDICATOR
4663  014536  105061  007556                  CLRB    DRVSTA(R1)      ;SET UNIT OFFLINE
4664  014542  012763  177777  007650          MOV     #-1,TIMER(R3)   ;STOP THE TIMER
4665  014550  004737  016034                  JSR     PC,GETREQ       ;GET THE DPB ADDRESS
4666  014554  005702                          TST     R2              ;REQUEST IN QUEUE ?
4667  014556  001424                          BEQ     ST09            ;BR IF NOT
4668  014560  052762  140000  000016          BIS     #BIT15!BIT14,16(R2)  ;INFORM THE USER DRIVE NOT AVAILABLE
4669  014566  000414                          BR      ST08            ;FINISH
4670  014570  012763  177777  007650  ST07:   MOV     #-1,TIMER(R3)   ;STOP THE TIMER
4671  014576  105061  007606                  CLRB    DPRQS(R1)       ;CLEAR PORT REQUEST INDICATOR
4672  014602  004737  016034                  JSR     PC,GETREQ       ;GET DPB ADDRESS
4673  014606  005702                          TST     R2              ;QUEUE ENTRY FOR DRIVE ?
4674  014610  001407                          BEQ     ST09            ;BR IF NONE
4675  014612  012762  100004  000016          MOV     #BIT15!BIT2,16(R2)  ;INFORM USER OF PORT REQUEST ERROR
4676  014620  004737  015740          ST08:   JSR     PC,EMPTYQ       ;CLEAR THE QUEUE FOR THE DRIVE
4677  014624  004737  015200                  JSR     PC,SVRH11       ;SAVE THE REGISTERS
4678  014630  012603                  ST09:   MOV     (SP)+,R3        ;RESTORE R3
4679  014632  012601                          MOV     (SP)+,R1        ;RESTORE R1
4680  014634  000207                          RTS     PC              ;RETURN
4681
4682                                  ;ROUTINE TO READ A RH11/RP04/5/6 REGISTER
4683                                  ;
4684                                  ;CALL
4685                                  ;       JSR     R0,RD.RP        ;GO READ A REGISTER
4686                                  ;       INDEX                   ;REG. INDEX FROM BASE
```

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4687                                    ;       ERRADR                  ;ERROR ADDRESS--PROCESS ERROR STARTING
4688                                    ;                               ;AT THIS ADDRESS
4689                                    ;       RETURN                  ;CONTENTS OF REG. IS ON THE STACK
4690                                    ;
4691  014636  013737  007702  015000    RD.RP:  MOV     MCPEMX,RD.RP2   ;MAX. RETRYS ALLOWED
4692  014644  011646                            MOV     (SP),-(SP)      ;SAVE R0 FOR RETURN
4693  014646  013737  007704  014662            MOV     RPADR,RD.ADR    ;FORM THE DESIRED ADDRESS
4694  014654  062037  014662                    ADD     (R0)+,RD.ADR    ;USING THE BASE AND THE INDEX
4695  014660  013727                    RD.RP1: MOV     @(PC)+,(PC)+    ;READ THE DESIRED REGISTER OF THE RP04
4696  014662  000000                    RD.ADR: .WORD   0               ;ADDRESS IS FORMED HERE
4697  014664  000000                    RD.WRD: .WORD   0               ;REG. CONTENTS PUT HERE
4698  014666  013766  014664  000002            MOV     RD.WRD,2(SP)    ;RETURN IT TO THE USER
4699  014674  013746  007704                    MOV     RPADR,-(SP)     ;PUT THE ADDRESS ON THE STACK
4700  014700  062716  000010                    ADD     #RPCS2,(SP)     ;FORM THE ADDRESS OF RPCS2
4701  014704  032736  010000                    BIT     #BIT12,@(SP)+   ;CHECK THE 'NED' BIT
4702  014710  001035                            BNE     RD.RP3          ;BR IF DRIVE NON-EXISTENT
4703  014712  017746  172766                    MOV     @RPADR,-(SP)    ;READ RPCS1
4704  014716  032716  020000                    BIT     #BIT13,(SP)     ;DID MCPE SET?
4705  014722  001002                            BNE     1$              ;BRANCH IF YES
4706  014724  022620                            CMP     (SP)+,(R0)+     ;ADJUST FOR RETURN
4707  014726  000430                            BR      RD.RP4          ;EXIT
4708  014730                            1$:
4709                  001                       .IF DF $ESCAPE
4710                                            JSR     R0,ES.SAV       ;SAVE THE ADDRESS IN '$ESCAPE'
4711                  000                       .ENDC
4712  014730  104003                            ERROR   3               ;REPORT "MCPE" ERROR
4713  014732  005737  007670                    TST     DTUW            ;DATA TRANSFER UNDERWAY?
4714  014736  100405                            BMI     2$              ;NO--BRANCH
4715  014740  032716  040000                    BIT     #BIT14,(SP)     ;NO--"TRE"=1?
4716  014744  001402                            BEQ     2$              ;NO--BRANCH
4717  014746  005726                            TST     (SP)+           ;YES--CLEAN OFF THE STACK AND
4718  014750  000415                            BR      RD.RP3          ;TAKE THE FATAL ERROR EXIT
4719  014752  052716  040000            2$:     BIS     #BIT14,(SP)     ;CLEAR "MCPE" BY SENDING A "1" TO "TRE"
4720  014756  000316                            SWAB    (SP)            ;POSITION BEFORE WRITING
4721  014760  013737  007704  014774            MOV     RPADR,3$        ;FORM ADDRESS OF HIGH BYTE
4722  014766  005237  014774                    INC     3$
4723  014772  112637                            MOVB    (SP)+,@(PC)+    ;WRITE THE HIGH BYTE OF RPCS1
4724  014774  000000                    3$:     .WORD   0               ;ADDRESS STORAGE
4725  014776  005327                            DEC     (PC)+           ;EXCEEDED MAX. RETRYS
4726  015000  000003                    RD.RP2: .WORD   3
4727  015002  002326                            BGE     RD.RP1          ;BRANCH IF NO
4728  015004  011000                    RD.RP3: MOV     (R0),R0         ;FATAL ERROR EXIT
4729  015006  012616                            MOV     (SP)+,(SP)
4730  015010  000200                    RD.RP4: RTS     R0
4731
4732                                    ;ROUTINE TO WRITE A REGISTER
4733                                    ;
4734                                    ;CALL
4735                                    ;       MOV     DATA,-(SP)      ;DATA TO BE LOADED ON THE STACK
4736                                    ;       JSR     R0,WRT.RP       ;CALL THE ROUTINE TO LOAD(WRITE) THE REG.
4737                                    ;       INDEX                   ;INDEX OF THE REGISTER TO BE LOADED
4738                                    ;       ERRADR                  ;ADDRESS TO RETURN TO ON AN ERROR
4739                                    ;       RETURN                  ;ERROR FREE RETURN
4740
4741  015012  013737  007702  015162    WRT.RP: MOV     MCPEMX,WRT.R2   ;MAX RETRYS ALLOWED
4742  015020  016637  000002  015100            MOV     2(SP),WRT.WD    ;SAVE THE WORD TO WRITE
```

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 4743  015026  012616                        MOV     (SP)+,(SP)      ;ADJUST THE STACK
 4744  015030  012037  015102                MOV     (R0)+,WRT.AD    ;GET INDEX OF REGISTER TO BE WRITTEN
 4745  015034  001015                        BNE     1$              ;BRANCH IF NOT RPCS1
 4746  015036  122737  000150  015100        CMPB    #150,WRT.WD     ;IS THE COMMAND FOR DATA TRANSFERS?
 4747  015044  002411                        BLT     1$              ;YES--DON'T GET THE OLD A16 & A17, & PSEL
 4748  015046  004037  014636                JSR     R0,RD.RP        ;NO---COMBINE A16&A17, & PSEL WITH
 4749  015052  000000                        RPCS1                   ;THE COMMAND BEFORE SENDING IT TO
 4750  015054  015170                        WRT.R3                  ;THE RH11/RP04
 4751  015056  000316                        SWAB    (SP)
 4752  015060  042716  177770                BIC     #^C7,(SP)
 4753  015064  112637  015101                MOVB    (SP)+,WRT.WD+1
 4754  015070  063737  007704  015102  1$:   ADD     RPADR,WRT.AD    ;FORM THE ADDRESS OF THE DISK REG.
 4755  015076  012737                WRT.R1: MOV     (PC)+,@(PC)+    ;LOAD THE DESIRED REG.
 4756  015100  000000                WRT.WD: .WORD   0               ;WORD TO WRITE GOES HERE
 4757  015102  000000                WRT.AD: .WORD   0               ;ADDRESS IS FORMED HERE
 4758  015104  013746  007704                MOV     RPADR,-(SP)     ;PUT THE ADDRESS ON THE STACK
 4759  015110  062716  000010                ADD     #RPCS2,(SP)     ;FORM THE ADDRESS OF RPCS2
 4760  015114  032736  010000                BIT     #BIT12,@(SP)+   ;CHECK THE 'NED' BIT
 4761  015120  001023                        BNE     WRT.R3          ;BR IF DRIVE NON-EXISTENT
 4762  015122  004037  014636                JSR     R0,RD.RP        ;CHECK FOR PARITY ERROR ON WRITE
 4763  015126  000014                        RPER1
 4764  015130  015170                        WRT.R3
 4765  015132  032726  000010                BIT     #BIT03,(SP)+
 4766  015136  001416                        BEQ     WRT.R4          ;BRANCH IF "PAR=0"
 4767  015140  016037  177776  015152        MOV     -2(R0),1$       ;PICKUP THE INDEX
 4768  015146  004037  014636                JSR     R0,RD.RP        ;READ THE REG.
 4769  015152  000000                1$:     .WORD   0               ;REG. INDEX
 4770  015154  015170                        WRT.R3                  ;RETURN TO THIS ADDRESS ON ERROR
 4771             001                .IF DF $ESCAPE
 4772                                        JSR     R0,ES.SAV       ;SAVE THE ADDRESS IN '$ESCAPE'
 4773             000                .ENDC
 4774  015156  104004                        ERROR   4               ;REPORT THE PARITY ON WRITE ERROR
 4775  015160  005327                        DEC     (PC)+           ;DECREMENT THE ERROR COUNT
 4776  015162  000003                WRT.R2: .WORD   3               ;RETRY COUNTER
 4777  015164  002344                        BGE     WRT.R1          ;TRY AGAIN IF NOT FINISHED
 4778  015166  005726                        TST     (SP)+           ;CLEAN OFF THE STACK
 4779  015170  011000                WRT.R3: MOV     (R0),R0         ;TAKE THE "PARITY ON WRITE" ERROR EXIT
 4780  015172  000401                        BR      WRT.R5          ;EXIT
 4781  015174  005720                WRT.R4: TST     (R0)+           ;ADJUST FOR ERROR FREE EXIT
 4782  015176  000200                WRT.R5: RTS     R0
 4783
 4784                                ;ROUTINE TO SAVE THE RH11/RP04/5/6 REGISTERS AS PER DPB+14
 4785                                ;
 4786                                ;CALL
 4787                                ;       MOV     #DPBNUM,R2      ;DPB POINTER TO R2
 4788                                ;       JSR     PC,SVRH11       ;SAVE THE DRIVES REG'S
 4789
 4790  015200  104412                SVRH11: SAVREG                  ;SAVE R0 - R5
 4791  015202  005702                        TST     R2              ;QUEUE ENTRY FOR THE DRIVE ?
 4792  015204  001430                        BEQ     4$              ;BR IF NONE
 4793  015206  013704  007704                MOV     RPADR,R4
 4794  015212  111264  000010                MOVB    (R2),RPCS2(R4)  ;SELECT DRIVE
 4795  015216  016203  000014                MOV     14(R2),R3       ;GET THE ERROR TABLE POINTER
 4796  015222  001433                        BEQ     6$              ;EXIT IF NO ADDRESS
 4797  015224  005037  015260                CLR     3$              ;COUNTER & POINTER
 4798  015230  023727  015260  000022  1$:   CMP     3$,#RPDB        ;REACHED THE BUFFER REGISTER ?
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4799  015236  001006                        BNE     2$                      ;BR IF NOT
4800  015240  032764  000200  000010        BIT     #BIT07,RPCS2(R4)        ;'OR' SET ?
4801  015246  001002                        BNE     2$                      ;BR IF SET
4802  015250  005023                        CLR     (R3)+                   ;STORE RPDB AS ZEROES
4803  015252  000405                        BR      4$                      ;CONTINUE
4804  015254  004037  014636        2$:     JSR     R0,RD.RP                ;READ THE SELECTED REGISTER
4805  015260  000000                3$:     .WORD   0                       ;REGISTER INDEX
4806  015262  015306                        5$                              ;ERROR RETURN ADDRESS
4807  015264  012623                        MOV     (SP)+,(R3)+             ;STORE THE REGISTER CONTENTS
4808  015266  023727  015260  000046  4$:     CMP     3$,#RPEC2               ;REACHED THE END ?
4809  015274  001406                        BEQ     6$                      ;BR IF YES
4810  015276  062737  000002  015260        ADD     #2,3$                   ;INCREMENT THE REGISTER INDEX
4811  015304  000751                        BR      1$                      ;CONTINUE READING THE REGISTERS
4812  015306  004737  012074        5$:     JSR     PC,CI7                  ;PROCESS THE UNCORRECTABLE PARITY ERROR
4813  015312  104413                6$:     RESREG                          ;RESTORE R0 - R5
4814  015314  000207                        RTS     PC                      ;RETURN
4815
4816                                ;ROUTINE TO SET THE INTERRUPT WITHOUT GETTING A "TRE"
4817                                ;CALL
4818                                ;       MOV     #DRVNUM,R1              ;DRIVE NUMBER TO R1
4819                                ;       JSR     PC,SET.IE               ;SET "IE"
4820                                ;       RETURN
4821
4822  015316  010446                SET.IE: MOV     R4,-(SP)                ;SAVE R4
4823  015320  013704  007704                MOV     RPADR,R4                ;PICKUP ADDRESS OF RPCS1
4824  015324  010164  000010                MOV     R1,RPCS2(R4)            ;SELECT DRIVE
4825  015330  011446                        MOV     (R4),-(SP)              ;READ RPCS1
4826  015332  052716  040000                BIS     #BIT14,(SP)             ;SET THE "TRE" BIT OF THE WORD READ
4827  015336  000316                        SWAB    (SP)                    ;ADJUST FOR DATO
4828  015340  112714  000100                MOVB    #BIT06,(R4)             ;SET "IE"
4829  015344  032764  010000  000010        BIT     #BIT12,RPCS2(R4)        ;IS "NED"=1?
4830  015352  001002                        BNE     1$                      ;YES--CLEAR "TRE"
4831  015354  005726                        TST     (SP)+                   ;CLEAN OFF THE STACK
4832  015356  000402                        BR      2$
4833  015360  112664  000001        1$:     MOVB    (SP)+,1(R4)             ;CLEAR "TRE"
4834  015364  012604                2$:     MOV     (SP)+,R4                ;RESTORE R4
4835  015366  000207                        RTS     PC                      ;RETURN TO CALLER
4836
4837                                ;QUEUE COUNT
4838  015370        000             QCNT:   .BYTE   0                       ;DRIVE 0
4839  015371        000                     .BYTE   0                       ;DRIVE 1
4840  015372        000                     .BYTE   0                       ;DRIVE 2
4841  015373        000                     .BYTE   0                       ;DRIVE 3
4842  015374        000                     .BYTE   0                       ;DRIVE 4
4843  015375        000                     .BYTE   0                       ;DRIVE 5
4844  015376        000                     .BYTE   0                       ;DRIVE 6
4845  015377        000                     .BYTE   0                       ;DRIVE 7
4846
4847                                ;QUEUE INPUT POINTERS
4848
4849  015400  015462                QINPT:  .WORD   QDRV0                   ;DRIVE 0
4850  015402  015502                        .WORD   QDRV1                   ;DRIVE 1
4851  015404  015522                        .WORD   QDRV2                   ;DRIVE 2
4852  015406  015542                        .WORD   QDRV3                   ;DRIVE 3
4853  015410  015562                        .WORD   QDRV4                   ;DRIVE 4
4854  015412  015602                        .WORD   QDRV5                   ;DRIVE 5
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 4855  015414  015622                        .WORD   QDRV6           ;DRIVE 6
 4856  015416  015642                        .WORD   QDRV7           ;DRIVE 7
 4857
 4858                                  ;QUEUE OUTPUT POINTERS
 4859
 4860  015420  015462                  QOUTPT: .WORD   QDRV0           ;DRIVE 0
 4861  015422  015502                          .WORD   QDRV1           ;DRIVE 1
 4862  015424  015522                          .WORD   QDRV2           ;DRIVE 2
 4863  015426  015542                          .WORD   QDRV3           ;DRIVE 3
 4864  015430  015562                          .WORD   QDRV4           ;DRIVE 4
 4865  015432  015602                          .WORD   QDRV5           ;DRIVE 5
 4866  015434  015622                          .WORD   QDRV6           ;DRIVE 6
 4867  015436  015642                          .WORD   QDRV7           ;DRIVE 7
 4868
 4869  015440  015462                  QSTART: .WORD   QDRV0           ;DRIVE 0 START ADDRESS
 4870  015442  015502                  QSTOP:  .WORD   QDRV1           ;DRIVE 0 STOP ADDRESS & DRIVE 1 START ADDRESS
 4871  015444  015522                          .WORD   QDRV2           ;STOP DRIVE 1--START DRIVE 2
 4872  015446  015542                          .WORD   QDRV3           ;STOP DRIVE 2--START DRIVE 3
 4873  015450  015562                          .WORD   QDRV4           ;STOP DRIVE 3--START DRIVE 4
 4874  015452  015602                          .WORD   QDRV5           ;STOP DRIVE 4--START DRIVE 5
 4875  015454  015622                          .WORD   QDRV6           ;STOP DRIVE 5--START DRIVE 6
 4876  015456  015642                          .WORD   QDRV7           ;STOP DRIVE 6--START DRIVE 7
 4877  015460  015662                          .WORD   QTERM           ;STOP DRIVE 7
 4878
 4879                                  ;DRIVE REQUEST QUEUES
 4880
 4881  015462  000010                  QDRV0:  .BLKW   10
 4882  015502  000010                  QDRV1:  .BLKW   10
 4883  015522  000010                  QDRV2:  .BLKW   10
 4884  015542  000010                  QDRV3:  .BLKW   10
 4885  015562  000010                  QDRV4:  .BLKW   10
 4886  015602  000010                  QDRV5:  .BLKW   10
 4887  015622  000010                  QDRV6:  .BLKW   10
 4888  015642  000010                  QDRV7:  .BLKW   10
 4889          015662                  QTERM=.
 4890
 4891                                  ;ROUTINE TO CLEAR ALL OF THE REQUEST QUEUES
 4892                                  ;
 4893                                  ;CALL
 4894                                  ;       JSR     PC,CLRQUE
 4895
 4896  015662  104412                  CLRQUE: SAVREG                  ;SAVE R0 - R5
 4897  015664  012702  015370                  MOV     #QCNT,R2        ;ZERO THE QUEUE COUNTS
 4898  015670  005022                          CLR     (R2)+           ;DRIVES 0 & 1
 4899  015672  005022                          CLR     (R2)+           ;DRIVES 2 & 3
 4900  015674  005022                          CLR     (R2)+           ;DRIVES 4 & 5
 4901  015676  005022                          CLR     (R2)+           ;DRIVES 6 & 7
 4902  015700  012703  000010                  MOV     #8.,R3          ;MOVE THE STARTING
 4903  015704  012701  015440                  MOV     #QSTART,R1      ;ADDRESS OF THE QUEUE INTO
 4904  015710  012122                  1$:     MOV     (R1)+,(R2)+     ;THE QUEUE INPUT POINTER
 4905  015712  005303                          DEC     R3
 4906  015714  001375                          BNE     1$
 4907  015716  012703  000010                  MOV     #8.,R3          ;MOVE THE STARTING ADDRESS
 4908  015722  012701  015440                  MOV     #QSTART,R1      ;OF THE QUEUE INTO THE
 4909  015726  012122                  2$:     MOV     (R1)+,(R2)+     ;QUEUE OUTPUT POINTER
 4910  015730  005303                          DEC     R3
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4911  015732  001375                      BNE     2$
4912  015734  104413                      RESREG                  ;RESTORE R0 - R5
4913  015736  000207                      RTS     PC
4914
4915                                  ;EMPTY THE QUEUE SPECIFIED BY R1
4916                                  ;
4917                                  ;CALL
4918                                  ;       MOV     DRVNUM,R1       ;DRIVE NUMBER TO R1
4919                                  ;       JSR     PC,EMPTYQ
4920
4921  015740  105061  015370          EMPTYQ: CLRB    QCNT(R1)        ;CLEAR NUMBER OF ITEMS IN QUEUE
4922  015744  006301                          ASL     R1
4923  015746  016161  015400  015420          MOV     QINPT(R1),QOUTPT(R1) ;SET OUTPUT QUEUE POINTER=INPUT POINTER
4924  015754  006201                          ASR     R1
4925  015756  000207                          RTS     PC
4926
4927                                  ;ROUTINE TO PUT A REQUEST IN QUEUE
4928                                  ;
4929                                  ;CALL
4930                                  ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER
4931                                  ;       MOV     #DPB,R2         ;ADDRESS OF PARAMETER BLOCK
4932                                  ;       JSR     R0,DRVQUE       ;GO PUT REQUEST IN QUEUE
4933                                  ;       RETURN1                 ;RETURN HERE IF QUEUE IS FULL
4934                                  ;       RETURN2                 ;RETURN HERE IF REQUEST IS IN QUEUE
4935
4936  015760  122761  000010  015370  DRVQUE: CMPB    #10,QCNT(R1)    ;IS QUEUE FULL?
4937  015766  001421                          BEQ     2$              ;BR IF YES-TAKE RETURN1
4938  015770  105261  015370                  INCB    QCNT(R1)        ;INCREMENT QUEUE COUNT
4939  015774  006301                          ASL     R1
4940  015776  010271  015400                  MOV     R2,@QINPT(R1)   ;PUT THIS REQUEST IN QUEUE
4941  016002  062761  000002  015400          ADD     #2,QINPT(R1)    ;UPDATE THE QUEUE POINTER
4942  016010  026161  015400  015442          CMP     QINPT(R1),QSTOP(R1) ;TIME TO RESET THE POINTER
4943  016016  001003                          BNE     1$              ;BRANCH IF NO
4944  016020  016161  015440  015400          MOV     QSTART(R1),QINPT(R1) ;YES--RESET POINTER
4945  016026  006201                  1$:     ASR     R1
4946  016030  005720                          TST     (R0)+           ;TAKE RETURN 2
4947  016032  000200                  2$:     RTS     R0              ;RETURN TO USER
4948
4949                                  ;ROUTINE TO GET THE "DPB" ADDRESS OF NEXT REQUEST IN QUEUE
4950                                  ;
4951                                  ;CALL
4952                                  ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
4953                                  ;       JSR     PC,GETREQ       ;GO GET THE REQUEST
4954                                  ;       RETURN                  ;R2="DPB" ADDRESS OF THE REQUEST
4955                                  ;                               ;R2=0 IF NO REQUEST IN QUEUE
4956
4957  016034  005002                  GETREQ: CLR     R2
4958  016036  105761  015370                  TSTB    QCNT(R1)        ;IS THERE ANY REQUEST IN QUEUE?
4959  016042  001404                          BEQ     2$              ;NO---BRANCH
4960  016044  006301                  1$:     ASL     R1
4961  016046  017102  015420                  MOV     @QOUTPT(R1),R2  ;PICKUP "DPB" POINTER FOR THIS DRIVE
4962  016052  006201                          ASR     R1
4963  016054  000207                  2$:     RTS     PC              ;RETURN TO USER
4964
4965                                  ;ROUTINE TO "POP" THE REQUEST FROM QUEUE
4966                                  ;
```

```
                                        ;CALL
                                        ;       MOV     #DRVNUM,R1      ;DRIVE NUMBER TO R1
                                        ;       JSR     PC,POPQUE       ;CALL TO REMOVE REQUEST
                                        ;       RETURN                  ;R2=ADDRESS OF DPB REMOVED
                                        
016056  105361  015370        POPQUE: DECB    QCNT(R1)                ;DECREMENT QUEUE COUNT
016062  006301                        ASL     R1
016064  017102  015420                MOV     @QOUTPT(R1),R2          ;GET THE "DPB" POINTER
016070  062761  000002  015420        ADD     #2,QOUTPT(R1)           ;UPDATE THE QUEUE POINTER
016076  026161  015420  015442        CMP     QOUTPT(R1),QSTOP(R1) ;TIME TO RESET THE POINTER?
016104  001003                        BNE     1$                      ;NO--BRANCH TO EXIT
016106  016161  015440  015420        MOV     QSTART(R1),QOUTPT(R1) ;YES--RESET THE POINTER
016114  006201                1$:     ASR     R1
016116  000207                        RTS     PC                      ;RETURN TO USER
                                        
                    001                 .IF DF $ESCAPE
                                        ;ROUTINE TO SAVE THE CONTENTS OF '$ESCAPE' WHEN THE DRIVER
                                        ;REPORTS AN ERROR DIRECTLY.
                                        ;
                                        ;CALL
                                        ;       JSR     R0,ES.SAV
                                        ;       ERROR   N                       ;;THE ERROR CALL
                                        ;       RETURN                          ;THE RETURN IS PAST THE ERROR CALL
                                        
                                        ES.SAV: MOV     (R0)+,1$                ;GET THE ERROR CALL
                                                MOV     $ESCAPE,-(SP)           ;SAVE THE ADDRESS IN '$ESCAPE'
                                                CLR     $ESCAPE                 ;CLEAR THE ESCAPE RETURN
                                        1$:     .WORD   0                       ;THE ERROR CALL IS MOVED HERE
                                                MOV     (SP)+,$ESCAPE           ;RESTORE THE ESCAPE ADDRESS
                                                RTS     R0                      ;RETURN
                    000                 .ENDC
                                        
                    001                 .IF B
                                        ;;*****************************************************************
                                        .IFF
                                        .NLIST
                                        .REPT
                                        .LIST
                                        ;;*****************************************************************
                                        .NLIST
                                        .ENDR
                                        .LIST
                000                     .ENDC
                                        
                                        .SBTTL  DATA PARAMETER BLOCK
                                        
                001                     .IF B
                                        ;;*****************************************************************
                                        .IFF
                                        .NLIST
                                        .REPT
                                        .LIST
                                        ;;*****************************************************************
                                        .NLIST
                                        .ENDR
```

```
                                .LIST
                        000     .ENDC

016120  000             DPB:    .BYTE 0                 ;DRIVE NUMBER
016121  000                     .BYTE 0                 ;OFFSET VALUE OR FMT22, ECI, AND HCI
016122  000                     .BYTE 0                 ;COMMAND
016123  000                     .BYTE 0                 ;PSEL AND A17 AND A16
016124  000000                  .WORD 0                 ;WORD COUNT (MUST BE NEG)
016126  001206                  .WORD INREG             ;BUFFER ADDRESS OR
                                                        ;REGISTER TABLE POINTER
016130  000                     .BYTE 0                 ;SECTOR ADDRESS OR
                                                        ;FIRST REGISTER INDEX
016131  000                     .BYTE 0                 ;TRACK ADDRESS OR
                                                        ;LAST REGISTER INDEX
016132  000000                  .WORD 0                 ;CYLINDER ADDRESS
016134  016140                  .WORD REG               ;ERROR TABLE POINTER
                                                        ;POINTS TO THE FIRST OF TWENTY
                                                        ;LOCATIONS WHERE THE DRIVER IS
                                                        ;TO STORE THE RH11/RP04 REGISTERS
                                                        ;ON AN ERROR.  IF ZERO, REGISTERS
                                                        ;ARE NOT SAVED.
016136  000000                  .WORD 0                 ;STATUS/ERROR INDICATOR
                                                        ;BIT15 = 1 => ERROR OCCURRED
                                                        ;BIT07 = 1 => DONE
                                                        ;BIT 14 - BIT10 AND BIT06 - BIT03
                                                        ;INDICATE TYPE OF ERROR

016140  000000          REG:    .WORD   0               ;STORE RP04 REGISTERS HERE
016142  000000                  .WORD   0               ;RPWC
016144  000000                  .WORD   0               ;RPBA
016146  000000                  .WORD   0               ;RPDA
016150  000000                  .WORD   0               ;RPCS2
016152  000000                  .WORD   0               ;RPDS1
016154  000000                  .WORD   0               ;RPER1
016156  000000                  .WORD   0               ;RPAS
016160  000000                  .WORD   0               ;RPLA
016162  000000                  .WORD   0               ;RPDB
016164  000000                  .WORD   0               ;RPMR
016166  000000                  .WORD   0               ;RPDT
016170  000000                  .WORD   0               ;RPSN
016172  000000                  .WORD   0               ;RPOF
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5064  016174  000000                    .WORD   0                       ;RPCA
5065  016176  000000                    .WORD   0                       ;RPCC
```

```
                        ;RPER2
                        ;RPER3
                        ;RPEC1
                        ;RPEC2

                        ;DPB INDEX EQUATES

                .IF B
                ;;*****************************************************************
                .IFF
                .NLIST
                .REPT
                .LIST
                ;;*****************************************************************
                .NLIST
                .ENDR
                .LIST
                .ENDC

                .SBTTL  HEAD CODE TABLE

                .IF B
                ;;*****************************************************************
                .IFF
                .NLIST
                .REPT
                .LIST
                ;;*****************************************************************
                .NLIST
                .ENDR
                .LIST
                .ENDC

HEAD1:          .WORD   0               ;HEAD ADDRESSES FOR CYLINDERS 245 & 496
                .WORD   1
                .WORD   2
                .WORD   3
                .WORD   4
                .WORD   5
                .WORD   6
                .WORD   7
                .WORD   10
                .WORD   11
                .WORD   12
                .WORD   13
                .WORD   14
                .WORD   15
                .WORD   16
                .WORD   17
                .WORD   20
```

```
5122  016252  000021                  .WORD   21
5123  016254  000022                  .WORD   22
5124  016256  100000                  .WORD   100000                  ;TABLE TERMINATOR
5125
5126  016260  000000          HEAD6:  .WORD   0                       ;HEAD ADDRESSES FOR CYLS 800 & 008
5127  016262  000001                  .WORD   1
5128  016264  000012                  .WORD   10.
5129  016266  000021                  .WORD   17.
5130  016270  000022                  .WORD   18.
5131  016272  100000                  .WORD   100000
5132  016274  000000                  .WORD   0
5133  016276  000001                  .WORD   1
5134  016300  000012                  .WORD   10.
5135  016302  000021                  .WORD   17.
5136  016304  000022                  .WORD   18.
5137  016306  100000                  .WORD   100000                  ;TERMINATOR
5138
5139  016310  000000          HEAD45: .WORD   0                       ;HEAD ADDRESSES FOR CYLINDERS 400 & 4
5140  016312  000022                  .WORD   18.
5141  016314  100000                  .WORD   100000
5142  016316  000000                  .WORD   0
5143  016320  000022                  .WORD   18.
5144  016322  100000                  .WORD   100000                  ;TERMINATOR
5145
5146              001         .IF B
5147                          ;;*****************************************************************
5148                          .IFF
5149                          .NLIST
5150                          .REPT
5151                          .LIST
5152                          ;;*****************************************************************
5153                          .NLIST
5154                          .ENDR
5155                          .LIST
5156              000         .ENDC
5157
5158                          .SBTTL  OFFSET CODE TABLES
5159
5160              001         .IF B
5161                          ;;*****************************************************************
5162                          .IFF
5163                          .NLIST
5164                          .REPT
5165                          .LIST
5166                          ;;*****************************************************************
5167                          .NLIST
5168                          .ENDR
5169                          .LIST
5170              000         .ENDC
5171
5172  016324                  OFTBL6:                                 ;OFFSET TABLE FOR CYLINDER 496
5173  016324      030                 .BYTE   30
5174  016325      027                 .BYTE   27
5175  016326      026                 .BYTE   26
5176  016327      025                 .BYTE   25
5177  016330      024                 .BYTE   24
```

```
5178  016331  023                    .BYTE   23
5179  016332  022                    .BYTE   22
5180  016333  021                    .BYTE   21
5181  016334  020                    .BYTE   20
5182  016335  017                    .BYTE   17
5183  016336  016                    .BYTE   16
5184  016337  015                    .BYTE   15
5185  016340  014                    .BYTE   14
5186  016341  013                    .BYTE   13
5187  016342  012                    .BYTE   12
5188  016343  011                    .BYTE   11
5189  016344  010                    .BYTE   10
5190  016345  007                    .BYTE   7
5191  016346  006                    .BYTE   6
5192  016347  005                    .BYTE   5
5193  016350  004                    .BYTE   4
5194  016351  003                    .BYTE   3
5195  016352  002                    .BYTE   2
5196  016353  001                    .BYTE   1
5197  016354  000                    .BYTE   0
5198  016355  201                    .BYTE   201
5199  016356  202                    .BYTE   202
5200  016357  203                    .BYTE   203
5201  016360  204                    .BYTE   204
5202  016361  205                    .BYTE   205
5203  016362  206                    .BYTE   206
5204  016363  207                    .BYTE   207
5205  016364  210                    .BYTE   210
5206  016365  211                    .BYTE   211
5207  016366  212                    .BYTE   212
5208  016367  213                    .BYTE   213
5209  016370  214                    .BYTE   214
5210  016371  215                    .BYTE   215
5211  016372  216                    .BYTE   216
5212  016373  217                    .BYTE   217
5213  016374  220                    .BYTE   220
5214  016375  221                    .BYTE   221
5215  016376  222                    .BYTE   222
5216  016377  223                    .BYTE   223
5217  016400  224                    .BYTE   224
5218  016401  225                    .BYTE   225
5219  016402  226                    .BYTE   226
5220  016403  227                    .BYTE   227
5221  016404  230                    .BYTE   230
5222
5223  016405                 OFTBL4:                ;OFFSET TABLE FOR CYLINDER 245
5224  016405  060                    .BYTE   60
5225  016406  057                    .BYTE   57
5226  016407  056                    .BYTE   56
5227  016410  055                    .BYTE   55
5228  016411  054                    .BYTE   54
5229  016412  053                    .BYTE   53
5230  016413  052                    .BYTE   52
5231  016414  051                    .BYTE   51
5232  016415  050                    .BYTE   50
5233  016416  047                    .BYTE   47
```

```
  5234  016417  046                    .BYTE   46
  5235  016420  045                    .BYTE   45
  5236  016421  044                    .BYTE   44
  5237  016422  043                    .BYTE   43
  5238  016423  042                    .BYTE   42
  5239  016424  041                    .BYTE   41
  5240  016425  040                    .BYTE   40
  5241  016426  037                    .BYTE   37
  5242  016427  036                    .BYTE   36
  5243  016430  035                    .BYTE   35
  5244  016431  034                    .BYTE   34
  5245  016432  033                    .BYTE   33
  5246  016433  032                    .BYTE   32
  5247  016434  031                    .BYTE   31
  5248  016435  030                    .BYTE   30
  5249  016436  027                    .BYTE   27
  5250  016437  026                    .BYTE   26
  5251  016440  025                    .BYTE   25
  5252  016441  024                    .BYTE   24
  5253  016442  023                    .BYTE   23
  5254  016443  022                    .BYTE   22
  5255  016444  021                    .BYTE   21
  5256  016445  020                    .BYTE   20
  5257  016446  017                    .BYTE   17
  5258  016447  016                    .BYTE   16
  5259  016450  015                    .BYTE   15
  5260  016451  014                    .BYTE   14
  5261  016452  013                    .BYTE   13
  5262  016453  012                    .BYTE   12
  5263  016454  011                    .BYTE
  5264  016455  010                    .BYTE   1C
  5265  016456  007                    .BYTE   7
  5266  016457  006                    .BYTE   6
  5267  016460  005                    .BYTE   5
  5268  016461  004                    .BYTE   4
  5269  016462  003                    .BYTE   3
  5270  016463  002                    .BYTE   2
  5271  016464  001                    .BYTE   1
  5272  016465  000                    .BYTE   0
  5273  016466  201                    .BYTE   201
  5274  016467  202                    .BYTE   202
  5275  016470  203                    .BYTE   203
  5276  016471  204                    .BYTE   204
  5277  016472  205                    .BYTE   205
  5278  016473  206                    .BYTE   206
  5279  016474  207                    .BYTE   207
  5280  016475  210                    .BYTE   210
  5281  016476  211                    .BYTE   211
  5282  016477  212                    .BYTE   212
  5283  016500  213                    .BYTE   213
  5284  016501  214                    .BYTE   214
  5285  016502  215                    .BYTE   215
  5286  016503  216                    .BYTE   216
  5287  016504  217                    .BYTE   217
  5288  016505  220                    .BYTE   220
  5289  016506  221                    .BYTE   221
```

```
5290  016507  222                     .BYTE   222
5291  016510  223                     .BYTE   223
5292  016511  224                     .BYTE   224
5293  016512  225                     .BYTE   225
5294  016513  226                     .BYTE   226
5295  016514  227                     .BYTE   227
5296  016515  230                     .BYTE   230
5297  016516  231                     .BYTE   231
5298  016517  232                     .BYTE   232
5299  016520  233                     .BYTE   233
5300  016521  234                     .BYTE   234
5301  016522  235                     .BYTE   235
5302  016523  236                     .BYTE   236
5303  016524  237                     .BYTE   237
5304  016525  240                     .BYTE   240
5305  016526  241                     .BYTE   241
5306  016527  242                     .BYTE   242
5307  016530  243                     .BYTE   243
5308  016531  244                     .BYTE   244
5309  016532  245                     .BYTE   245
5310  016533  246                     .BYTE   246
5311  016534  247                     .BYTE   247
5312  016535  250                     .BYTE   250
5313  016536  251                     .BYTE   251
5314  016537  252                     .BYTE   252
5315  016540  253                     .BYTE   253
5316  016541  254                     .BYTE   254
5317  016542  255                     .BYTE   255
5318  016543  256                     .BYTE   256
5319  016544  257                     .BYTE   257
5320  016545  260                     .BYTE   260
5321                                  .EVEN
5322
5323          001                     .IF B
5324                                  ;;*****************************************************************
5325                                  .IFF
5326                                  .NLIST
5327                                  .REPT
5328                                  .LIST
5329                                  ;;*****************************************************************
5330                                  .NLIST
5331                                  .ENDR
5332                                  .LIST
5333          000                     .ENDC
5334
5335                                  .SBTTL  MESSAGES
5336
5337          001                     .IF B
5338                                  ;;*****************************************************************
5339                                  .IFF
5340                                  .NLIST
5341                                  .REPT
5342                                  .LIST
5343                                  ;;*****************************************************************
5344                                  .NLIST
5345                                  .ENDR
```

```
5346                                        .LIST
5347                 000                    .ENDC
5348
5349  016546  005015  055132  041455  TITLE:  .ASCII  <CR><LF>/ZZ-CZRJC-B/<CR><LF>
5350  016554  051132  041512  041055
5351  016562  005015
5352  016564  050122  032060  032457          .ASCIZ  @RP04/5/6 HEAD ALIGNMENT VERIFICATION PROGRAM@<CR><LF><LF>
5353  016572  033057  044040  040505
5354  016600  020104  046101  043511
5355  016606  046516  047105  020124
5356  016614  042526  044522  044506
5357  016622  040503  044524  047117
5358  01663C  050040  047522  051107
5359  016636  046501  005015  000012
5360
5361  016644  047504  047040  052117  DDU:     .ASCII  /DO NOT SELECT DRIVE UNTIL HEAD ALIGNMENT TEST BOX HAS BEEN CONNECTED/<C
5362  016652  051440  046105  041505
5363  016660  020124  051104  053111
5364  016666  020105  047125  044524
5365  016674  020114  042510  042101
5366  016702  040440  044514  047107
5367  016710  042515  052116  052040
5368  016716  051505  020124  047502
5369  016724  020130  040510  020123
5370  016732  042502  047105  041440
5371  016740  047117  042516  052103
5372  016746  042105  005015
5373  016752  047040  052117  035105          .ASCII  / NOTE:  WITH THE ALIGNMENT PACK MOUNTED, CONSTANT INDEX ERRORS MAY OCCU
5374  016760  020040  044527  044124
5375  016766  052040  042510  040440
5376  016774  044514  047107  042515
5377  017002  052116  050040  041501
5378  017010  020113  047515  047125
5379  017016  042524  026104  041440
5380  017024  047117  052123  047101
5381  017032  020124  047111  042504
5382  017040  020130  051105  047522
5383  017046  051522  046440  054501
5384  017054  047440  041503  051125
5385  017062  006456     012
5386  017065     040  044124  051505          .ASCII  / THESE INDEX ERRORS ARE CAUSED BY THE ALIGNMENT PACK AND MAY//<CR><LF>
5387  017072  020105  047111  042504
5388  017100  020130  051105  047522
5389  017106  051522  040440  042522
5390  017114  041440  052501  042523
5391  017122  020104  054502  052040
5392  017130  042510  040440  044514
5393  017136  047107  042515  052116
5394  017144  050040  041501  020113
5395  017152  047101  020104  040515
5396  017160  006531     012
5397  017163     040  047516  020124          .ASCII  / NOT OCCUR WITH SOME ALIGNMENT PACKS.  TO INHIBIT THE ALIGNMENT PACK <C
5398  017170  041517  052503  020122
5399  017176  044527  044124  051440
5400  017204  046517  020105  046101
5401  017212  043511  046516  047105
```

```
5402  017220  020124  040520  045503
5403  017226  027123  020040  047524
5404  017234  044440  044116  041111
5405  017242  052111  052040  042510
5406  017250  040440  044514  047107
5407  017256  042515  052116  050040
5408  017264  041501  006513     012
5409  017271     040  042522  040514          .ASCII  / RELATED INDEX ERROR, GROUND THE FOLLOWING PINS://<CR><LF>
5410  017276  04252'  020104  047111
5411  017304  042504  020130  051105
5412  017312  047522  026122  043440
5413  017320  047522  047125  020104
5414  017326  044124  020105  047506
5415  017334  046114  053517  047111
5416  017342  020107  044520  051516
5417  017350  006472     012
5418  017353     040  020040  020040          .ASCII  /      RP04: PIN A1A0508 (FUNCTION '+TPNDEXER')/<CR><LF>
5419  017360  051040  030120  035064
5420  017366  050040  047111  040440
5421  017374  040461  032460  034060
5422  017402  024040  052506  041516
5423  017410  044524  047117  023440
5424  017416  052053  047120  042504
5425  017424  042530  023522  006451
5426  017432     012
5427  017433     040  020040  020040          .ASCIZ  @      RP05/6:  PIN D04R19 (FUNCTION '-INDEX')@<CR><LF><LF>
5428  017440  051040  030120  027465
5429  017446  035066  020040  044520
5430  017454  020116  030104  051064
5431  017462  034461  024040  052506
5432  017470  041516  044524  047117
5433  017476  023440  044455  042116
5434  017504  054105  024447  005015
5435  017512  000012
5436
5437  017514  005015  051104  053111  NODRV:  .ASCIZ  <CR><LF>/DRIVE NOT AVAILABLE//<CR><LF><LF>
5438  017522  020105  047516  020124
5439  017530  053101  044501  040514
5440  017536  046102  006505  005012
5441  017544     000
5442
5443  017545     015  042412  052116  ENTERD: .ASCIZ  <CR><LF>/ENTER DRIVE NUMBER: /
5444  017552  051105  042040  044522
5445  017560  042526  047040  046525
5446  017566  042502  035122  000040
5447
5448  017574  005015  051104  053111  WLOCK:  .ASCIZ  <CR><LF>/DRIVE NOT WRITE PROTECTED//<CR><LF><LF
5449  017602  020105  047516  020124
5450  017610  051127  052111  020105
5451  017616  051120  052117  041505
5452  017624  042524  006504  005012
5453  017632     000
5454
5455  017633     040  044040  040505  TOLRG:  .ASCIZ  /  HEAD OUT OF RANGE/
5456  017640  020104  052517  020124
5457  017646  043117  051040  047101
```

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5458  017654  042507     000
5459
5460  017657     015  020012  020040  HEADER: .ASCII  <CR><LF>/                TRK CENTER/<CR><LF>
5461  017664  020040  020040  020040
5462  017672  020040  020040  052040
5463  017700  045522  041440  047105
5464  017706  042524  006522     012
5465  017713     040  020040  042510          .ASCIZ  /   HEAD  CYL (IN U INCHES)/<CR><LF><LF>
5466  017720  042101  020040  054503
5467  017726  020114  044450  020116
5468  017734  020125  047111  044103
5469  017742  051505  006451  005012
5470  017750     000
5471
5472  017751     101  046050  043511  MODE:   .ASCIZ  /A(LIGN), V(ERIFY), OR E(XERCISE) ? /
5473  017756  024516  020054  024126
5474  017764  051105  043111  024531
5475  017772  020054  051117  042440
5476  020000  054050  051105  044503
5477  020006  042523  020051  020077
5478  020014     000
5479
5480  020015     126  051105  043111  VERIFY: .ASCIZ  /VERIFY/<CR><LF><LF>
5481  020022  006531  005012     000
5482
5483  020027     101  044514  047107  ALIGN:  .ASCIZ  /ALIGN/<CR><LF><LF>
5484  020034  005015  000012
5485
5486  020040  054105  051105  044503  EXER:   .ASCIZ  /EXERCISE/<CR><LF><LF>
5487  020046  042523  005015  000012
5488
5489  020054  042510  042101  030040  HDZERO: .ASCIZ  /HEAD 0 SELECTED BY DEFAULT/<CR><LF><LF>
5490  020062  051440  046105  041505
5491  020070  042524  020104  054502
5492  020076  042040  043105  052501
5493  020104  052114  005015  000012
5494
5495  020112  054503  044514  042116  CYL245: .ASCIZ  /CYLINDER 245 SELECTED BY DEFAULT/<CR><LF><LF>
5496  020120  051105  031040  032464
5497  020126  051440  046105  041505
5498  020134  042524  020104  054502
5499  020142  042040  043105  052501
5500  020150  052114  005015  000012
5501
5502  020156  054503  044514  042116  CYL496: .ASCIZ  /CYLINDER 496 SELECTED BY DEFAULT/<CR><LF><LF>
5503  020164  051105  032040  033071
5504  020172  051440  046105  041505
5505  020200  042524  020104  054502
5506  020206  042040  043105  052501
5507  020214  052114  005015  000012
5508
5509  020222  044504  045523  044440  ALN245: .ASCIZ  /DISK IS POSITIONED AT CYLINDER 245/<CR><LF><LF>
5510  020230  020123  047520  044523
5511  020236  044524  047117  042105
5512  020244  040440  020124  054503
5513  020252  044514  042116  051105
```

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5514  020260  031040  032464  005015
5515  020266  000012
5516
5517  020270  044504  045523  044440  ALN496: .ASCIZ  /DISK IS POSITIONED AT CYLINDER 496/<CR><LF><LF>
5518  020276  020123  047520  044523
5519  020304  044524  047117  042105
5520  020312  040440  020124  054503
5521  020320  044514  042116  051105
5522  020326  032040  033071  005015
5523  020334  000012
5524
5525  020336  005015  047105  042524  ENTHD:  .ASCIZ  <CR><LF>/ENTER HEAD: /
5526  020344  020122  042510  042101
5527  020352  020072     000
5528
5529  020355     015  042412  052116  ENTCYL: .ASCIZ  <CR><LF>/ENTER CYLINDER ADDRESS: /
5530  020362  051105  041440  046131
5531  020370  047111  042504  020122
5532  020376  042101  051104  051505
5533  020404  035123  000040
5534
5535  020410  047111  040526  044514  BADTRK: .ASCIZ  /INVALID HEAD ADDRESS/<CR><LF>
5536  020416  020104  042510  042101
5537  020424  040440  042104  042522
5538  020432  051523  005015     000
5539
5540  020437     111  053116  046101  BADCYL: .ASCIZ  /INVALID CYLINDER ADDRESS/<CR><LF>
5541  020444  042111  041440  046131
5542  020452  047111  042504  020122
5543  020460  042101  051104  051505
5544  020466  006523  000012
5545
5546  020472  005015  042012  047117  ENDMSG: .ASCIZ  <CR><LF><LF>/DONE/<CR><LF><LF>
5547  020500  006505  005012     000
5548
5549
5550          020506                          .EVEN
5551
5552  020506  044122  030461  044440  EM1:    .ASCIZ  /RH11 INTERRUPT OCCURRED (RPAS=0)/
5553  020514  052116  051105  052522
5554  020522  052120  047440  041503
5555  020530  051125  042522  020104
5556  020536  051050  040520  036523
5557  020544  024460     000
5558
5559  020547     125  042516  050130  EM2:    .ASCIZ  /UNEXPECTED ATTENTION OCCURRED/
5560  020554  041505  042524  020104
5561  020562  052101  042524  052116
5562  020570  047511  020116  041517
5563  020576  052503  051122  042105
5564  020604     000
5565
5566  020605     115  051501  041123  EM3:    .ASCIZ  /MASSBUS PARITY ERROR (MCPE=1)/
5567  020612  051525  050040  051101
5568  020620  052111  020131  051105
5569  020626  047522  020122  046450
```

```
5570  020634  050103  036505  024461
5571  020642     000
5572
5573  020643     115  051501  041123  EM4:    .ASCIZ  /MASSBUS PARITY ERROR (PAR=1)/
5574  020650  051525  050040  051101
5575  020656  052111  020131  051105
5576  020664  047522  020122  050050
5577  020672  051101  030475  000051
5578
5579  020700  042101  051104  051505  EM5:    .ASCIZ  /ADDRESS PLUG CHANGE BIT SET/
5580  020706  020123  046120  043525
5581  020714  04144C  040510  043516
5582  020722  020105  044502  020124
5583  020730  042523  000124
5584
5585  020734  044122  030461  042040  EM6:    .ASCIZ  /RH11 DIDN'T RESPOND TO ADDRESSING/
5586  020742  042111  023516  020124
5587  020750  042522  050123  047117
5588  020756  020104  047524  040440
5589  020764  042104  042522  051523
5590  020772  047111  000107
5591
5592  020776  051104  053111  020105  EM10:   .ASCIZ  /DRIVE OR DATA ERROR/
5593  021004  051117  042040  052101
5594  021012  020101  051105  047522
5595  021020  000122
5596
5597  021022  051104  053111  020105  EM11:   .ASCIZ  /DRIVE UNSAFE ERROR/
5598  021030  047125  040523  042506
5599  021036  042440  051122  051117
5600  021044     000
5601
5602  021045     110  040505  020104  EM12:   .ASCIZ  /HEAD OUT OF ALIGNMENT/
5603  021052  052517  020124  043117
5604  021060  040440  044514  047107
5605  021066  042515  052116     000
5606
5607  021073     110  040505  020104  EM13:   .ASCIZ  /HEAD TOO FAR OUT OF ALIGNMENT/
5608  021100  047524  020117  040506
5609  021106  020122  052517  020124
5610  021114  043117  040440  044514
5611  021122  047107  042515  052116
5612  021130     000
5613
5614  021131     123  043117  053524  EM14:   .ASCIZ  /SOFTWARE TIMEOUT/
5615  021136  051101  020105  044524
5616  021144  042515  052517  000124
5617
5618  021152  047125  047503  051122  EM15:   .ASCIZ  /UNCORRECTABLE MASSBUS PARITY ERROR/
5619  021160  041505  040524  046102
5620  021166  020105  040515  051523
5621  021174  052502  020123  040520
5622  021202  044522  054524  042440
5623  021210  051122  051117     000
5624
5625  021215     104  044522  042526  EM16:   .ASCIZ  /DRIVE UNAVAILABLE/
```

```
5626  021222  052440  040516  040526
5627  021230  046111  041101  042514
5628  021236     000
5629
5630
5631  021237     122  040520  000123  DH1:    .ASCIZ  /RPAS/
5632
5633  021244  051104  053111  020105  DH2:    .ASCIZ  /DRIVE   RPDS1   RPER1   RPER2   RPER3   RPAS/
5634  021252  020040  050122  051504
5635  021260  020061  020040  050122
5636  021266  051105  020061  020040
5637  021274  050122  051105  020062
5638  021302  020040  050122  051105
5639  021310  020063  020040  050122
5640  021316  051501     000
5641
5642  021321     104  044522  042526  DH3:    .ASCIZ  /DRIVE   REG ADR  DATA/
5643  021326  020040  051040  043505
5644  021334  040440  051104  020040
5645  021342  040504  040524     000
5646
5647  021347     104  044522  042526  DH4:    .ASCIZ  /DRIVE   REG ADR    GOOD    BAD/
5648  021354  020040  051040  043505
5649  021362  040440  051104  020040
5650  021370  020040  047507  042117
5651  021376  020040  020040  040502
5652  021404  000104
5653
5654  021406  044122  040440  042104  DH6:    .ASCIZ  /RH ADDRESS/
5655  021414  042522  051523     000
5656
5657  021421     104  044522  042526  DH10:   .ASCIZ  /DRIVE   RPCS1   RPCS2   RPDS1   RPER1   RPER2   RPER3/
5658  021426  020040  051040  041520
5659  021434  030523  020040  051040
5660  021442  041520  031123  020040
5661  021450  051040  042120  030523  )
5662  021456  020040  051040  042520
5663  021464  030522  020040  051040
5664  021472  042520  031122  020040
5665  021500  051040  042520  031522
5666  021506     000
5667
5668  021507     040  020040  020040  DH12:   .ASCII  /                TRK CENTER/<CR><LF>
5669  021514  020040  020040  020040
5670  021522  020040  020040  052040
5671  021530  045522  041440  047105
5672  021536  042524  006522     012
5673  021543     040  020040  042510          .ASCIZ  /   HEAD    CYL (IN U INCHES)/
5674  021550  042101  020040  020040
5675  021556  054503  020114  044450
5676  021564  020116  020125  047111
5677  021572  044103  051505  000051
5678
5679  021600  020040  044040  040505  DH13:   .ASCIZ  /   HEAD    CYL/
5680  021606  020104  020040  041440
5681  021614  046131     000
```

```
5682
5683  021617      104  044522  042526  DH16:   .ASCIZ  /DRIVE/
5684  021624      000
5685
5686            021626                  .EVEN
5687
5688  021626  001170  000000          DT1:    .WORD   ATTN,0
5689
5690  021632  001166  007536  007540  DT2:    .WORD   DRIVE,RPERRS,RPERRS+2,RPERRS+4,RPERRS+6,ATTN,0
5691  021640  007542  007544  001170
5692  021646  000000
5693
5694  021650  001166  014662  014664  DT3:    .WORD   DRIVE,RD.ADR,RD.WRD,0
5695  021656  000000
5696
5697  021660  001166  015102  015100  DT4:    .WORD   DRIVE,WRT.AD,WRT.WD,RD.WRD,0
5698  021666  014664  000000
5699
5700  021672  001264  000000          DT6:    .WORD   $RPADR,0
5701
5702  021676  001164  016140  016150  DT10:   .WORD   DRVSEL,REG,REG+RPCS2,REG+RPDS1,REG+RPER1,REG+RPER2,REG+RPER3,0
5703  021704  016152  016154  016200
5704  021712  016202  000000
5705
5706  021716  001172  016132  001204  DT12:   .WORD   $HEAD,DPB+CYL,PLUS,0
5707  021724  000000
5708
5709  021726  001172  016132  000000  DT13:   .WORD   $HEAD,DPB+CYL,0
5710
5711  021734  001164  000000          DT16:   .WORD   DRVSEL,0
5712
5713
5714
5715  021740      000                 DF1:    .BYTE   0
5716
5717  021741      000       000       000     DF2:    .BYTE   0,0,0,0,0,0
5718  021744      000       000       000
5719
5720  021747      000       000       000     DF3:    .BYTE   0,0,0
5721
5722  021752      000       000       000     DF4:    .BYTE   0,0,0,0
5723  021755      000
5724
5725  021756      000       000       000     DF10:   .BYTE   0,0,0.0,0,0,0
5726  021761      000       000       000
5727  021764      000
5728
5729  021765      001       001       001     DF12:   .BYTE   1,1,1
5730
5731  021770      001       001               DF13:   .BYTE   1,1
5732
5733
5734                                          .SBTTL  BUSADR - GET BUS ADDRESS AND VECTOR ADDRESS FOR RH11
5735                                          ;THIS ROUTINE IS USED TO INSURE THE BUS ADDRESS
5736                                          ;OF THE RH11 IS SETUP FOR THE PROPER ADDRESS.
5737                                          ;IT WILL ALSO READ THE ADDRESS FROM THE TTY IF
```

```
                                ;REQUIRED.
                                ;NOTE: THIS ROUTINE DESTROYS R0-R4
                                ;CALL
                                ;
                                ;       JSR     PC,BUSADR
                                ;       RETURN
021772  177700                  HIAD:   .WORD 177700
021774  000776                  HIVEC:  .WORD 776
021776  000000                  LIMIT:  .WORD
022000  005737  001242          BUSADR: TST     CHGADR          ;INPUT FROM TTY REQUESTED?
022004  001460                          BEQ     7$              ;NO--BRANCH
022006  005037  001242                  CLR     CHGADR          ;YES--CLEAR THE REQUEST FLAG
022012  012700  001264          1$:     MOV     #$RPADR,R0      ;FIRST ADDRESS
022016  104401  022220                  TYPE    ,MRPCS1         ;"RPCS1="
022022  012046                          MOV     (R0)+,-(SP)     ;PRESENT RPCS1 ADDRESS
022024  104402                          TYPOC                   ;TYPE IT
022026  104401  022242                  TYPE    ,LINSP          ;2 SPACES
022032  104411                          RDLIN                   ;GET THE ENTRY
022034  012601                          MOV     (SP)+,R1        ;ADDRESS OF ASCII TEXT
022036  013737  021772  021776          MOV     HIAD,LIMIT      ;SET UP ADDRESS-MAX
                   001                  .IF NB
                                        MOV     ,R2     ;UPPER LIMIT OF INPUT
                   000                  .ENDC
022044  004537  022246                  JSR     R5,CK.NUM       ;CHECK THE NUMBER
022050  022070                          3$                      ;CARRIAGE RETURN ONLY ENTERED
022052  022146                          7$                      ;PERIOD ONLY ENTERED
022054  022012                          1$                      ;ILLEGAL INPUT
022056  022064                          2$                      ;TERMINATED WITH A CARRIAGE RETURN
022060  022012                          1$                      ;TERMINATED WITH A ","
022062  022142                          4$                      ;TERMINATED WITH A ";"
022064  010260  177776          2$:     MOV     R2,-2(R0)       ;SAVE NEW RPCS1
022070  104401  022231          3$:     TYPE    ,MRHVEC         ;"RHVEC="
022074  012700  001266                  MOV     #$RPVEC,R0      ;GET THE DEFAULT VECTOR ADDRESS
022100  012046                          MOV     (R0)+,-(SP)     ;PRESENT RH11 VECTOR ADDRESS ON THE STACK
022102  104402                          TYPOC                   ;TYPE IT
022104  104401  022242                  TYPE    ,LINSP          ;2 SPACES
022110  104411                          RDLIN                   ;READ THE ENTRY
022112  012601                          MOV     (SP)+,R1        ;ASCII TEXT ADDRESS
022114  013737  021774  021776          MOV     HIVEC,LIMIT     ;SET UP THE VECTOR-MAX
                   001                  .IF NB
                                        MOV     ,R2     ;UPPER LIMIT OF INPUT
                   000                  .ENDC
022122  004537  022246                  JSR     R5,CK.NUM       ;CHECK THE NUMBER
022126  022146                          7$                      ;CARRIAGE RETURN ONLY ENTERED
022130  022146                          7$                      ;PERIOD ONLY ENTERED
022132  022070                          3$                      ;ILLEGAL INPUT
022134  022142                          4$                      ;TERMINATED WITH A CARRIAGE RETURN
022136  022070                          3$                      ;TERMINATED WITH A ","
022140  022142                          4$                      ;TERMINATED WITH A ";"
022142  010260  177776          4$:     MOV     R2,-2(R0)               ;SAVE INPUT
022146  013701  000004          7$:     MOV     ERRVEC,R1       ;SAVE THE ERROR VECTOR
022152  012737  022206  000004          MOV     #8$,ERRVEC      ;SETUP FOR TRAP
022160  005777  157100                  TST     @$RPADR         ;CHECK FOR RH11
```

```
                                        MOV     R1,ERRVEC       ;RESTORE ERROR VECTOR
                                        MOV     #$RPADR,R0      ;FIRST ADDRESS OF NEW PARAMETERS
                                        MOV     #RPADR,R1       ;FIRST ADDRESS OF WHERE TO PUT THEM
                                        MOV     (R0)+,(R1)+     ;BUS ADDRESS
                                        MOV     (R0)+,(R1)+     ;VECTOR ADDRESS
                                        RTS     PC              ;RETURN
                                8$:     MOV     R1,ERRVEC       ;RESTORE ERROR VECTOR
                                        CMP     (SP)+,(SP)+     ;CLEAN OFF THE STACK
                                        ERROR   6               ;REPORT THE ERROR
                                        BR      1$              ;ASK FOR BUS ADDRESS

                        020061  MRPCS1: .ASCIZ  @RPCS1 = @
                        041505  MRHVEC: .ASCIZ  @RHVEC = @
                                LINSP:  .ASCIZ  @  @

                                .EVEN

                                .SBTTL  CK.NUM - CHECK NUMBER (OCTAL)
                                ;THIS ROUTINE CHECKS AN ASCIZ STRING FOR LEGAL CHARACTERS
                                ;AND FORMS AN OCTAL NUMBER IN R2
                                ;CALL:
                                ;       MOV     #ADR,R1         ;ADDRESS OF ASCIZ STRING
                                ;       MOV     #NUM,R2         ;MAX SIZE OF INPUT NUMBER
                                ;       JSR     R5,CK.NUM       ;GO FORM THE NUMBER
                                ;       RETURN  ADR1            ;"CR" ONLY ENTERED -- R2 = 0
                                ;       RETURN  ADR2            ;"PERIOD" ONLY ENTERED -- R2 = 0
                                ;       RETURN  ADR3            ;ILLEGAL CHARACTER IN THE INPUT STRING
                                ;       RETURN  ADR4            ;"CR" ENTERED -- R2 = NUMBER
                                ;       RETURN  ADR5            ;"COMMA" -- R2 = NUMBER
                                ;       RETURN  ADR6            ;"PERIOD" -- R2 = NUMBER

                                CK.NUM: MOV     R4,-(SP)        ;SAVE R4
                                        MOV     R3,-(SP)        ;SAVE R3
                                        MOV     R2,-(SP)        ;SAVE R2
                                        CLR     R4              ;RETURN POINTER
                                        CLR     R3              ;START NUMBER AT ZERO
                                        CLR     R2              ;STORE RESULT
                        022464          JSR     R5,CK.CHR       ;CHECK ONE CHARACTER
                                        6$                      ;ILLEGAL CHARACTER
                                        8$                      ;CARRIAGE RETURN
                                        6$                      ;","
                                        7$                      ;"."
                                        1$                      ;DIGIT 0-7
                                        6$                      ;DIGIT 8-9
                        000004  1$:     ADD     #4,R5           ;INCREMENT RETURN PAST "CR" AND "PERIOD" ONLY RETURNS
                                2$:     ASL     R3              ;FOR THE OCTAL NUMBER IN R3
                                        BCS     6$              ;DON'T LET IT GET TO BIG
                                        ASL     R3
                                        BCS     6$
                                        ASL     R3
                                        BCS     6$
                                        ADD     R2,R3
                        022464          JSR     R5,CK.CHR       ;CHECK ONE CHARACTER
                                        8$                      ;ILLEGAL CHARACTER
```

```
5850   022332  022354                          5$                      ;CARRIAGE RETURN
5851   022334  022352                          4$                      ;"."
5852   022336  022344                          3$                      ;"'"
5853   022340  022306                          2$                      ;DIGIT 0-7
5854   022342  022372                          8$                      ;DIGIT 8-9
5855   022344  105711                3$:       TSTB    (R1)            ;DOES A "CR" FOLLOW THE "PERIOD"
5856   022346  001011                          BNE     8$              ;BR IF NOT
5857   022350  005724                          TST     (R4)+           ;INCREMENT THE RETURN
5858   022352  005724                4$:       TST     (R4)+           ;INCREMENT THE RETURN INDEX
5859   022354  005724                5$:       TST     (R4)+           ;INCREMENT THE RETURN INDEX
5860   022356  023703  021776                  CMP     LIMIT,R3        ;INPUT VALUE TOO LARGE ?
5861   022362  101003                          BHI     8$              ;BR IF IT IS
5862   022364  000401                          BR      7$              ;BR IF NOT
5863   022366  005725                6$:       TST     (R5)+           ;INCREMENT THE RETURN ADDRESS
5864   022370  005725                7$:       TST     (R5)+           ;INCREMENT THE RETURN ADDRESS
5865   022372  060405                8$:       ADD     R4,R5           ;SETUP FOR PROPER RETURN
5866   022374  010302                          MOV     R3,R2           ;LOAD ENTERED VALUE
5867   022376  005726                          TST     (SP)+           ;CLEAN OFF THE STACK
5868   022400  012603                          MOV     (SP)+,R3        ;RESTORE R3
5869   022402  012604                          MOV     (SP)+,R4        ;RESTORE R4
5870   022404  011505                          MOV     (R5),R5         ;GET RETURN ADDRESS
5871   022406  000205                          RTS     R5              ;RETURN
5872
5873
5874
5875                                  ;THIS ROUTINE IS USED TO CHECK IF AN
5876                                  ;ASCII CHARACTER IS A DIGIT BETWEEN 0 AND 7.
5877                                  ;CALL
5878                                  ;       MOV     #ADR,R1         ;ADDRESS OF ASCII CHARACTER
5879                                  ;       JSR     R5,CK.OCT       ;CHECK THE CHARACTER
5880                                  ;       RETURN1                 ;CHARACTER IS NOT BETWEEN 0-7
5881                                  ;       RETURN2                 ;CHARACTER IS IN R2 AS A
5982                                  ;                               ;OCTAL DIGIT
5883
5884   022410  121127  000060        CK.OCT: CMPB    (R1),#'0        ;LESS THAN ZERO?
5885   022414  103407                          BLO     1$              ;YES -- BRANCH
5886   022416  121127  000067                  CMPB    (R1),#'7        ;GREATER THAN SEVEN?
5887   022422  101004                          BHI     1$              ;YES -- BRANCH
5888   022424  111102                          MOVB    (R1),R2         ;GET THE CHARACTER
5889   022426  042702  177770                  BIC     #^C7,R2         ;STRIP AWAY THE ASCII
5890   022432  005725                          TST     (R5)+           ;ADJUST FOR RETURN
5891   022434  000205                1$:       RTS     R5              ;RETURN
5892
5893                                  ;THIS ROUTINE IS USED TO CHECK AN ASCII CHARACTER
5894                                  ;AND DETERMINE IF IT IS A DIGIT BETWEEN 0 AND 9.
5895                                  ;CALL
5896                                  ;       MOV     #ADR,R1         ;ADDRESS OF ASCII CHARACTER
5897                                  ;       JSR     R5,CK.DEC       ;CHECK THE CHARACTER
5898                                  ;       RETURN1                 ;NOT BETWEEN 0 AND 9
5899                                  ;       RETURN2                 ;BETWEEN 0 AND 9
5900                                  ;                               ;R2 = DIGIT
5901:
5902   022436  121127  000060        CK.DEC: CMPB    (R1),#'0        ;LESS THAN ZERO?
5903   022442  103407                          BLO     1$              ;YES -- BRANCH
5904   022444  121127  000071                  CMPB    (R1),#'9        ;GREATER THAN NINE?
5905   022450  101004                          BHI     1$              ;YES -- BRANCH
```

```
022452  111102                  MOVB    (R1),R2         ;GET THE CHARACTER
022454  042702  000060          BIC     #'0,R2          ;STRIP AWAY THE ASCII
022460  005725                  TST     (R5)+           ;ADJUST FOR RETURN
022462  000205                  1$:     RTS     R5      ;RETURN

                                ;THIS ROUTINE WILL CHECK AN ASCII CHARACTER TO
                                ;DETERMINE WHAT IT IS.
                                ;CALL
                                ;       MOV     #ADR,R1         ;ADDRESS OF ASCII CHARACTER
                                ;       JSR     R5,CK.CHR       ;CHECK CHARACTER
                                ;       RETURN  ADR1            ;UNKNOWN CHARACTER
                                ;       RETURN  ADR2            ;CARRIAGE RETURN * (R1)=ADR+1
                                ;       RETURN  ADR3            ;COMMA * (R1)=ADR+1
                                ;       RETURN  ADR4            ;PERIOD * (R1)=ADR+1
                                ;       RETURN  ADR5            ;DIGIT BETWEEN 0 AND 7.
                                ;       RETURN  ADR6            ;DIGIT BETWEEN 8 AND 9.
                                ;                               ;R2 = DIGIT * (R1)=ADR+1

022464  105711                  CK.CHR: TSTB    (R1)            ;"CARRIAGE RETURN"?
022466  001417                          BEQ     3$              ;YES -- BRANCH
022470  121127  000054                  CMPB    (R1),#',        ;"COMMA"?
022474  001413                          BEQ     2$              ;YES -- BRANCH
022476  121127  000056                  CMPB    (R1),#'.        ;"PERIOD"?
022502  001407                          BEQ     1$              ;YES -- BRANCH
022504  004537  022436                  JSR     R5,CK.DEC       ;"DIGIT"?
022510  000410                          BR      4$              ;NO -- BRANCH
022512  004537  022410                  JSR     R5,Ck.OCT       ;OCTAL ?
022516  005725                          TST     (R5)+           ;DIGIT BETWEEN 8-9
022520  005725                          TST     (R5)+           ;DIGIT BETWEEN 0-7
022522  005725                  1$:     TST     (R5)+           ;PERIOD
022524  005725                  2$:     TST     (R5)+           ;COMMA
022526  005725                  3$:     TST     (R5)+           ;CARRIAGE RETURN
022530  005201                          INC     R1              ;MOVE POINTER TO NEXT CHARACTER
022532  011505                  4$:     MOV     (R5),R5         ;UNKNOWN CHARACTER
022534  000205                          RTS     R5              ;RETURN

000001                          .END
```

```
ABS    = 000200
ACK    = 000123
ACL    = 000040
ACTDRV  007622
ACTSTR  007623
ACU    = 100000
ALIGN   020027
ALN245  020222
ALN496  020270
AOE    = 001000
ATA    = 100000
ATABIT  007672
ATTN    001170
AT0    = 000001
AT1    = 000002
AT2    = 000004
AT3    = 000010
AT4    = 000020
AT5    = 000040
AT6    = 000100
AT7    = 000200
A16    = 000400
A17    = 001000
BADCYL  020437
BADTRK  020410
BAI    = 000010
BITIND  001200
BIT0   = 000001
BIT00  = 000001
BIT01  = 000002
BIT02  = 000004
BIT03  = 000010
BIT04  = 000020
BIT05  = 000040
BIT06  = 000100
BIT07  = 000200
BIT08  = 000400
BIT09  = 001000
BIT1   = 000002
BIT10  = 002000
BIT11  = 004000
BIT12  = 010000
BIT13  = 020000
BIT14  = 040000
BIT15  = 100000
BIT2   = 000004
BIT3   = 000010
BIT4   = 000020
BIT5   = 000040
BIT6   = 000100
BIT7   = 000200
BIT8   = 000400
BIT9   = 001000
BPTVEC= 000014
BUF    = 000006
BUSADR  022000
CHECK   003032
CHGADR  001242
CI1     011244
CI3     011352
CI4     011460
CI5     012036
CI6     012060
CI7     012074
CI7B    012122
CI8     012174
CKSWR  = 104407
CK.CHR  022464
CK.DEC  022436
CK.NUM  022246
CK.OCT  022410
CLR    = 000040
CLRQUE  015662
CODE   = 000001
COMND  = 000002
CR     = 000015
CRLF   = 000200
CSF    = 000002
CSU    = 000010
CYL    = 000012
CYLDER  002646
CYL245  020112
CYL496  020156
DCK    = 100000
DCL    = 000100
DCU    = 000001
DDISP  = 177570
DDU     016644
DDUALN  003530
DE1    = 000040
DFF20  = 000002
DF1     021740
DF10    021756
DF12    021765
DF13    021770
DF2     021741
DF3     021747
DF4     021752
DH1     021237
DH10    021421
DH12    021507
DH13    021600
DH16    021617
DH2     021244
DH3     021321
DH4     021347
DH6     021406
DIGB   = 000004
DISPLA  001142
DISPRE  000174
DLT    = 100000
DL64   = 000020
DMD    = 000001
DPB     016120
DPINT   007576
DPR    = 000400
DPRQS   007606
DRIVE   001166
DRIVER  003736
DRQ    = 004000
DRVACT  007546
DRVCLR= 000111
DRVINT  010134
DRVQUE  015760
DRVSEL  001164
DRVSTA  007556
DRVTYP  007566
DRY    = 000200
DSWR   = 177570
DTE    = 010000
DTSY   = 000200
DTUW    007670
DT00   = 000001
DT01   = 000002
DT02   = 000004
DT03   = 000010
DT04   = 000020
DT05   = 000040
DT06   = 000100
DT07   = 000200
DT08   = 000400
DT1     021626
DT10    021676
DT12    021716
DT13    021726
DT16    021734
DT2     021632
DT3     021650
DT4     021660
DT6     021672
DVA    = 004000
ECH    = 000100
ECI    = 004000
EMPTYQ  015740
EMTVEC= 000030
EM1     020506
EM10    020776
EM11    021022
EM12    021045
EM13    021073
EM14    021131
EM15    021152
EM16    021215
EM2     020547
EM3     020605
EM4     020643
EM5     020700
EM6     020734
ENDMSG  020472
ENTCYL  020355
ENTERD  017545
ENTHD   020336
ERR    = 040000
ERRVEC= 000004
EXER    020040
EXT1   = 000001
EXT10  = 000010
EXT2   = 000002
EXT20  = 000020
EXT4   = 000004
EXT40  = 000040
FEN    = 000200
FER    = 000020
FMT22  = 010000
F1     = 000002
F2     = 000004
F3     = 000010
F4     = 000020
F5     = 000040
GETNUM  004270
GETREG= 000141
GETREQ  016034
GO     = 000001
GRV    = 000010
GTSWR  = 104406
HCE    = 000200
HCI    = 002000
HCRC   = 000400
HDZERO  020054
HEADER  017657
HEAD1   016210
HEAD45  016310
HEAD6   016260
HIAD    021772
HIVEC   021774
HT     = 000011
IAE    = 002000
IE     = 000100
ILF    = 000001
ILR    = 000002
INCYL   001226
INIT    001744
INREG   001206
IOTVEC= 000020
IR     = 000100
ISR     012566
IXE    = 004000
LA      012430
LACNT   007634
LF     = 000012
LIMIT   021776
LINSP   022242
LKS     001262
LKV     001256
LST    = 002000
MAXCYL  001212
MAXNEG  001216
MAXOFF  001220
MAXPOS  001214
MCLK   = 000002
MCPE   = 020000
MCPEMX  007702
MHS    = 001000
MIDCYL  001230
MIDTOL  001224
MINX   = 000004
MNDLTA  007716
MODE    017751
MOH    = 020000
MOL    = 010000
MPE    = 000400
MRD    = 000020
MRHVEC  022231
MRPCSI  022220
MSE    = 000020
MSTCK  = 000010
MWR    = 000040
MXDLTA  007714
MXF    = 001000
MXLACT  007712
MXWNDW  007720
N      = 000261
NBA    = 100000
NED    = 010000
NEM    = 004000
NHS    = 002000
NODRV   017514
OCYL   = 100000
OFFDIR  001176
OFFSET= 000115
OFREV  = 000200
OFTBL4  016405
OFTBL6  016324
OF100  = 000004
OF200  = 000010
```

```
OF25  = 000001
OF400 = 000020
OF50  = 000002
OF800 = 000040
ONEHD   002444
OPE   = 020000
OPI   = 020000
OPT     010764
OR    = 000200
OUTCYL  001232
OUTTOL  001222
PAR   = 000010
PAT   = 000020
PGE   = 002000
PGM   = 001000
PIP   = 020000
PIRQ  = 177772
PIRQVE= 000240
PKB     001252
PKC     001254
PKCS    001250
PKV     001244
PLJ   = 020000
PLUS    001204
POPQUE  016056
PRESET= 000121
PR0   = 000000
PR1   = 000040
PR2   = 000100
PR3   = 000140
PR4   = 000200
PR5   = 000240
PR6   = 000300
PR7   = 000340
PS    = 177776
PSEL  = 002000
PSU   = 000001
PSW   = 177776
PWRVEC= 000024
QCNT    015370
QDRV0   015462
QDRV1   015502
QDRV2   015522
QDRV3   015542
QDRV4   015562
QDRV5   015602
QDRV6   015622
QDRV7   015642
QINPT   015400
QOUTPT  015420
QSTART  015440
QSTOP   015442
QTERM = 015662
RANDOM  003640
RAW   = 000020
RDCHR = 104410
RDDAT = 000171
RDHD  = 000173
RDLIN = 104411
RDY   = 000200
RD.ADR  014662
RD.RP   014636
RD.RP1  014660
RD.RP2  015000
RD.RP3  015004
RD.RP4  015010
RD.WRD  014664
RECAL = 000107
REG     016140
REL   = 000113
RESREG= 104413
RESVEC= 000010
RMR   = 000004
RNOP  = 000101
RPADR   007704
RPAS  = 000016
RPBA  = 000004
RPCA  = 000034
RPCC  = 000036
RPCS1 = 000000
RPCS2 = 000010
RPDA  = 000006
RPDB  = 000022
RPDS1 = 000012
RPDT  = 000026
RPEC1 = 000044
RPEC2 = 000046
RPERRS  007536
RPER1 = 000014
RPER2 = 000040
RPER3 = 000042
RPINIT  007722
RPLA  = 000020
RPMR  = 000024
RPOF  = 000032
RPSN  = 000030
RPTMR   014110
RPVEC   007706
RPWC  = 000002
RP04    010472
RTC   = 000117
R6    =%000006
R7    =%000007
SAVEFG  007644
SAVREG= 104412
SC      012772
SC1   = 000100
SC10  = 001000
SC11    013610
SC12    013700
SC13    013750
SC2   = 000200
SC20  = 002000
SC3     013036
SC4     013042
SC5     013054
SC6     013244
SC6A    013354
SC7     013502
SC8     013560
SEARCH= 000131
SEC   = 000010
SEEK  = 000105
SEEKFG  007646
SEKCNT  001240
SELDRV= 000145
SETFMT= 000143
SET.IE  015316
SINCNG  001202
SKI   = 040000
SRCHWT  007620
SRVCLK  004256
STACK = 001100
START   001450
START1  001460
START2  001464
STATUS= 000016
STKLMT= 177774
ST0     014202
ST01    014232
ST02    014430
ST03    014500
ST05    014524
ST06    014532
ST07    014570
ST08    014620
ST09    014630
ST.CLK  004114
ST.LCL  004232
ST.PCL  004200
SVRH11  015200
SWR     001140
SWREG   000176
SW0   = 000001
SW00  = 000001
SW01  = 000002
SW02  = 000004
SW03  = 000010
SW04  = 000020
SW05  = 000040
SW06  = 000100
SW07  = 000200
SW08  = 000400
SW09  = 001000
SW1   = 000002
SW10  = 002000
SW11  = 004000
SW12  = 010000
SW13  = 020000
SW14  = 040000
SW15  = 100000
SW2   = 000004
SW3   = 000010
SW4   = 000020
SW5   = 000040
SW6   = 000100
SW7   = 000200
SW8   = 000400
SW9   = 001000
TABLE1  001234
TABLE2  001236
TAP   = 040000
TBITVE= 000014
TD      012632
TDF   = 000040
TIMER   007650
TITLE   016546
TKVEC = 000060
TOLER   001210
TOLRG   017633
TOPLN   001174
TPVEC = 000064
TRAPVE= 000034
TRE   = 040000
TRK   = 000011
TRK1  = 004000
TRK10 = 040000
TRK2  = 010000
TRK20 = 100000
TRK4  = 020000
TRNSWT  007616
TRTVEC= 000014
TUF   = 000100
TYPDS = 104405
TYPE  = 104401
TYPOC = 104402
TYPON = 104404
TYPOS = 104403
ULDFLG  007624
UNLOAD= 000103
UNS   = 040000
UPE   = 020000
US1   = 000001
US2   = 000002
US4   = 000004
UWR   = 000010
VERIFY  020015
VUF   = 000002
VU30  = 010000
VV    = 000100
WAO   = 000002
WCE   = 040000
WCF   = 000040
WCHKD = 000151
WCHKHD= 000153
WCU   = 000001
WLE   = 004000
WLOCK   017574
WRL   = 004000
WRTDAT= 000161
WRTHD = 000163
WRT.AD  015102
WRT.RP  015012
WRT.R1  015076
WRT.R2  015162
WRT.R3  015170
WRT.R4  015174
WRT.R5  015176
WRT.WD  015100
WRU   = 000400
WSU   = 000004
$AUTOB  001134
$BDADR  001122
$BDDAT  001126
$BELL   006767
$CHARC  005110
$CKSWR  006072
$CMTAG  001100
$CM3  = 000000
$CNTLC  006773
$CNTLG  007005
$CNTLU  007000
$CRLF   001161
$DBLK   005556
$DIV    007136
$DTBL   005546
$ERFLG  001103
$ERMAX  001115
$ERROR  004412
$ERRPC  001116
$ERRTB  001270
$ERRTY  004520
$ERTTL  001112
$FILLC  001156
$FILLS  001155
```

```
$GDADR  001120          $LPERR  001110          $RESRE  007414          $TKQOU  005572          $TSTNM  001102
$GDDAT  001124          $MNEW   007023          $RPADR  001264          $TKQSR  005574          $TTYIN  006760
$GTSWR  006162          $MSWR   007012          $RPVEC  001266          $TKS    001144          $TYPDS  005342
$HD   = 000001          $NULL   001154          $SAVRE  007356          $TKSRV  005654          $TYPE   004674
$HEAD   001172          $OCNT   005336          $SETUP= 000146          $TN   = 000001          $TYPEC  005044
$HINUM  007132          $OMODE  005340          $STUP = 177777          $TPB    001152          $TYPEX  005112
$ICNT   001104          $PASS   001100          $SWR  = 120000          $TPFLG  001157          $TYPOC  005140
$INTAG  001135          $QUES   001160          $TKB    001146          $TPS    001150          $TYPON  005154
$ITEMB  001114          $RAND   007034          $TKCNT  005566          $TRAP   007452          $TYPOS  005114
$LF     001162          $RDCHR  006434          $TKINT  005604          $TRAP2  007474          $OFILL  005337
$LONUM  007134          $RDLIN  006524          $TKQEN= 005603          $TRP  = 000014          .     - 022536
$LPADR  001106          $RDSZ = 000007          $TKQIN  005570          $TRPAD  007506

. ABS    022536      000

 ERRORS DETECTED:  0

 RM03:CZRJCB,CZRJCB.SEQ/SOL/LI:ME/NL:MC=RP0456.011,CZRJCB.P11
 RUN-TIME: 21  15  .6 SECONDS
 RUN-TIME RATIO: 92/37=2.4
 CORE USED:  34K  (67 PAGES)
```