

BM873

RESTART ROM LOADER
MD-11-DZBMD-H

EP DZBMD H DL B
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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZBMD-H-D

PRODUCT NAME: BM873 - UNIVERSAL RESTART ROM LOADER

DATE RELEASED: JANUARY 1977

MAINTAINER: DIAGNOSTIC GROUP

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PROGRAM HISTORY

<u>PRODUCT CODE:</u>	MAINDEC-11-DZBMD-H-D		
<u>PRODUCT NAME:</u>	BM873 - UNIVERSAL RESTART ROM LOADER		
<u>DATE CREATED:</u>	JULY 1973		
<u>MAINTAINER:</u>	DIAGNOSTIC GROUP		
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	JIM KELLY	7/21/75	SYSMAC
	JOHN EGOLF	11/21/75	YF
	RICH MURATORI	10/76	YG
	RICH MURATORI	10/76	YH
	FITZCARL JOHNSON		

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1. ABSTRACT

THIS MAINDEC CONSISTS OF FOUR PROGRAMS. THE TWO MAIN PROGRAMS ARE PROGRAM ONE AND PROGRAM FOUR. THESE PROGRAMS WILL BE DISCUSSED LATER.
THE PURPOSE OF THIS DIAGNOSTIC IS TO VERIFY THE DATA IN THE ROM, MAKE SURE ALL ADDRESS WILL CAUSE A TIME OUT TRAP WHEN WRITTEN INTO (EXCEPT THE TRAP VECTORS: 173024, 173224) AND ALERT THE OPERATOR AS TO WHAT THE OFFSET ADDRESS WOULD BE IF A SELECTED BUTTON IS PUSHED.

NOTE: FOR NORMAL CONFIGURATIONS; THE ONLY PROGRAMS NECESSARY FOR ACCEPTANCE OF THE BM873 ARE PROGRAMS ONE AND FOUR. PROGRAM TWO IS NECESSARY FOR "NON-STANDARD" SETUPS AND IS A MAINTAINCE TOOL. PROGRAM THREE IS ALSO JUST FOR MAINTAINCE AID.
2. REQUIRMENTS
 - 2.1 EQUIPMENT

ANY PDP-11/40 CPU
UNIVERSAL RESTART LOADER
TELETYPE OR EQUIVALENT
AT LEAST 4K OF MEMORY.
 - 2.2 STORAGE

THIS PROGRAM RESERVES THE RIGHT TO USE ALL OF THE FIRST 4K EXCEPT WHERE BOOTSTRAP LOADER AND ABSOLUTE LOADER RESIDE.
3. LOADING PROCEDURE

THE PROGRAM MAY BE LOADED LIKE ANY OTHER PROGRAM SUCH AS: PAPER TAPE, DECTAPE MAGTAPE, DISK, ETC. MOST COMMON WILL BE THROUGH DECTAPE BY THE USE OF ROM BOOT LOADER.

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138 4. STARTING PROCEDURE
139
140 4.1 CONTROL SWITCH SETTINGS
141 SWITCH 00 CLEARED INDICATES ONLY FIRST 128
142 WORDS TO BE CHECKED.
143 SET INDICATES EXTENDED 128. WORDS
144 ARE TO BE CHECKED IN WHICH CASE
145 PROGRAM 2 MUST BE RUN FIRST.
146 WHEN RUNNING ON BM873Y-B,C,D,F,G OR H, 256 WORDS
147 ARE AUTOMATICALLY CHECKED.
148
149
150 4.2 STARTING ADDRESS
151 STARTING ADDRESS 000200
152
153 4.3 OPERATOR ACTION
154
155 4.3.1 FOR NORMAL OPERATION (WITHOUT EXTENDED 128 WORDS)
156 1. LOAD STARTING ADDRESS (000200)
157 2. SET SWITCHES AS PER 5.1.1 (NORMAL ALL SWITCHES DOWN)
158 3. PRESS START SWITCH AND RELEASE.
159
160 4. DEVICE VERSION.
161 WHEN PROGRAM IS STARTED FOR THE FIRST TIME THE FOLLOWING
162 WILL BE PRINTED OUT:
163 MAINDEC-11-DZBMDG
164 DEVICE VERSION
165 BM873-Y
166 THE OPERATOR WILL THEN SPECIFY THE VERSION BEING RUN.
167 BM873-Y* IS ANY NON-STANDARD VERSION.
168 NOTE: PROGRAM TWO MUST BE RUN FIRST.
169 BM873-YA REPLACES M792-YA,MR11-DB,M792-YH
170 BM873-YB MASSBUS
171 BM873-YC DDCMP BOOTSTRAP ROM
172 BM873-YD KL10 (PDP-11) 256 BOOTSTRAP ROM (VERSION 2(17))
173 BM873-YF KL10 (PDP-11) 256 BOOTSTRAP ROM (VERSION 3(23))
174 BM873-YG KL10 (PDP-11) 256 BOOTSTRAP ROM
175 BM873-YH KL10 (PDP-11) 256 BOOTSTRAP ROM
176
177 5. THEN TYPE IN NUMBER OF PROGRAM TO BE RUN (NORMALLY PROGRAM 1 AND 4)
178
179 4.3.2 IF YOU WISH TO TEST THE EXTENDED 128. WORDS THIS IS THE
180 PROCEDURE:
181 (NOT NEEDED FOR NORMAL TESTING OF BM873Y-B,C,D,F,G OR H)
182 1. LOAD STARTING ADD. 000200
183 2. SET SW00=1
184 3. SET HALT ENABLE SW AND SINGLE CYCLE SW UP
185 4. HIT START SWITCH AND RELEASE.
186 5. RUN PROGRAM 2 FOR ONE PASS.
187 6. NOW ANY PROGRAM MAY BE RUN.
188 NOTE: VISUAL INSPECTION OF EXTENDED DUMP
189 IS YOUR RESPONSIBILITY. THAT DATA WAS
190 PLACED INTO SOFTWARE TABLE FOR TEST COMPARISON.

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- 5. OPERATING PROCEDURE
 - 5.1.1 SWITCH SETTINGS (APPLICABLE IN ALL PROGRAMS)
 - SW15 = 1 OR UP ... HALT ON ERROR
 - SW14 = 1 OR UP ... LOOP ON TEST
 - SW13 = 1 OR UP ... INHIBIT ERROR PRINT OUT
 - SW12 = 1 OR UP ... RESERVED
 - SW11 = 1 OR UP ... INSTEAD OF EXERCISING EACH ADDRESS 10X DO IT 1X.
 - SW09 = 1 OR UP ... LOOP WITH CURRENT ADDRESS
 - SW08 = 1 OR UP ... GOTO BEGINNING OF CURRENT PROGRAM ON ERROR
- 6. ERRORS
 - 6.1 ERROR PRINT OUT
 - ALL ERRORS WILL HAVE A PRINT OUT. IF IT WAS A COMPARISON ERROR; THE SOFT ADDRESS, ROM ADDRESS, EXPECTED DATA (FROM SOFTWARE MAP), AND THE FOUND DATA WILL BE PRINTED OUT. IF IT WAS A "NO TRAP WHEN WRITTEN" ERROR; THE ADDRESS WILL BE PRINTED OUT. IF IT WAS AN "UNEXPECTED TRAP " WHEN READING ROM THE ADDRESS WILL BE PRINTED .

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6.2 ERROR RECOVERY

1. ITS A GOOD IDEA TO LEAVE SW15=1 WHILE TEST RUNS TO PREVENT A RUN AWAY ERROR FROM GOING WILD IF YOU LEAVE THE CPU.
2. IN AN ERROR: SET SW14=1(LOOP ON THIS ADDR.) AND SET SW 13=1(DELETE ERROR PRINT OUT). IF CPU IS HALTED; HIT CONTINUE.
3. NOW THE PROGRAM IS RUNNING AND YOU MAY SCOPE IT.

7. RESTRICTIONS

7.1 STARTING RESTRICTIONS

SEE SECTION 4.

7.2 OPERATING RESTRICTIONS

- 7.2.1 IF YOU WISH PROGRAM TO TEST YOUR EXTENDED 128. WORDS; YOU MUST START AS PER SECTION 4 AND THEN
***** RUN PROGRAM 2 FIRST AND VISUALLY VERIFY DATA.****
(NOT APPLICABLE TO BM873Y-B,C,D,F,G OR H)
- 7.2.2 YOU MAY NOT ALTER THE SOFTWARE MAP UNLESS--
***** YOU KNOW WHAT YOU ARE DOING *****
- 7.2.3 THE ROM ADDRESS MUST START AT 173000 AND BE AT LEAST 128 WORDS LONG. (256 FOR THE BM873Y-B,C,D,F,G OR H)

8. MISCELLANEOUS

8.1 EXECUTION TIME

PROGRAM ONE WILL PASS AT APPROX. FIVE MINS.
PROGRAM TWO HAS NO END PASS; BUT WILL HALT AT COMPLETEION
HIT CONTINUE TO PROCEED IN THIS PROGRAM.
PROGRAM THREE (RUN) WILL PASS APPROX. FIVE MINS.
PROGRAM FOUR WILL PASS APPROX. FIVE MINS

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9. PROGRAM DESCRIPTION

9.1 PROGRAM 1

PROGRAM 1 WILL VERIFY THE DATA IN THE ROM AND THE VERIFY THAT WRITING THE ROM WILL TRAP OUT (EXCEPT THE VECTORS) EACH ADDRESS IS REFERENCED FIVE TIMES IN A ROW BEFORE UPDATING TO THE NEXT ADDRESS.
IF SW00 WAS UP WHEN START WAS HIT, THE EXTENDED 128 WORDS WILL BE CHECKED.
256 WORDS WILL BE CHECKED AUTOMATICALLY IF BM873Y-B,C,D,F,G OR H IS TESTED.

9.2 PROGRAM 2

PROGRAM 2 WILL DUMP THE CONTENTS OF THE ROM ONTO THE TTY. NOTE NO VERIFICATION OF ANY KIND IS PERFORMED ON THE DATA. (AN ERROR WILL OCCUR IF A TRAP IS ENCOUNTERED WHILE READING) YOU MUST INSPECT THE DATA YOUR SELF. IF SW00 WAS UP WHEN START WAS HIT THE EXTENDED 128. WORDS WILL BE PRINTED.
256 WORDS WILL BE PRINTED IF BM873Y-B,C,D,F,G OR H IS SELECTED.

9.3 PROGRAM 3

PROGRAM 3 IS THE SAME AS PROGRAM ONE EXCEPT THAT THE USER HAS THE ABILITY TO ALTER THE SOFTWARE MAP, LIST OR PRINT THE SOFTWARE MAP, AND RUN THE PROGRAM. NOTE THAT IF YOU ALTER THE MAP BE CAREFULL OF WHAT YOU CHANGE.
FOR THE COMMANDS TO BE USED SEE TOP OF PROGRAM 3 IN THIS LISTING

9.4 PROGRAM 4

PROGRAM 4 CHECKS THE OFFSET ADDRESS WHEN THE SIMULATED PUSHING OF A BUTTON IS DONE BY THE SOFTWARE. ON THE FIRST PASS THE OFFSET IS TYPED OUT FOR YOU TO VERIFY (NOTE: THE PROGRAM HAS NO WAY OF KNOWING WHAT THE OFFSET WILL BE). AFTER THE DATA IS TYPED OUT IT IS STORED AWAY IN CORE. WHEN THE FIRST PASS IS FINISHED THE PROCESS IS REPEATED ONLY NO TYPE OUT IS PERFORMED, AND THE DATA IN CORE IS COMPARED TO THE DATA FOUND AT THE ROM.

DURING THIS TEST "WRITING" THE ROM IS PERFORMED. THE VECTORS (173024,173224) ARE "WRITTEN" AND ARE **NOT** EXPECTED TO TRAP. AN ERROR MESSAGE WILL BE REPORTED IF A TRAP IS DISCOVERED.

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9.5 THIS PROGRAM IS "XXDP AND ACT-11" COMPATIBLE;
AT PRESENT TIME IF IN CHAIN MODE UNDER ACT-11 OR
XXDP THE PROGRAM AUTOMATICALLY DETERMINES IF THE ROM IS
BM873YA OR YB, YC, YD, YF, YG OR YH BY COMPARING THE 1ST WORD IN ROM WITH
THE EXPECTED WORD. THE DIAGNOSTIC THEN RUNS
PROGRAM 1 AND PROGRAM 4 BEFORE ENTERING THE MONITOR.

9.6 ELECTRICAL PREQUISITES (HARDWARE)

9.7.1 THIS OPTION MUST BE ON THE CPU SIDE OF ANY BUS BUFFERS.

9.7.2 NPR CYCLES ARE NOT PERMITTED DURING THE POWER UP TRAP
SEQUENCE.

9.7.3 IF FURTHER INFORMATION IS NEEDED
CONSULT THE BM873 MANUAL FOR HELP.
NOTE: THE DIAGNOSTIC RUNNING WITHOUT ANY INTERFERENCE FROM
THE USER HAS NO WAY OF CHECKING THE PRESENTS OF THE
"ACLO" AND "DCLO" SIGNALS ON THE OPTION.

.NLIST
.LIST SEQ,LOC,BIN
.LIST
.PAGE
.ENDM HELLO

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336
337      .MCALL .HEADER, .SWRHI, .SWRLO, .EQUATE, .SETUP, $TRAP, .SCATCH, .SCMTAG
338      .MCALL .RDLIN, .SSCOPE, .SEERROR, .SERRTYP, .SRDOCT
339
340      .SBTTL TRAP CATCHER
341
342      .=0
343      ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ".+2,HALT"
344      ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
345      ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
346
347      .SBTTL STARTING ADDRESS(ES)
348      .=200
349
350      000200 000137 011000      JMP      @#RESTR1      ;JUMP TO STARTING ADDRESS OF PROGRAM
351
352      .SBTTL BASIC DEFINITIONS
353
354      ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
355      001100      STACK= 1100
356      .EQUIV EMT,ERROR      ;BASIC DEFINITION OF ERROR CALL
357      .EQUIV IOT,SCOPE      ;BASIC DEFINITION OF SCOPE CALL
358      177776      PS= 177776      ;PROCESSOR STATUS WORD
359      .EQUIV PS,PSW
360      177774      STKLMT= 177774      ;STACK LIMIT REGISTER
361      177772      PIRQ= 177772      ;PROGRAM INTERRUPT REQUEST REGISTER
362      177570      SWR= 177570      ;SWITCH REGISTER
363      177570      DISPLAY=SWR
364
365      ;*GENERAL PURPOSE REGISTER DEFINITIONS
366      000000      R0= %0      ;GENERAL REGISTER
367      000001      R1= %1      ;GENERAL REGISTER
368      000002      R2= %2      ;GENERAL REGISTER
369      000003      R3= %3      ;GENERAL REGISTER
370      000004      R4= %4      ;GENERAL REGISTER
371      000005      R5= %5      ;GENERAL REGISTER
372      000006      R6= %6      ;GENERAL REGISTER
373      000007      R7= %7      ;GENERAL REGISTER
374      .EQUIV R6,SP      ;STACK POINTER
375      .EQUIV R7,PC      ;PROGRAM COUNTER
376
377      ;*"SWITCH REGISTER" SWITCH DEFINITIONS
378      100000      SW15= 100000
379      040000      SW14= 40000
380      020000      SW13= 20000
381      010000      SW12= 10000
382      004000      SW11= 4000
383      002000      SW10= 2000
384      001000      SW09= 1000
385      000400      SW08= 400
386      000200      SW07= 200
387      000100      SW06= 100
388      000040      SW05= 40
389      000020      SW04= 20

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BASIC DEFINITIONS

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390      000010      SW03= 10
391      000004      SW02= 4
392      000002      SW01= 2
393      000001      SW00= 1
394      .EQUIV     SW09,SW9
395      .EQUIV     SW08,SW8
396      .EQUIV     SW07,SW7
397      .EQUIV     SW06,SW6
398      .EQUIV     SW05,SW5
399      .EQUIV     SW04,SW4
400      .EQUIV     SW03,SW3
401      .EQUIV     SW02,SW2
402      .EQUIV     SW01,SW1
403      .EQUIV     SW00,SW0
404
405      ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
406      100000      BIT15= 100000
407      040000      BIT14= 40000
408      020000      BIT13= 20000
409      010000      BIT12= 10000
410      004000      BIT11= 4000
411      002000      BIT10= 2000
412      001000      BIT09= 1000
413      000400      BIT08= 400
414      000200      BIT07= 200
415      000100      BIT06= 100
416      000040      BIT05= 40
417      000020      BIT04= 20
418      000010      BIT03= 10
419      000004      BIT02= 4
420      000002      BIT01= 2
421      000001      BIT00= 1
422      .EQUIV     BIT09,BIT9
423      .EQUIV     BIT08,BIT8
424      .EQUIV     BIT07,BIT7
425      .EQUIV     BIT06,BIT6
426      .EQUIV     BIT05,BIT5
427      .EQUIV     BIT04,BIT4
428      .EQUIV     BIT03,BIT3
429      .EQUIV     BIT02,BIT2
430      .EQUIV     BIT01,BIT1
431      .EQUIV     BIT00,BIT0
432
433      ;*BASIC "CPU" TRAP VECTOR ADDRESSES
434      000004      ERRVEC= 4 ;TIME OUT AND OTHER ERRORS
435      000010      RESVEC= 10 ;RESERVED AND ILLEGAL INSTRUCTIONS
436      000014      TBITVEC=14 ;"T" BIT
437      000014      TRTVEC= 14 ;TRACE TRAP
438      000014      BPTVEC= 14 ;BREAKPOINT TRAP (BPT)
439      000020      IOTVEC= 20 ;INPUT/OUTPUT TRAP (IOT) **SCOPE**
440      000024      PWRVEC= 24 ;POWER FAIL
441      000030      EMTVEC= 30 ;EMULATOR TRAP (EMT) **ERROR**
442      000034      TRAPVEC=34 ;"TRAP" TRAP
443      000060      TKVEC= 60 ;TTY KEYBOARD VECTOR
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BASIC DEFINITIONS

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445

000064
000240

TPVEC= 64
PIRQVEC=240

L01

;TTY PRINTER VECTOR
;PROGRAM INTERRUPT REQUEST VECTOR

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BASIC DEFINITIONS

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446      ;*****
447
448      .SBTTL  COMMON TAGS
449
450      ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
451      ;*USED IN THE PROGRAM.
452
453      000046      000046      .=46
454      000046      016640      $ENDAD      ;LOGICAL END OF PROGRAM
455
456      000052      000052      .=52
457      000052      000000      .WORD      0
458
459      001100      001100      .=1100
460
461      001100      $CMTAG:      ;START OF COMMON TAGS
462      001100      000000      $PASS:  .WORD      0      ;CONTAINS PASS COUNT
463      001102      000      $TSTNM: .BYTE      0      ;CONTAINS THE TEST NUMBER
464      001103      000      $ERFLG: .BYTE      0      ;CONTAINS ERROR FLAG
465      001104      000000      $ICNT:  .WORD      0      ;CONTAINS SUBTEST ITERATION COUNT
466      001106      000000      $LPADR: .WORD      0      ;CONTAINS SCOPE LOOP
467      001110      000000      $LPERR: .WORD      0      ;CONTAINS SCOPE RETURN FOR ERRORS
468      001112      000000      $ERTTL: .WORD      0      ;CONTAINS TOTAL ERRORS DETECTED
469      001114      000      $ITEMB: .BYTE      0      ;CONTAINS ITEM CONTROL BYTE
470      001115      001      $ERMAX: .BYTE      1      ;CONTAINS MAX. ERRORS PER TEST
471      001116      000000      $ERRPC: .WORD      0      ;CONTAINS PC OF LAST ERROR INSTRUCTION
472      001120      000000      $GDADR: .WORD      0      ;CONTAINS OF 'GOOD' DATA
473      001122      000000      $BDADR: .WORD      0      ;CONTAINS OF 'BAD' DATA
474      001124      000000      $GDDAT: .WORD      0      ;CONTAINS 'GOOD' DATA
475      001126      000000      $BDDAT: .WORD      0      ;CONTAINS 'BAD' DATA
476      001130      000000      000000 000000 .WORD      0,0,0      ;RESERVED--NOT TO BE USED
477      001136      177560      $TKS:   177560      ;TTY KBD STATUS
478      001140      177562      $TKB:   177562      ;TTY KBD BUFFER
479      001142      177564      $TPS:   177564      ;TTY PRINTER STATUS REG.
480      001144      177566      $TPB:   177566      ;TTY PRINTER BUFFER REG.
481      001146      000      $NULL: .BYTE      0      ;CONTAINS NULL CHARACTER FOR FILLS
482      001147      002      $FILLS: .BYTE      2      ;CONTAINS # OF FILLER CHARACTERS REQUIRED
483      001150      012      $FILLC: .BYTE     12      ;INSERT FILL CHARS. AFTER A "LINE FEED"
484      001151      000      $TPFLG: .BYTE      0      ;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
485      001152      077      $QUES: .ASCII    /?/      ;QUESTION MARK
486      001153      015      $CRLF:  .ASCII    <15>      ;CARRIAGE RETURN
487      001154      000012      $LF:   .ASCIZ    <12>      ;LINE FEED

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NO1

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488 ;*****
489
490 .SBTTL ERROR POINTER TABLE
491
492 ;*THIS TABLE CONTAINS THE INFORMATION FOR EACH ERROR THAT CAN OCCUR.
493 ;*THE INFORMATION IS OBTAINED BY USING THE INDEX NUMBER FOUND IN
494 ;*LOCATION $ITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
495 ;*NOTE1: IF $ITEMB IS 0 THE ONLY PERTINENT DATA IS ($ERRPC).
496 ;*NOTE2: EACH ITEM IN THE TABLE CONTAINS 4 POINTERS EXPLAINED AS FOLLOWS:
497
498 ;* EM ;POINTS TO THE ERROR MESSAGE
499 ;* DH ;POINTS TO THE DATA HEADER
500 ;* DT ;POINTS TO THE DATA
501 ;* DF ;POINTS TO THE DATA FORMAT
502
503
504 001156 $ERRTB:
505
506 ;ERROR TABLE ITEM FOR ERROR MESSAGE 0
507
508 001156 020054 EM1 ;"ROM READ DATA COMPARISON ERROR"
509 001160 020254 DH1 ;*
510 001162 020452 DT1 ;*
511 001164 000000 0 ;* PRINT ALL NUMERIC DATA IN OCTAL
512
513 ;ERROR TABLE ITEM FOR ERROR MESSAGE 1
514
515 001166 020116 EM2 ;"WRITTING ROM FAILED TO TRAP"
516 001170 020353 DH2
517 001172 020466 DT2
518 001174 000000 0 ;PRINT ALL NUMERIC DATA IN OCTAL.
519
520 ;ERROR TABLE ITEM FOR ERROR MESSAGE 2
521
522 001176 020154 EM3 ;"UNEXPECTED TRAP WHILE READING ROM"
523 001200 020405 DH3
524 001202 020474 DT3
525 001204 000000 0
526
527 ;ERROR TABLE ITEM FOR ERROR MESSAGE 3
528 001206 020214 EM4 ;"FATAL TRAP. ROM PC ON STACK."
529 001210 020353 DH2
530 001212 020466 DT2
531 001214 000000 0
532
533 001216 000000 LSTERR: 0 ;ERROR FLAG
534 001220 000000 ICOUNT: 0 ;ITERATION COUNT.
535 001222 000000 TEMPS: 0
536 001224 000000 TEMP3: 0
537 001226 000000 TEMP4: 0
538 001230 000000 SAVR0: 0
539 001232 000000 SAVR1: 0
540 001234 000000 SAVR4: 0
541 001236 000000 SAVR5: 0

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554
555      . =1400
556 001400 MAP.YA:
557      ; THE FOLLOWING IS A REPRODUCTION
558      ; OF THE ROM PROGRAM FOR BM873YA.
559      ; IT IS HERE FOR COMPARISON TO
560      ; ACTUAL ROM AND FOR REFERENCE.
561      ; 173000 . =173000
562      ; STARTING ADDRESS FOR BOOTSTRAP
563      ; THIS LOADER IS DESIGNED FOR THE RESTART MODULE M873.
564      ; IT FUNCTIONALLY REPLACES THE FOLLOWING ROMS:
565      ; M792-YA - PAPER TAPE BOOTSTRAP FOR PC11, KL11
566      ; MR11-DB BULK STORAGE BOOTSTRAP ROM
567      ; M792-YH TAPI CASSETTE BOOTSTRAP ROM
568      ; REGISTER DEFINITIONS
569      ;
570      ;
571      ;
572      ;
573      ;
574      ;
575      ;
576      ;
577      ;
578      ; STARTING LOCATION FOR RF11 DISK
579      ; RF11: MOV PC,R2 ; SET POINTER TO PARAMETER LISTS
580      ; BR OTHER ; TRANSFER TO SERVICE ROUTINE
581      ; .WORD 177462 ; DEVICE WORD COUNT ADDRESS
582      ; .WORD 5 ; DEVICE READ INSTRUCTION
583      ;
584      ; THIS IS THE STARTING LOCATION FOR THE RK11 CONTROLLER
585      ; RK11: MOV PC,R2 ; SET POINTER TO PARAMETER LIST
586      ; BR OTHER ; TRANSFER TO SERVICE ROUTINE
587      ; .WORD 177406 ; DEVICE WORD COUNT REGISTER
588      ; .WORD 5 ; DEVICE READ INSTRUCTION
589      ;
590      ; THIS IS A SPARE STARTING LOCATION. IT TRANSFERS TO ADDRESS
591      ; CONTAINED IN THE SWITCH REGISTER.
592      ; TRANSR: MOV @#SR,PC ; GO TO INDICATED LOCATION
593      ; NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
594      ;
595      ; THIS IS THE POWER UP VECTOR REQUIRED FOR DEVICE AND
596      ; POWER: .WORD RF11 ; ADDRESS OF FIRST LOCATION IN ROM
597      ; .WORD 340 ; PROCESSOR STATUS LEVEL 7
598      ;
599      ; THIS IS THE STARTING ADDRESS FOR TC11 (DECTAPE) CONTROLLER.
600      ; TC11: MOV PC,R2 ; SET UP POINTER TO PARAMETER LIST
601      ; BR TAPES ; AND TRANSFER TO FIRST ROUTINE
602      ; .WORD 177344 ; DEVICE WORD COUNT ADDRESS
603      ; .WORD 4003 ; FIND PREVIOUS BLOCK COMMAND
604      ; .WORD 100000 ; USED AS DONE INDICATOR
605      ; .WORD 24000 ; USED AS ERROR INDICATOR/TEST FLAG
606      ; BR OTHERX ; THEN TRANSFER TO NEXT ROUTINE
607      ; .WORD 5 ; DEVICE READ COMMAND

```

```

608
609
610 001450 010702 ;173050 010702
611 001452 000416 ;173052 000416
612 001454 172524 ;173054 172524
613 001456 060017 ;173056 060017
614 001460 000200 ;173060 000200
615 001462 100000 ;173062 100000
616 001464 000413 ;173064 000413
617 001466 060011 ;173066 060011
618 001470 000200 ;173070 000200
619 001472 100000 ;173072 100000
620 001474 000431 ;173074 000431
621 001476 060003 ;173076 060003
622
623
624 001500 010702 ;173100 010702
625 001502 000424 ;173102 000424
626 001504 176716 ;173104 176716
627 001506 000005 ;173106 000005
628
629
630 001510 010200 ;173110 010200
631 001512 005720 ;173112 005720
632 001514 000005 ;173114 000005
633 001516 005720 ;173116 005720
634 001520 016201 ;173120 016201
635 001522 000002 ;173122 000002
636 001524 005311 ;173124 005311
637 001526 012041 ;173126 012041
638 001530 031011 ;173130 031011
639 001532 001776 ;173132 001776
640 001534 005720 ;173134 005720
641 001536 032041 ;173136 032041
642 001540 001063 ;173140 001063
643 001542 000110 ;173142 000110
644
645
646 001544 010702 ;173144 010702
647 001546 000402 ;173146 000402
648 001550 177450 ;173150 177450
649 001552 000005 ;173152 000005
650
651
652 001554 010200 ;173154 010200
653 001556 005720 ;173156 005720
654 001560 005720 ;173160 005720
655 001562 000005 ;173162 000005
656 001564 016201 ;173164 016201
657 001566 000002 ;173166 000002
658 001570 012711 ;173170 012711
659 001572 177000 ;173172 177000
660 001574 011041 ;173174 011041
661 001576 105711 ;173176 105711

```

; THIS IS THE START LOCATION FOR TM11 MAGTAPE CONTROLLER
TM11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
BR TAPES ;AND TRANSFER TO FIRST ROUTINE
.WORD 172524 ;DEVICE BYTE/RECORD COUNT REGISTER
.WORD 60017 ;DEVICE REWIND COMMAND
.WORD 200 ;DEVICE DONE FLAG
.WORD 100000 ;DEVICE ERROR FLAG BIT
BR TAPESX ;THEN TRANSFER TO NEXT SERVICE RTN
.WORD 60011 ;DEVICE FORWARD SPACE COMMAND
.WORD 200 ;SAME AS ABOVE
.WORD 100000 ;SAME AS ABOVE
BR OTHERX ;THEN TRANSFER TO READ/TRANSFER ROUTINE
.WORD 60003 ;DEVICE READ COMMAND

; THIS IS THE START LOCATION FOR THE RP11 CONTROLLER
RP11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
BR OTHER ;TRANSFER TO TRANSFER ROUTINE
.WORD 176716 ;DEVICE WORD COUNT REGISTER
.WORD 5 ;DEVICE READ COMMAND

; THIS IS THE TAPE DEVICE SERVICE ROUTINE.
TAPES: MOV R2,R0 ;GET ADDRESS OF PARAMETER LIST
TST (R0)+ ;SKIP TWO WORDS FIRST TIME
TAPESX: RESET ;RESET ALL DEVICES
TST (R0)+ ;SKIP OVER BRANCH INSTRUCTION
MOV 2(R2),R1 ;THEN GET DEVICE WORD/BYTE COUNT ADDRESS

DEC R1 ;AND SET TO -1
MOV (R0)+,-(R1) ;AND THEN ISSUE COMMAND TO DEVICE
TAPWAT: SIT R0,R1 ;WAIT FOR DEVICE COMPLETION
BEQ TAPWAT ;BY HANGING IN LOOP
TST (R0)+ ;AND THEN SKIP DONE FLAG
BIT (R0)+,-(R1) ;THEN TEST FOR ERROR
BNE ERROR ;THERE IS ONE
RETURN: JMP R0 ;AND TRANSFER TO FOLLOWING INSTRUCTION

; THIS IS THE STARTING ADDRESS FOR RC11 DISK CONTROLLERS
RC11: MOV PC,R2 ;SET UP POINTER TO PARAMETER LIST
BR OTHER ;TRANSFER TO SERVICE RTN
.WORD 177450 ;DEVICE WORD COUNT REGISTER
.WORD 5 ;DEVICE READ INSTRUCTION

; THIS ROUTINE PERFORMS THE ACTUAL TRANSFER TO MEMORY OF DATA
OTHER: MOV R2,R0 ;SET POINTER TO LIST IN R0
TST (R0)+ ;SKIP TWO WORDS FIRST TIME.
OTHERX: TST (R0)+ ;SKIP PAST BR INSTRUCTION
RESET ;REST THE WORLD
MOV 2(R2),R1 ;OBTAIN DEVICE WORD COUNT ADDRESS

MOV #-1000,R1 ;THEN OBTAIN LARGE WORD COUNT

MOV R0,-(R1) ;AND PUT COMMAND TO DEVICE
OTHWAT: TSTB R1 ;WAIT FOR DONE FLAG

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662	001600	100376	;173200	100376	BPL OTHWAT	;BY HANGING IN LOOP
663	001602	005711	;173202	005711	TST R1	;THEN TEST FOR ERROR
664	001604	100441	;173204	100441	BMI ERROR	;GOT PROBLEMS
665	001606	005007	;173206	005007	CLR PC	;AND TRANSFER TO ZERO
666						
667						;THIS IS THE STARTING ADDRESS FOR THE PC11 PAPER TAPE CONTROLLER
668	001610	012704	;173210	012704	KL11: MOV #177560,R4	;OBTAIN DEVICE ADDRESS
669	001612	177560	;173212	177560		
670	001614	000440	;173214	000440	BR CKDEV	;AND TRANSFER TO READER SERVICE ROUTINE
671						
672						
673						;THIS IS THE CASSETTE DEVICE COMMAND TABLE
674	001616	017640	;173216	240	TABLE: .BYTE 240	;COMPARE WORD NOT A COMMAND
675			;173217	037	.BYTE 37	;ILBS+RWD+GO
676	001620	002415	;173220	015	.BYTE 15	;SPACE FORWARD BLOCK+GO
677			;173221	005	.BYTE 5	;READ+GO
678	001622	112024	;173222	024	.BYTE 24	;READ+ILBS
679			;173223	224	.BYTE 224	;READ+ILBS+END FLAG
680						;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
681						
682						;THIS IS AN ADDITIONAL POWER VECTOR ADDRESS REQUIRED BY DEVICE
683	001624	173000	;173224	173000	POWER2: .WORD R11	;ADDRESS OF BEGINNING OF BOOTSTRAP
684	001626	000340	;173226	000340	.WORD 340	;PRIORITY LEVEL 7
685						
686						;THIS IS THE STARTING ADDRESS FOR THE CASSETTE DEVICE #0
687	001630	005004	;173230	005004	CBOOT: CLR R4	;LOAD DEVICE NUMBER 0 IN R4
688	001632	012700	;173232	012700	RESTX: MOV #177500,R0	;GET DEVICE ADDRESS
689	001634	177500		177500		
690	001636	000005	;173236	000005	RESTR1: RESET	;ISSUE RESET INSTRUCTION
691	001640	010410	;173240	010410	MOV R4,R0	;LOAD DEVICE WITH UNIT NUMBER
692	001642	012701	;173242	012701	MOV #TABLE,R1	;GET FUNNY TABLE OF INSTRUCTIONS
693	001644	173216	;173244	173216		
694	001646	012702	;173246	012702	MOV #375,R2	;AND LOAD UP TRANSFER COUNTER
695	001650	000375	;173250	000375		
696	001652	112103	;173252	112103	MOV (R1)+,R3	;THE LOAD UP COMPARATOR
697	001654	112110	;173254	112110	MOV (R1)+,R0	;LOAD DEVICE REGISTER WITH COMMAND
698	001656	100407	;173256	100407	BMI DONE	
699	001660	130310	;173260	130310	LOOP2: BIT R3,R0	;HAS COMMAND COMPLETED
700	001662	001776	;173262	001776	BEQ LOOP2	;NO, WAIT
701	001664	105202	;173264	105202	INCB R2	;THEN INCREMENT ADDRESS CTR
702	001666	100772	;173266	100772	BMI LOOP1	;IF NEGATIVE, GET COMMAND
703	001670	116012	;173270	116012	MOV 2(R0),R2	;AND STORE DATA AWAY
704	001672	000002	;173272	000002		
705	001674	000771	;173274	000771	BR LOOP2	;GO GET ANOTHER BYTE
706	001676	005710	;173276	005710	DONE: TST R0	;ANY DEVICE ERRORS
707	001700	100756	;173300	100756	BMI RESTR1	;YES, RETRY
708	001702	005002	;173302	005002	CLR R2	;CLEAR COMPARE ADDRESS AND TRANSFER ADDRESS
709	001704	120312	;173304	120312	CMPB R3,R2	;IT MUST BE 240
710	001706	001377	;173306	001377	BNE .+0	;NO, THERE WAS AN ERROR
711	001710	000112	;173310	000112	ERROR: JMP R2	;NORMAL CASSETTE AND ERROR FOR BULK STORAGE
712						
713						;THIS IS THE STARTING LOCATION FOR THE PC11 CONTROLLER
714	001712	012704	;173312	012704	PC11: MOV #177550,R4	;LOAD DEVICE ADDRESS
715	001714	177550	;173314	177550		

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716	001716	000005	;173316	000005	CKDEV: RESET	;KILL ALL DEVICE ACTION
717	001720	012701	;173320	012701	MOV #160000,R1	;THEN SET UP MEMORY TEST LIMITS
718	001722	160000	;173322	160000		
719	001724	012702	;173324	012702	MOV #6,R2	;AND SET UP POINTER TO TIMEOUT LOCATION
720	001726	000006	;173326	000006		
721	001730	012712	;173330	012712	MOV #340,@R2	;AND SET UP VECTOR TO RETURN TO NEXT
722	001732	000340	;173332	000340		
723	001734	010742	;173334	010742	MOV PC,-(R2)	;SAVE THE PC
724	001736	012706	;173336	012706	MOV #24,SP	;AND LOAD UP STACK POINTER
725	001740	000024	;173340	000024		
726	001742	010441	;173342	010441	MOV R4,-(R1)	;AND LOOK FOR END OF MEMORY
727	001744	040601	;173344	040601	BIC SP,R1	;THEN DROP TO XX7752
728	001746	010111	;173346	010111	MOV R1,@R1	;AND STORE IN ITSELF
729	001750	011102	;173350	011102	LOOP: MOV @R1,R2	;THEN LOAD ADDRESS FOR DATA INSERTION
730	001752	005214	;173352	005214	INC @R4	;AND START DEVICE
731	001754	105714	;173354	105714	RDRWAT: TSTB @R4	;THEN WAIT FOR CHARACTER AVAILABLE
732	001756	100376	;173356	100376	BPL RDRWAT	;HANGING THERE IF NECESSARY
733	001760	116412	;173360	116412	MOVB 2(R4),@R2	;STORE AWAY DATA BYTE
734	001762	000002	;173362	000002		
735	001764	005211	;173364	005211	INC @R1	
736	001766	120227	;173366	120227	CMPB R2,#375	;HAS BRANCH OFFSET BEEN STORED
737	001770	000375	;173370	000375		
738	001772	001366	;173372	001366	BNE LOOP	;NO
739	001774	105222	;173374	105222	INCB (R2)+	;YES, ALL DONE
740	001776	END.YA:				
741	001776	000142	;173376	000142	JMP -(R2)	;THEN TRANSFER TO RTN

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742 ; BM873B      BOOTSTRAP      MACY11 27(655) 1-OCT-74 14:50 PAGE 1
743 ;
744 ;           ;DATE:  AUG 23, 1974
745 002000 MAP.YB:
746 ; THE FOLLOWING IS A REPRODUCTION
747 ; OF THE ROM PROGRAM FOR BMB73YB.
748 ; IT IS HERE FOR COMPARISON TO THE
749 ; ACTUAL ROM AND FOR REFERENCE
750 ;
751 ;
752 ;
753 ; THIS IS THE LOADER TO REPLACE THE FOLLOW
754 ; M792-YA      PAPER TAPE BOOTSTRAP ROM
755 ; MR11-DB      BULK STORAGE BOOTSTRAP ROM
756 ; M792-YH      TAII CASSETTE BOOTSTRAP ROM
757 ; RM873A COMBINATION OF ABOVE ROMS
758 ;
759 ; PREPHERIAL EXTERNAL PAGE REGISTERS ASSIGNMENTS:
760 ;
761 ; 177462 RFWC= 177462 ; WORD COUNT REG. FOR RF1
762 ; 177406 RKWC= 177406 ; WORD COUNT REG. FOR RK1
763 ; 177344 TCWC= 177344 ; WORD COUNT REG. FOR TC1
764 ; 172524 TMWC= 172524 ; BYTE/RECORD COUNT FOR T
765 ; 176716 RPWC= 176716 ; WORD COUNT REG. FOR RPI
766 ; 177450 RCWC= 177450 ; WORD COUNT REG. FOR RC1
767 ; 177560 KLCS= 177560 ; CONTROL REG. FOR KL11
768 ; 177500 TACS= 177500 ; CONTROL REG. FOR TAII C
769 ; 177550 PCCS= 177550 ; CONTROL REG. FOR PC11
770 ; 172440 TUCS= 172440 ; CONTROL STATUS REG. 1
771 ; 172442 TUWC= TUCS+2 ; TU16 WORD COUNT REG.
772 ;
773 ; 176300 RHCSA= 176300 ; CONTROLLER REG. 1 FOR R
774 ; 176302 RHWCA= RHCSA+2
775 ; 172040 RSCSA= 172040 ; CONTROLLER REG.1 FOR RH
776 ; 172042 RSWCA= RSCSA+2
777 ; 176700 RPCSA= 176700 ; CONTROLLER REG. 1 FOR R
778 ; 176702 RPWCA= RPCSA+2
779 ; FUNCTION VALUE FOR PREPHERALS:
780 ; 000005 RFREAD= 5 ; READ FUNCTION
781 ; 004003 RNUM= 4003 ; REVERSE AND IDENTIFY BL
782 ; 060017 TMRWND= 60017 ; REWIND AND SET 800 BPI
783 ; 060011 TMFWRD= 60011 ; FORWARD RECORD COMMAND
784 ; 060003 TMREAD= 60003 ; TM11 READ
785 ; 000011 DRCLR= 11 ; DRIVE CLEAR
786 ; 000071 RHREAD= 71 ; RH11 READ COMMAND
787 ; 000021 RHPRST= 21 ; READ IN PRESET
788 ; 000031 TUSPAC= 31 ; SPACE FORWARD COMMAND F
789 ; 040000 TUTAPE= 40000 ; TAPE BIT IN RH11/RHDT R
790 ; 001300 TUMODE= 1300 ; 800 BPI NORMAL MODE FOR
791 ; 001000 FCE= 1000 ; FRAME COUNT ERROR BIT
792 ; CONSOLE SWITCH REG.
793 ; 177570 CSW= 177570
794 ;
795 ;

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796 ; ONLY THE LOW BYTE OF CONSOL SWITCH REGISTER IS
797 ; SELECT THE UNIT NUMBER OF THE DEVICE TO BOOT FR
798
799      173000  .=173000
800
801
802 ; THIS IS THE STARTING ADDRESS FOR RH11/RS03/04 D
803 002000 000405 ; 173000 000405 RHRSA: BR 1$ ; ENTRY FOR SELECTING UNI
804 002002 010703 ; 173002 010703 RHRSB: MOV PC,R3 ; ENTRY TO SELECT UNITS
805 002004 113737 ; 173004 113737      MOVB 2#CSW,2#RSCSA+10;LOAD UNIT # INS
806 002006 177570 ; 173006 177570
807 002010 172050 ; 173010 172050
808 002012 000401 ; 173012 000401      BR 2$
809 002014 010703 ; 173014 010703 1$: MOV PC,R3
810 002016 012700 ; 173016 012700 2$: MOV #RSCSA,R0;SET CONTROL STATUS REG
811 002020 172040 ; 173020 172040
812 002022 000526 ; 173022 000526      BR RHCOMN
813
814 ; THIS IS THE AUTO LOAD VECTOR
815 002024 173000 ; 173024 173000      .WORD RHRSA
816 002026 000340 ; 173026 000340      .WORD 340
817
818 ; THIS IS THE STARTING ADDRESS FOR RK11 CONTROLLE
819 002030 000412 ; 173030 000412 RK11A: BR 2$ ; ENTRY TO SELECT UNIT 0
820 002032 010703 ; 173032 010703 RK11B: MOV PC,R3 ; ENTRY TO SELECT ALL UNI
821 ; SAVE ERROR RETRY ADDRES
822 002034 113705 ; 173034 113705      MOVB 2#CSW,R5;SET POINTER TO PARAMETE
823 002036 177570 ; 173036 177570
824 002040 052705 ; 173040 052705      BIS #10,R5 ;SET POSITION BIT
825 002042 000010 ; 173042 000010
826 002044 006105 ; 173044 006105 1$: ROL R5 ;SHIFT UNIT # TO BIT 13-
827 002046 103376 ; 173046 103376      BCC 1$ ;KEEP GOING
828 002050 010537 ; 173050 010537      MOV R5,2#RKWC+4;MOVE IN TO RKDA REGI
829 002052 177412 ; 173052 177412
830 002054 000401 ; 173054 000401      BR 3$ ;SKIP NEXT INSTRUCTION
831 002056 010703 ; 173056 010703 2$: MOV PC,R3 ;SAVE ERROR RETRY ADDRES
832 002060 010702 ; 173060 010702 3$: MOV PC,R2
833 002062 000546 ; 173062 000546      BR OTHERA
834 002064 177406 ; 173064 177406      .WORD RKWC
835 002066 000005 ; 173066 000005      .WORD RFREAD
836
837 ; THIS IS THE STARTING ADDRESS FOR TC11 (DECTAPE)
838 002070 010703 ; 173070 010703 TC11: MOV PC,R3 ;SAVE ERROR RETRY ADDRES
839 002072 010702 ; 173072 010702      MOV PC,R2
840 002074 000570 ; 173074 000570      BR TAPES
841 002076 177344 ; 173076 177344      .WORD TCWC
842 002100 000005 ; 173100 000005      .WORD RFREAD
843 002102 004003 ; 173102 004003      .WORD RNUM
844 002104 100000 ; 173104 100000      .WORD 100000 ;DONE MASK
845 002106 024000 ; 173106 024000      .WORD 24000 ;ERROR MASK
846
847
848
849 ; TM11 STARTING ADDRESS

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850 002110 010703 ;173110 010703 TM11: MOV PC,R3 ;SAVE ERROR RETRY ADDRESS
851 002112 012737 ;173112 012737 MOV #TMRWND,0#TMWC-2;REWIND TAPE
852 002114 060017 ;173114 060017
853 002116 172522 ;173116 172522
854 002120 010702 ;173120 010702 MOV PC,R2
855 002122 000555 ;173122 000555 BR TAPES
856 002124 172524 ;173124 172524 .WORD TMWC
857 002126 060003 ;173126 060003 .WORD TMREAD ;TM11 READ COMMAND
858 002130 060011 ;173130 060011 .WORD TMFWRD ;TM11 FORWARD RECORD COM
859 002132 000200 ;173132 000200 .WORD 200 ;DONE MASK
860 002134 100000 ;173134 100000 .WORD 100000 ;ERROR MASK
861 ;
862 ;
863 002136 010703 ;173136 010703 RF11: MOV PC,R3 ;SAVE ERROR RETRY ADDRESS
864 002140 010702 ;173140 010702 MOV PC,R2 ;SET POINTER TO PARAMETE
865 002142 000516 ;173142 000516 BR OTHERA ;GO TO COMMON SERVICE RO
866 ; ;ASSUME UNIT 0
867 002144 177462 ;173144 177462 .WORD RFWC ;DEVICE WORD COUNT REGIS
868 002146 000005 ;173146 000005 .WORD RFREAD ;READ COMMAND
869 ;
870 ;
871 002150 010703 ;173150 010703 TU16: MOV PC,R3 ;SAVE ERROR RETRY ADDRESS
872 002152 012700 ;173152 012700 MOV #TUCS,RO;GET CONTROL STATUS WORD
873 002154 172440 ;173154 172440
874 002156 012710 ;173156 012710 TU16RE: MOV #RHPRST,(RO);REWIND TAPE CLEAR E
875 002160 000021 ;173160 000021
876 002162 012760 ;173162 012760 MOV #TUMODE,32(RO);SET 800 BPI NORMA
877 002164 001300 ;173164 001300
878 002166 000032 ;173166 000032
879 002170 012760 ;173170 012760 MOV #-1,6(RO);LOAD FRAME COUNT
880 002172 177777 ;173172 177777
881 002174 000006 ;173174 000006
882 002176 012710 ;173176 012710 MOV #TUSPAC,(RO);SPACE FORWARD
883 002200 000031 ;173200 000031
884 002202 105760 ;173202 105760 1$: TSTB 12(RO)
885 002204 000012 ;173204 000012
886 002206 100375 ;173206 100375 BPL 1$ ;KEEP LOOPING
887 002210 000433 ;173210 000433 BR RHCOMN
888 ;
889 ;
890 002212 010703 ;173212 010703 RC11: MOV PC,R3 ;THIS IS THE STARTING ADDRESS FOR RC11 CONTROLLE
891 002214 010702 ;173214 010702 MOV PC,R2 ;ASSUME UNIT 0
892 002216 000470 ;173216 000470 BR OTHERA
893 002220 177450 ;173220 177450 .WORD RCWC
894 002222 000005 ;173222 000005 .WORD RFREAD
895 ;
896 ;
897 002224 173000 ;173224 173000 .WORD RHSA ;THIS IS THE AUTO LOAD VECTOR
898 002226 000340 ;173226 000340 .WORD 340
899 ;
900 ;
901 ;
902 ;
903 ;
;NOTE: IF TM02/TU16 SHOULD BE SELECTED. THE VAL
;IN CONSOL SWITCH REGISTER IS THE POSITIO

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904      ;
905      ;
906 002230 000405 ;173230 000405 RHP1A: BR 1$ ;ENTRY TO SELECT UNIT 0
907 002232 010703 ;173232 010703 RHP1B: MOV PC,R3 ;ENTRY TO SELECT ALL UNI
908 002234 113737 ;173234 113737 MOVB 2#CSW,2#RHP1A+10;LOAD UNIT # INS
909 002236 177570 ;173236 177570
910 002240 176310 ;173240 176310
911 002242 000401 ;173242 000401 BR 2$
912 002244 010703 ;173244 010703 1$: MOV PC,R3
913 002246 012700 ;173246 012700 2$: MOV #RHP1A,RO
914 002250 176300 ;173250 176300
915 002252 032760 ;173252 032760 RPCOMN: BIT #TUTAPE,26(RO);TAPE UNIT?
916 002254 040000 ;173254 040000
917 002256 000026 ;173256 000026
918 002260 001336 ;173260 001336 BNE TUI16RE ;YES. GO TO TAPE LOGIC
919 002262 012710 ;173262 012710 MOV #RHP1B,(RO);RESET DRIVE
920 002264 000021 ;173264 000021
921 002266 012760 ;173266 012760 MOV #14000,32(RO);SET 16 BIT FORMAT
922 002270 014000 ;173270 014000
923 002272 000032 ;173272 000032
924 002274 012710 ;173274 012710 MOV #DRCLR,(RO);CLEAR DRIVE ERROR
925 002276 000011 ;173276 000011
926      ;
927 002300 005720 ;173300 005720 RHCOMN: TST (RO)+ ;(GENERATED IF RS03/04
928 002302 010037 ;173302 010037 MOV RO,2#2 ;MOVE TO WORD COUNT ADDR
929 002304 000002 ;173304 000002
930 002306 012737 ;173306 012737 MOV #RHP1A,2#4 ;FAKE CALLING SEQUENCE
931 002310 000071 ;173310 000071
932 002312 000004 ;173312 000004
933 002314 005002 ;173314 005002 CLR R2 ;FOR FLAG AND POINTER TO
934 002316 000430 ;173316 000430 BR OTHERA
935      ;
936      ;
937      ;
938 002320 000405 ;173320 000405 RHRPA: BR 1$ ;THIS IS THE STARTING ADDRESS FOR RH11/RP04 DISK
939 002322 010703 ;173322 010703 RHRPB: MOV PC,R3 ;ENTRY FOR SELECT UNIT 0
940 002324 113737 ;173324 113737 MOVB 2#CSW,2#RHP1A+10;LOAD UNIT # INS
941 002326 177570 ;173326 177570
942 002330 176710 ;173330 176710
943 002332 000401 ;173332 000401 BR 2$
944 002334 010703 ;173334 010703 1$: MOV PC,R3
945 002336 012700 ;173336 012700 2$: MOV #RHP1A,RO
946 002340 176700 ;173340 176700
947 002342 000743 ;173342 000743 BR RPCOMN
948      ;
949      ;
950 002344 013707 ;173344 013707 CSRGO: MOV 2#CSW,PC ;ENTRY TO BRANCH TO THE PC SELECTED BY CONSOL SW
951 002346 177570 ;173346 177570
952      ;
953      ;
954      ;
955      ;
956 002350 000405 ;173350 000405 RP11A: BR 1$ ;THIS IS THE STARTING ADDRESS FOR RP11 CONTROLLE
957 002352 010703 ;173352 010703 RP11B: MOV PC,R3 ;ENTRY TO SELECT UNIT 0

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K02

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958	002354	113705	; 173354	113705		MOV B	2#CSW, R5
959	002356	177570	; 173356	177570			
960	002360	000305	; 173360	000305		SWAB	R5 ; GET UNIT # INTO HIGH BY
961	002362	000402	; 173362	000402		BR	3\$
962	002364	010703	; 173364	010703	1\$:	MOV	PC, R3
963	002366	005005	; 173366	005005		CLR	R5
964	002370	010702	; 173370	010702	3\$:	MOV	PC, R2
965	002372	000403	; 173372	000403		BR	OTHER
966	002374	176716	; 173374	176716		.WORD	RPWC
967	002376	000005	; 173376	000005		.WORD	RFREAD
968		.		.			
969	002400	005005	; 173400	005005	OTHERA:	CLR	R5 ; SET TO UNIT 0
970	002402	010200	; 173402	010200	OTHER:	MOV	R2, R0 ; RO POINT AT WORD COUNT
971	002404	005720	; 173404	005720		TST	(R0)+ ; POINT TO PARAMETER LIST
972	002406	012001	; 173406	012001		MOV	(R0)+, R1 ; MOVE WORD COUNT ADDRESS
973	002410	012711	; 173410	012711		MOV	#-256.*2, (R1); LOAD WORD COUNT
974	002412	177000	; 173412	177000			
975	002414	051005	; 173414	051005		BIS	(R0), R5 ; COMBINE UNIT # WITH COM
976	002416	010541	; 173416	010541		MOV	R5, -(R1); LOAD READ COMMAND
977	002420	032711	; 173420	032711		BIT	#100200, (R1); CHECK FOR ERROR AND
978	002422	100200	; 173422	100200			
979	002424	001775	; 173424	001775		BEQ	.-+ ; WAIT UNTIL COMPLETE
980	002426	100012	; 173426	100012		BPL	1\$; NO ERROR
981	002430	005702	; 173430	005702		TST	R2 ; WAS IT CALLED BY MASS B
982	002432	001024	; 173432	001024		BNE	AGAIN ; NO ERROR
983	002434	032761	; 173434	032761		BIT	#TUTAPE, 26(R1); IS TU16?
984	002436	040000	; 173436	040000			
985	002440	000026	; 173440	000026			
986	002442	001420	; 173442	001420		BEQ	AGAIN ; NO. ERROR
987	002444	022761	; 173444	022761		CMP	#FCE, 14(R1); ARE WE READ A SHORT
988	002446	001000	; 173446	001000			
989	002450	000014	; 173450	000014			
990	002452	001014	; 173452	001014		BNE	AGAIN ; SOME OTHER ERROR
991	002454	005007	; 173454	005007	1\$:	CLR	PC ; O.K.
992		.		.			
993		.		.			
994	002456	010200	; 173456	010200			
995	002460	005720	; 173460	005720	TAPES:	MOV	R2, R0 ; GET THE ADDRESS OF THE
996	002462	012001	; 173462	012001		TST	(R0)+ ; STEP TO LAST COMMAND
997	002464	005311	; 173464	005311		MOV	(R0)+, R1 ; GET THE WORD COUNT ADDR
998	002466	005720	; 173466	005720		DEC	(R1) ; SET UP TO ADVANCE 1 REC
999	002470	012041	; 173470	012041		TST	(R0)+ ; MOVE RO TO FIRST COMMAN
1000	002472	031011	; 173472	031011		MOV	(R0)+, -(R1); LOAD COMMAND REG.
1001	002474	001776	; 173474	001776		BIT	(R0), (R1); DONE?
1002	002476	005720	; 173476	005720		BEQ	.-2 ; NO. KEEP LOOPING
1003	002500	031041	; 173500	031041		TST	(R0)+ ; YES. CHECK FOR ERROR
1004	002502	001736	; 173502	001736		BIT	(R0), -(R1); ANY ERROR?
1005	002504	000005	; 173504	000005	AGAIN:	BEQ	OTHERA ; NO ERROR- TRY TO READ
1006		.		.		RESET	
1007	002506	000113	; 173506	000113		JMP	(R3) ; ERROR RETURN
1008		.		.			
1009		.		.			
1010	002510	012704	; 173510	012704			
1011	002512	177560	; 173512	177560	KL11:	MOV	#KLCS, R4; OBTAIN CONTROL REG.

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1012 002514 000443 ;173514 000443          BR      CKDEV      ;AND TRANSFER TO READER
1013      ;
1014      ;
1015      ;
1016      ;          ;CASSETTE TAPE DEVICE COMMAND TABLE
1017 002516 .BYTE 240 ;173516          240      TABLE: .BYTE 240          ;COMPARE WORD NOT A COMM
1018 002517 .BYTE 037 ;173517          037          ;ILBS+RWD+GO
1019 002520 .BYTE 015 ;173520          015          ;SPACE FORWARD BLOCK+GO
1020 002521 .BYTE 005 ;173521          005          ;READ
1021 002522 .BYTE 024 ;173522          024          ;READ +ILBS
1022 002523 .BYTE 224 ;173523          224          ;READ+ILBS+END FLAG
1023      ;
1024      ;          ;THIS IS THE STARTING ADDRESS FOR THE CASSETTE D
1025 002524 000404 ;173524 000404 CBOOTA: BR      1$          ;SELECT UNIT 0
1026 002526 113704 ;173526 113704 CBOOTB: MOVB   @#CSW,R4;SELECT UNITS
1027 002530 177570 ;173530 177570
1028 002532 000304 ;173532 000304          SWAB      R4
1029 002534 000401 ;173534 000401          BR      RESETX
1030 002536 005004 ;173536 005004 1$:      CLR      R4
1031 002540 012700 ;173540 012700 RESETX: MOV   #TACS,R0;GET CONTROL REG.
1032 002542 177500 ;173542 177500
1033 002544 000005 ;173544 000005 RESTRT: RESET
1034 002546 010410 ;173546 010410          MOV      R4,(R0);SELECT UNIT
1035 002550 012701 ;173550 012701          MOV      #TABLE,R1
1036 002552 173516 ;173552 173516
1037 002554 012702 ;173554 012702          MOV      #375,R2 ;LOAD TRANSFER COUNTER
1038 002556 000375 ;173556 000375
1039 002560 112103 ;173560 112103          MOVB   (R1)+,R3;LOAD COMPARATOR
1040 002562 112110 ;173562 112110 LOOP1: MOVB   (R1)+,(R0);LOAD COMMAND
1041 002564 100407 ;173564 100407          BMI   DONE
1042 002566 130310 ;173566 130310 LOOP2: BITB   R3,(R0);COMMAND COMPLETE?
1043 002570 001776 ;173570 001776          BEQ   LOOP2 ;NO. WAIT
1044 002572 105202 ;173572 105202          INCB   R2          ;INCREMENT ADDRESS CTR.
1045 002574 100772 ;173574 100772          BMI   LOOP1 ;IF (-), GET COMMAND
1046 002576 116012 ;173576 116012          MOVB   2(R0),(R2);STORE DATA
1047 002600 000002 ;173600 000002
1048 002602 000771 ;173602 000771          BR      LOOP2 ;GET ANOTHER BYTE
1049 002604 005710 ;173604 005710 DONE:  TST   (R0) ;ANY ERROR?
1050 002606 100756 ;173606 100756          BMI   RESTRT ;YES, RETRY
1051 002610 005002 ;173610 005002          CLR   R2          ;CLEAR COMPARE ADDRESS
1052 002612 120312 ;173612 120312          CMPB  R3,(R2) ;IT MUST BE 240
1053 002614 001377 ;173614 001377          BNE
1054 002616 000112 ;173616 000112 ERROR: JMP   (R2)
1055      ;
1056      ;          ;THIS IS THE STARTING ADDRESS FOR THE PC11 CONTR
1057 002620 012704 ;173620 012704 PC11:  MOV   #PCCS,R4
1058 002622 177550 ;173622 177550
1059 002624 000005 ;173624 000005 CKDEV: RESET
1060 002626 012701 ;173626 012701          MOV   #160000,R1;SET UP MEMORY TEST LI
1061 002630 160000 ;173630 160000
1062 002632 012702 ;173632 012702          MOV   #6,R2 ;SET UP POINTER TO TIME0
1063 002634 000006 ;173634 000006
1064 002636 012712 ;173636 012712          MOV   #340,(R2);SET UP VECTOR TO RETUR
1065 002640 000340 ;173640 000340

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M02

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1066	002642	010742	;173642	010742	MOV	PC,-(R2);SAVE PC
1067	002644	012706	;173644	012706	MOV	#24,SP ;LOAD UP STACK POINTER
1068	002646	000024	;173646	000024		
1069	002650	010441	;173650	010441	MOV	R4,-(R1);LOOK FOR END OF MEMORY
1070	002652	040601	;173652	040601	BIC	SP,R1 ;THEN DROP TO XX752
1071	002654	010111	;173654	010111	MOV	R1,(R1) ;AND STORE IN ITSELF
1072	002656	011102	;173656	011102	LOOP: MOV	(R1),R2
1073	002660	005214	;173660	005214	INC	(R4) ;START DEVICE
1074	002662	105714	;173662	105714	RDRWAT: TSTB	(R4) ;WAIT
1075	002664	100376	;173664	100376	BPL	RDRWAT
1076	002666	116412	;173666	116412	MOV	2(R4),(R2);SAVE THE DATA
1077	002670	000002	;173670	000002		
1078	002672	005211	;173672	005211	INC	(R1)
1079	002674	120227	;173674	120227	CMPB	R2,#375
1080	002676	000375	;173676	000375		
1081	002700	001366	;173700	001366	BNE	LOOP ;NO
1082	002702	105222	;173702	105222	INCB	(R2)+ ;YES
1083	002704	000142	;173704	000142	JMP	-(R2)
1084	002706	000000	;173706	000000	; THIS	AREA IS UNUSED
1085	002710	000000	;173710	000000	; THIS	AREA IS UNUSED
1086	002712	000000	;173712	000000	; THIS	AREA IS UNUSED
1087	002714	000000	;173714	000000	; THIS	AREA IS UNUSED
1088	002716	000000	;173716	000000	; THIS	AREA IS UNUSED
1089	002720	000000	;173720	000000	; THIS	AREA IS UNUSED
1090	002722	000000	;173722	000000	; THIS	AREA IS UNUSED
1091	002724	000000	;173724	000000	; THIS	AREA IS UNUSED
1092	002726	000000	;173726	000000	; THIS	AREA IS UNUSED
1093	002730	000000	;173730	000000	; THIS	AREA IS UNUSED
1094	002732	000000	;173732	000000	; THIS	AREA IS UNUSED
1095	002734	000000	;173734	000000	; THIS	AREA IS UNUSED
1096	002736	000000	;173736	000000	; THIS	AREA IS UNUSED
1097	002740	000000	;173740	000000	; THIS	AREA IS UNUSED
1098	002742	000000	;173742	000000	; THIS	AREA IS UNUSED
1099	002744	000000	;173744	000000	; THIS	AREA IS UNUSED
1100	002746	000000	;173746	000000	; THIS	AREA IS UNUSED
1101	002750	000000	;173750	000000	; THIS	AREA IS UNUSED
1102	002752	000000	;173752	000000	; THIS	AREA IS UNUSED
1103	002754	000000	;173754	000000	; THIS	AREA IS UNUSED
1104	002756	000000	;173756	000000	; THIS	AREA IS UNUSED
1105	002760	000000	;173760	000000	; THIS	AREA IS UNUSED
1106	002762	000000	;173762	000000	; THIS	AREA IS UNUSED
1107	002764	000000	;173764	000000	; THIS	AREA IS UNUSED
1108	002766	000000	;173766	000000	; THIS	AREA IS UNUSED
1109	002770	000000	;173770	000000	; THIS	AREA IS UNUSED
1110	002772	000000	;173772	000000	; THIS	AREA IS UNUSED
1111	002774	000000	;173774	000000	; THIS	AREA IS UNUSED
1112	002776	END.YB:				
1113	002776	000000	;173776	000000	; THIS	AREA IS UNUSED

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1114 003000 MAP.YC:
1115 ;THE FOLLOWING 1000 LOCATIONS ARE
1116 ;A REPRODUCTION OF THE ROM PROGRAM
1117 ;FOR THE BM873YC. THE FIRST 400 LOCATIONS
1118 ;ARE AN EXACT COPY OF THE BM873YA. THE
1119 ;REMAINING 400 LOCATIONS ARE
1120 ;THE DDCMP BOOTSTRAP ROM PROGRAM.
1121 ;IT IS HERE FOR COMPARISON TO
1122 ;ACTUAL ROM AND FOR REFERENCE.
1123 ;173000 .=173000 ;STARTING ADDRESS FOR BOOTSTRAP
1124 ;THIS LOADER IS DESIGNED FOR THE RESTART MODULE M873.
1125 ;IT FUNCTIONALLY REPLACES THE FOLLOWING ROMS:
1126 ;M792-YA - PAPER TAPE BOOTSTRAP FOR PC11,KL11
1127 ;MR11-DB BULK STORAGE BOOTSTRAP ROM
1128 ;M792-YH TAII CASSETTE BOOTSTRAP ROM
1129 ; ;REGISTER DEFINITIONS
1130 ; 000000 R0= %0
1131 ; 000001 R1= %1
1132 ; 000002 R2= %2
1133 ; 000003 R3= %3
1134 ; 000004 R4= %4
1135 ; 000005 R5= %5
1136 ; 000006 SP= %6
1137 ; 000007 PC= %7
1138 ; 177570 SR= 177570 ;PROCESSOR SWITCH REGISTER
1139 ;
1140 003000 010702 ;173000 010702 ;STARTING LOCATION FOR RF11 DISK
1141 003002 000464 ;173002 000464 RF11: MOV PC,R2 ;SET POINTER TO PARAMETER LISTS
1142 003004 177462 ;173004 177462 BR OTHER ;TRANSFER TO SERVICE ROUTINE
1143 003006 000005 ;173006 000005 .WORD 177462 ;DEVICE WORD COUNT ADDRESS
1144 ; .WORD 5 ;DEVICE READ INSTRUCTION
1145 ;
1146 003010 010702 ;173010 010702 ;THIS IS THE STARTING LOCATION FOR THE RK11 CONTROLLER
1147 003012 000460 ;173012 000460 RK11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
1148 003014 177406 ;173014 177406 BR OTHER ;TRANSFER TO SERVICE ROUTINE
1149 003016 000005 ;173016 000005 .WORD 177406 ;DEVICE WORD COUNT REGISTER
1150 ; .WORD 5 ;DEVICE READ INSTRUCTION
1151 ;
1152 ;THIS IS A SPARE STARTING LOCATION. IT TRANSFERS TO ADDRESS
1153 003020 013707 ;173020 013707 ;CONTAINED IN THE SWITCH REGISTER.
1154 003022 177570 ;173022 177570 TRANSR: MOV #SR,PC ;GO TO INDICATED LOCATION
1155 ;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
1156 ;
1157 ;THIS IS THE POWER UP VECTOR REQUIRED FOR DEVICE AND
1158 003024 173000 ;173024 173000 POWER: .WORD RF11 ;ADDRESS OF FIRST LOCATION IN ROM
1159 003026 000340 ;173026 000340 .WORD 340 ;PROCESSOR STATUS LEVEL 7
1160 ;
1161 ;THIS IS THE STARTING ADDRESS FOR TC11 (DECTAPE) CONTROLLER.
1162 003030 010702 ;173030 010702 TC11: MOV PC,R2 ;SET UP POINTER TO PARAMETER LIST
1163 003032 000426 ;173032 000426 BR TAPES ;AND TRANSFER TO FIRST ROUTINE
1164 003034 177344 ;173034 177344 .WORD 177344 ;DEVICE WORD COUNT ADDRESS
1165 003036 004003 ;173036 004003 .WORD 4003 ;FIND PREVIOUS BLOCK COMMAND
1166 003040 100000 ;173040 100000 .WORD 100000 ;USED AS DONE INDICATOR
1167 003042 024000 ;173042 024000 .WORD 24000 ;USED AS ERROR INDICATOR/TEST FLAG

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1168 003044 000445 ;173044 000445 BR OTHERX ;THEN TRANSFER TO NEXT ROUTINE
1169 003046 000005 ;173046 000005 .WORD 5 ;DEVICE READ COMMAND
1170
1171 ;THIS IS THE START LOCATION FOR TM11 MAGTAPE CONTROLLER
1172 003050 010702 ;173050 010702 TM11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
1173 003052 000416 ;173052 000416 BR TAPES ;AND TRANSFER TO FIRST ROUTINE
1174 003054 172524 ;173054 172524 .WORD 172524 ;DEVICE BYTE/RECORD COUNT REGISTER
1175 003056 060017 ;173056 060017 .WORD 60017 ;DEVICE REWIND COMMAND
1176 003060 000200 ;173060 000200 .WORD 200 ;DEVICE DONE FLAG
1177 003062 100000 ;173062 100000 .WORD 100000 ;DEVICE ERROR FLAG BIT
1178 003064 000413 ;173064 000413 BR TAPESX ;THEN TRANSFER TO NEXT SERVICE RTN
1179 003066 060011 ;173066 060011 .WORD 60011 ;DEVICE FORWARD SPACE COMMAND
1180 003070 000200 ;173070 000200 .WORD 200 ;SAME AS ABOVE
1181 003072 100000 ;173072 100000 .WORD 100000 ;SAME AS ABOVE
1182 003074 000431 ;173074 000431 BR OTHERX ;THEN TRANSFER TO READ/TRANSFER ROUTINE
1183 003076 060003 ;173076 060003 .WORD 60003 ;DEVICE READ COMMAND
1184
1185 ;THIS IS THE START LOCATION FOR THE RP11 CONTROLLER
1186 003100 010702 ;173100 010702 RP11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
1187 003102 000424 ;173102 000424 BR OTHER ;TRANSFER TO TRANSFER ROUTINE
1188 003104 176716 ;173104 176716 .WORD 176716 ;DEVICE WORD COUNT REGISTER
1189 003106 000005 ;173106 000005 .WORD 5 ;DEVICE READ COMMAND
1190
1191 ;THIS IS THE TAPE DEVICE SERVICE ROUTINE.
1192 003110 010200 ;173110 010200 TAPES: MOV R2,R0 ;GET ADDRESS OF PARAMETER LIST
1193 003112 005720 ;173112 005720 TST (R0)+ ;SKIP TWO WORDS FIRST TIME
1194 003114 000005 ;173114 000005 TAPESX: RESET ;RESET ALL DEVICES
1195 003116 005720 ;173116 005720 TST (R0)+ ;SKIP OVER BRANCH INSTRUCTION
1196 003120 016201 ;173120 016201 MOV 2(R2),R1 ;THEN GET DEVICE WORD/BYTE COUNT ADDRESS
1197 003122 000002 ;173122 000002
1198 003124 005311 ;173124 005311 DEC @R1 ;AND SET TO -1
1199 003126 012041 ;173126 012041 MOV (R0)+,-(R1) ;AND THEN ISSUE COMMAND TO DEVICE
1200 003130 031011 ;173130 031011 TAPWAT: BIT @R0,@R1 ;WAIT FOR DEVICE COMPLETION
1201 003132 001776 ;173132 001776 BEQ TAPWAT ;BY HANGING IN LOOP
1202 003134 005720 ;173134 005720 TST (R0)+ ;AND THEN SKIP DONE FLAG
1203 003136 032041 ;173136 032041 BIT (R0)+,-(R1) ;THEN TEST FOR ERROR
1204 003140 001063 ;173140 001063 BNE ERROR ;THERE IS ONE
1205 003142 000110 ;173142 000110 RETURN: JMP @R0 ;AND TRANSFER TO FOLLOWING INSTRUCTION
1206
1207 ;THIS IS THE STARTING ADDRESS FOR RC11 DISK CONTROLLERS
1208 003144 010702 ;173144 010702 RC11: MOV PC,R2 ;SET UP POINTER TO PARAMETER LIST
1209 003146 000402 ;173146 000402 BR OTHER ;TRANSFER TO SERVICE RTN
1210 003150 177450 ;173150 177450 .WORD 177450 ;DEVICE WORD COUNT REGISTER
1211 003152 000005 ;173152 000005 .WORD 5 ;DEVICE READ INSTRUCTION
1212
1213 ;THIS ROUTINE PERFORMS THE ACTUAL TRANSFER TO MEMORY OF DATA
1214 003154 010200 ;173154 010200 OTHER: MOV R2,R0 ;SET POINTER TO LIST IN R0
1215 003156 005720 ;173156 005720 TST (R0)+ ;SKIP TWO WORDS FIRST TIME.
1216 003160 005720 ;173160 005720 OTHERX: TST (R0)+ ;SKIP PAST BR INSTRUCTION
1217 003162 000005 ;173162 000005 RESET ;REST THE WORLD
1218 003164 016201 ;173164 016201 MOV 2(R2),R1 ;OBTAIN DEVICE WORD COUNT ADDRESS
1219 003166 000002 ;173166 000002
1220 003170 012711 ;173170 012711 MOV #-1000,@R1 ;THEN OBTAIN LARGE WORD COUNT
1221 003172 177000 ;173172 177000

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1222	003174	011041	;173174	011041	MOV @R0,-(R1)	;AND PUT COMMAND TO DEVICE
1223	003176	105711	;173176	105711	OTHWAT: TSTB @R1	;WAIT FOR DONE FLAG
1224	003200	100376	;173200	100376	BPL OTHWAT	;BY HANGING IN LOOP
1225	003202	005711	;173202	005711	TST @R1	;THEN TEST FOR ERROR
1226	003204	100441	;173204	100441	BMI ERROR	;GOT PROBLEMS
1227	003206	005007	;173206	005007	CLR PC	;AND TRANSFER TO ZERO
1228						
1229						;THIS IS THE STARTING ADDRESS FOR THE PC11 PAPER TAPE CONTROLLER
1230	003210	012704	;173210	012704	KL11: MOV #177560,R4	;OBTAIN DEVICE ADDRESS
1231	003212	177560	;173212	177560		
1232	003214	000440	;173214	000440	BR CKDEV	;AND TRANSFER TO READER SERVICE ROUTINE
1233						
1234						
1235						;THIS IS THE CASSETTE DEVICE COMMAND TABLE
1236	003216	017640	;173216	240	TABLE: .BYTE 240	;COMPARE WORD NOT A COMMAND
1237			;173217	037	.BYTE 37	;ILBS+RWD+GO
1238	003220	002415	;173220	015	.BYTE 15	;SPACE FORWARD BLOCK+GO
1239			;173221	005	.BYTE 5	;READ+GO
1240	003222	112024	;173222	024	.BYTE 24	;READ+ILBS
1241			;173223	224	.BYTE 224	;READ+ILBS+END FLAG
1242						;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
1243						
1244						;THIS IS AN ADDITIONAL POWER VECTOR ADDRESS REQUIRED BY DEVICE
1245	003224	173000	;173224	173000	POWER2: .WORD RF11	;ADDRESS OF BEGINNING OF BOOTSTRAP
1246	003226	000340	;173226	000340	.WORD 340	;PRIORITY LEVEL 7
1247						
1248						;THIS IS THE STARTING ADDRESS FOR THE CASSETTE DEVICE #C
1249	003230	005004	;173230	005004	CBOOT: CLR R4	;LOAD DEVICE NUMBER 0 IN R4
1250	003232	012700	;173232	012700	RESTX: MOV #177500,R0	;GET DEVICE ADDRESS
1251	003234	177500		177500		
1252	003236	000005	;173236	000005	RESTRT: RESET	;ISSUE RESET INSTRUCTION
1253	003240	010410	;173240	010410	MOV R4,@R0	;LOAD DEVICE WITH UNIT NUMBER
1254	003242	012701	;173242	012701	MOV #TABLE,R1	;GET FUNNY TABLE OF INSTRUCTIONS
1255	003244	173216	;173244	173216		
1256	003246	012702	;173246	012702	MOV #375,R2	;AND LOAD UP TRANSFER COUNTER
1257	003250	000375	;173250	000375		
1258	003252	112103	;173252	112103	MOV B (R1)+,R3	;THE LOAD UP COMPARATOR
1259	003254	112110	;173254	112110	LOOP1: MOV B (R1)+,@R0	;LOAD DEVICE REGISTER WITH COMMAND
1260	003256	100407	;173256	100407	BMI DONE	
1261	003260	130310	;173260	130310	LOOP2: BITB R3,@R0	;HAS COMMAND COMPLETED
1262	003262	001776	;173262	001776	BEQ LOOP2	;NO WAIT
1263	003264	105202	;173264	105202	INCB R2	;THEN INCREMENT ADDRESS CTR
1264	003266	100772	;173266	100772	BMI LOOP1	;IF NEGATIVE, GET COMMAND
1265	003270	116012	;173270	116012	MOV B 2(R0),@R2	;AND STORE DATA AWAY
1266	003272	000002	;173272	000002		
1267	003274	000771	;173274	000771	DONE: BR LOOP2	;GO GET ANOTHER BYTE
1268	003276	005710	;173276	005710	TST @R0	;ANY DEVICE ER.ORS
1269	003300	100756	;173300	100756	BMI RESTRT	;YES, RETRY
1270	003302	005002	;173302	005002	CLR R2	;CLEAR COMPARE ADDRESS AND TRANSFER ADDRESS
1271	003304	120312	;173304	120312	CMPB R3,@R2	;IT MUST BE 240
1272	003306	001377	;173306	001377	BNE +0	;NO, THERE WAS AN ERROR
1273	003310	000112	;173310	000112	ERROR: JMP @R2	;NORMAL CASSETTE AND ERROR FOR BULK STORAGE
1274						
1275						;THIS IS THE STARTING LOCATION FOR THE PC11 CONTROLLER

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 OZBMDH.P11 ROM CONTENTS TABLES

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1276 003312 012704 ;173312 012704 PC11:  MOV #177550,R4 ;LOAD DEVICE ADDRESS
1277 003314 177550 ;173314 177550
1278 003316 000005 ;173316 000005 CKDEV:  RESET ;KILL ALL DEVICE ACTION
1279 003320 012701 ;173320 012701      MOV #160000,R1 ;THEN SET UP MEMORY TEST LIMITS
1280 003322 160000 ;173322 160000
1281 003324 012702 ;173324 012702      MOV #6,R2 ;AND SET UP POINTER TO TIMEOUT LOCATION
1282 003326 000006 ;173326 000006
1283 003330 012712 ;173330 012712      MOV #340,R2 ;AND SET UP VECTOR TO RETURN TO NEXT
1284 003332 000340 ;173332 000340
1285 003334 010742 ;173334 010742      MOV PC,-(R2) ;SAVE THE PC
1286 003336 012706 ;173336 012706      MOV #24,SP ;AND LOAD UP STACK POINTER
1287 003340 000024 ;173340 000024
1288 003342 010441 ;173342 010441      MOV R4,-(R1) ;AND LOOK FOR END OF MEMORY
1289 003344 040601 ;173344 040601      BIC SP,R1 ;THEN DROP TO XX7752
1290 003346 010111 ;173346 010111      MOV R1,R1 ;AND STORE IN ITSELF
1291 003350 011102 ;173350 011102 LOOP:  MOV R1,R2 ;THEN LOAD ADDRESS FOR DATA INSERTION
1292 003352 005214 ;173352 005214      INC R4 ;AND START DEVICE
1293 003354 105714 ;173354 105714 RDRWAT: TSTB R4 ;THEN WAIT FOR CHARACTER AVAILABLE
1294 003356 100376 ;173356 100376      BPL RDRWAT ;HANGING THERE IF NECESSARY
1295 003360 116412 ;173360 116412      MOVB 2(R4),R2 ;STORE AWAY DATA BYTE
1296 003362 000002 ;173362 000002
1297 003364 005211 ;173364 005211      INC R1
1298 003366 120227 ;173366 120227      CMPB R2,#375 ;HAS BRANCH OFFSET BEEN STORED
1299 003370 000375 ;173370 000375
1300 003372 001366 ;173372 001366      BNE LOOP ;NO
1301 003374 105222 ;173374 105222      INCB (R2)+ ;YES, ALL DONE
1302 003376 000142 ;173376 000142      JMP -(R2) ;THEN TRANSFER TO RTN
  
```

1303
 1304 ;THE FOLLOWING 400 LOCATIONS ARE
 1305 ;A REPRODUCTION OF THE DDCMP BOOT-
 1306 ;STRAP ROM. IT IS HERE FOR COM-
 1307 ;PARISON TO THE ACTUAL ROM AND
 1308 ;FOR REFERENCE.

1309
 1310 ;
 1311 ;
 1312 ;
 1313 ;
 1314 ;
 1315 ;
 1316 ;
 1317 ;
 1318 ;
 1319 ;
 1320 ;
 1321 ;
 1322 ;
 1323 ;
 1324 ;
 1325 ;
 1326 ;
 1327 ;
 1328 ;
 1329 ;

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VERSION 01

STUART WECKER 01/22/75

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1384	:	000001	R1=%1		;DEVICE CSR ADDRESS
1385	:	000002	R2=%2		;CRC CALC TEMP
1386	:	000003	R3=%3		;SOFTWARE CRC
1387	:	000004	R4=%4		;BLOCK CHAR COUNT
1388	:	000005	R5=%5		;CRC CALC TEMP
1389	:	000006	SP=%6		;STACK ADDR
1390	:	000007	PC=%7		;LOCATION COUNTER
1391	:				
1392	:			LITERALS	
1393	:				
1394	:	000001	\$STADR=1		;STATION ADDR
1395	:	177570	\$SWR=177570		;SWITCH REGISTER ADDR
1396	:	000226	\$SYN=226		;SYNC CHARACTER
1397	:	000220	\$DLE=220		;DDCMP DLE CHARACTER
1398	:	000400	\$STRIP=400		
1399	:				
1400	:				THE STACK IS USED AS FOLLOWS:
1401	:				STACK-2:FOR JSR TO GET ROUTINE
1402	:				STACK-4:TEMP FOR CRC CALCULATION
1403	:				
1404	:				START OF BOOT PROGRAM
1405	:				
1406	:				START1-DEVICE UNIT 0-NORMAL CONFIGURATION
1407	:				START2-USE SWITCH REG AS DEVICE DISPLACEMENT
1408	:				I.E. #0-0,#1-10,#2-20
1409	:				
1410	:				
1411	003400	012700	:173400	012700	START1: MOV (PC)+,RO ;NON ZERO VALUE TO RO
1412	003402	005000	:173402	005000	START2: CLR RO ;CLEAR RO
1413	003404	000005	:173404	000005	RESET ;RESET SYS, MEM MGT, ETC...
1414	003406	012706	:173406	012706	MOV #17776,SP ;STACK AT 4K-2
1415	003410	017776	:173410	017776	
1416	:				
1417	:				FIND THE DU-11 IN THE FLOATING ADDRESS SPACE
1418	:				
1419	003412	010702	:173412	010702	MOV PC,R2 ;CURRENT PC
1420	003414	062702	:173414	062702	ADD #DEVTAB-. ,R2 ;DEVICE TABLE ADDR
1421	003416	000360	:173416	000360	
1422	003420	012703	:173420	012703	MOV #6,R3 ;TRAP PS ADDR
1423	003422	000006	:173422	000006	
1424	003424	005013	:173424	005013	CLR (R3) ;CLEAR NEW PS
1425	003426	010243	:173426	010243	MOV R2,-(R3) ;TABLE ADDR TO LOC 4
1426	003430	160313	:173430	160313	SUB R3,(R3) ;SUB TO TRAP RTN
1427	003432	005303	:173432	005303	DEC R3 ;LEAVE CNT 3 FOR LOOP
1428	003434	012701	:173434	012701	MOV #160010,R1 ;START SEARCH ADDR
1429	003436	160010	:173436	160010	
1430	003440	005711	:173440	005711	DEVELOP: TST (R1) ;IS DEVICE THERE
1431	003442	111204	:173442	111204	MOV R2,R4 ;DEVICE INCREMENT TO R3
1432	003444	060401	:173444	060401	ADD R4,R1 ;UPDATE TO NEXT DEVICE
1433	003446	005201	:173446	005201	INC R1 ;INCREMENT MODULO
1434	003450	040401	:173450	040401	BIC R4,R1 ;CLEAR EXCESS
1435	003452	005703	:173452	005703	TST R3 ;TEST FOR DONE
1436	003454	001371	:173454	001371	BNE DEVELOP ;NOT YET
1437	003456	005700	:173456	005700	TST RO ;TEST SWITCH REG USE

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ROM CONTENTS TABLES

1438	003460	001002	;173460	001002	BNE	SNDREQ	;NO SWITCH REG
1439	003462	063701	;173462	063701	ADD	2*SSWR,R1	;ADD SWR VALUE
1440	003464	177570	;173464	177570			
1441							
1442							
1443							
1444							
1445	003466	012711	;173466	012711	MOV	#6,(R1)	;DATA TERM RDY AND REQ TO SEND
1446	003470	000006	;173470	000006			
1447	003472	012761	;173472	012761	MOV	#36000+\$SYN,2(R1)	;SET SYNC REGISTER
1448	003474	036226	;173474	036226			
1449	003476	000002	;173476	000002			
1450	003500	032711	;173500	032711	L3: BIT	#20000,(R1)	;TEST CLEAR TO SEND
1451	003502	020000	;173502	020000			
1452	003504	001775	;173504	001775	BEQ	L3	;NOT YET
1453	003506	022121	;173506	022121	CMP	(R1)+,(R1)+	;MOVE PTR TO XMIT TSR
1454	003510	052711	;173510	052711	BIS	#20,(R1)	;TURN SEND ON
1455	003512	000020	;173512	000020			
1456							
1457							
1458							
1459	003514	010700	;173514	010700	MOV	PC,R0	;CURRENT PC
1460	003516	062700	;173516	062700	ADD	#RQMSG-,R0	;REQUEST MSG ADDR
1461	003520	000230	;173520	000230			
1462	003522	012704	;173522	012704	MOV	#RQMSGE-RQMSG,R4	;COUNT
1463	003524	000026	;173524	000026			
1464	003526	112061	;173526	112061	L4: MOVB	(R0)+,2(R1)	;CHAR TO XMIT REGISTER
1465	003530	000002	;173530	000002			
1466	003532	105711	;173532	105711	L5: TSTB	(R1)	;DONE YET ?
1467	003534	100376	;173534	100376	BPL	L5	;NO
1468	003536	005304	;173536	005304	DEC	R4	;DECREMENT COUNT
1469	003540	001372	;173540	001372	BNE	L4	;ONCE MORE
1470	003542	042711	;173542	042711	BIC	#20,(R1)	;DROP SEND
1471	003544	000020	;173544	000020			
1472	003546	024141	;173546	024141	CMP	-(R1),-(R1)	;RESET PTR TO RCV CSR
1473							
1474							
1475							
1476							
1477	003550	042711	;173550	042711	GETPGM: BIC	#20,(R1)	;CLEAR SEARCH SYNC
1478	003552	000020	;173552	000020			
1479	003554	012711	;173554	012711	MOV	#422,(R1)	;SET FOR CLEAR AND STRIP SYNC
1480	003556	000422	;173556	000422			
1481	003560	005003	;173560	005003	CLR	R3	;CLEAR CRC VALUE
1482							
1483							
1484							
1485	003562	012700	;173562	012700	MOV	#1,R0	;LOAD HDR AT LOC. 1
1486	003564	000001	;173564	000001			
1487	003566	012704	;173566	012704	MOV	#8.,R4	;BLOCK COUNT
1488	003570	000010	;173570	000010			
1489	003572	004767	;173572	004767	JSR	PC,GET	;GET HEADER
1490	003574	000060	;173574	000060			
1491	003576	005703	;173576	005703	TST	R3	;CHECK HEADER CRC

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1492	003600	001363	;173600	001363	BNE	GETPGM	;NO GOOD
1493	003602	123727	;173602	123727	CMPB	Q#6, #SSTADR	;CHECK FOR MY ADDR
1494	003604	000006	;173604	000006			
1495	003606	000001	;173606	000001			
1496	003610	001357	;173610	001357	BNE	GETPGM	;NOT MINE
1497	003612	123727	;173612	123727	CMPB	Q#1, #SOLE	;IS THIS A DLE MSG
1498	003614	000001	;173614	000001			
1499	003616	000220	;173616	000220			
1500	003620	001322	;173620	001322	BNE	SNDREQ	;NO, ASK FOR ONE
1501							
1502							
1503							
1504	003622	013704	;173622	013704	MOV	Q#2, R4	;DATA FIELD LENGTH
1505	003624	000002	;173624	000002			
1506	003626	042704	;173626	042704	BIC	#140000, R4	;MASK OFF S, F BITS
1507	003630	140000	;173630	140000			
1508	003632	122424	;173632	122424	CMPB	(R4)+, (R4)+	;ADD 2 FOR CRC
1509	003634	005000	;173634	005000	CLR	R0	;LOAD INTO LOCATION 0
1510	003636	004767	;173636	004767	JSR	PC, GET1	;GET DATA BLOCK
1511	003640	000014	;173640	000014			
1512	003642	005703	;173642	005703	TST	R3	;CHECK DATA FIELD CRC
1513	003644	001310	;173644	001310	BNE	SNDREQ	;NO GOOD
1514	003646	105713	;173646	105713	TSTB	(R3)	;CHECK CODE IN LOC 0
1515	003650	001306	;173650	001306	BNE	SNDREQ	;NOT PROGRAM LOAD
1516	003652	000137	;173652	000137	JMP	Q#6	;TRANSFER TO SECONDARY PGM
1517	003654	000006	;173654	000006			
1518							
1519							
1520							
1521			;173656				
1522			;173656				
1523	003656	105711	;173656	105711	TSTB	(R1)	;IS DEVICE DONE YET
1524	003660	100376	;173660	100376	BPL	GET	;NOT YET
1525	003662	042711	;173662	042711	BIC	#SSTRIP, (R1)	;NO STRIP SYNC
1526	003664	000400	;173664	000400			
1527	003666	116110	;173666	116110	MOVB	2(R1), (R0)	;STORE IT
1528	003670	000002	;173670	000002			
1529							
1530							
1531							
1532			; 120001				
1533							
1534	003672	012705	;173672	012705	MOV	#8, R5	;BYTE LENGTH
1535	003674	000010	;173674	000010			
1536	003676	112002	;173676	112002	MOVB	(R0)+, R2	;CHARACTER TO ADD TO CRC
1537	003700	000241	;173700	000241	CRCLOP: CLC		;CLEAR CARRY
1538	003702	006003	;173702	006003	ROR	R3	;SHIFT OLD PARTIAL
1539	003704	103003	;173704	103003	BCC	L10	;IF CLEAR CHECK CHAR
1540	003706	006002	;173706	006002	ROR	R2	;SHIFT CHARACTER
1541	003710	103003	;173710	103003	BCC	L11	;XOR POLY
1542	003712	000410	;173712	000410	BR	L12	;NEXT BIT
1543	003714	006002	;173714	006002	L10: ROR	R2	;SHIFT CHARACTER
1544	003716	103006	;173716	103006	BCC	L12	;NEXT BIT
1545	003720	012746	;173720	012746	L11: MOV	#POLY, -(SP)	;POLY TO STACK

1585 004000 MAP.YD:

1586 ; THE FOLLOWING IS A REPRODUCTION
1587 ; OF THE ROM PROGRAM FOR BM873YD.
1588 ; IT IS HERE FOR COMPARISON TO THE
1589 ; ACTUAL ROM AND FOR REFERENCE
1590 ; BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17)
1591 ; BM873-YD.P11

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THIS CODE IS TO BE BLASTED INTO PROMS ON THE BM873-YD BOARD.
WRITTEN BY DAVID M. ROSENBERG OCTOBER 1974
; REGISTER DEFINITIONS

1596	:	000000	RO=%0	;	GENERAL PURPOSE REGISTER 0
1597	:	000001	R1=%1	;	GENERAL PURPOSE REGISTER 1
1598	:	000002	R2=%2	;	GENERAL PURPOSE REGISTER 2
1599	:	000003	R3=%3	;	GENERAL PURPOSE REGISTER 3
1600	:	000004	R4=%4	;	GENERAL PURPOSE REGISTER 4
1601	:	000005	R5=%5	;	GENERAL PURPOSE REGISTER 5
1602	:	000006	SP=%6	;	STACK POINTER (REGISTER R6)
1603	:	000007	PC=%7	;	PROGRAM COUNTER (REGISTER R7)

; SYMBOL DEFINITIONS

1608	:	177776	PS=177776	;	PROCESSOR STATUS REGISTER
1609	:	177570	SWR=177570	;	FRONT PANEL SWITCH REGISTER
1610	:	000000	PR0=0*40	;	PRIORITY LEVEL 0
1611	:	000040	PR1=1*40	;	PRIORITY LEVEL 1
1612	:	000100	PR2=2*40	;	PRIORITY LEVEL 2
1613	:	000140	PR3=3*40	;	PRIORITY LEVEL 3
1614	:	000200	PR4=4*40	;	PRIORITY LEVEL 4
1615	:	000240	PR5=5*40	;	PRIORITY LEVEL 5
1616	:	000300	PR6=6*40	;	PRIORITY LEVEL 6
1617	:	000340	PR7=7*40	;	PRIORITY LEVEL 7
1618	:	000001	BIT0=000001		
1619	:	000002	BIT1=000002		
1620	:	000004	BIT2=000004		
1621	:	000010	BIT3=000010		
1622	:	000020	BIT4=000020		
1623	:	000040	BIT5=000040		
1624	:	000100	BIT6=000100		
1625	:	000200	BIT7=000200		
1626	:	000400	BIT8=000400		
1627	:	001000	BIT9=001000		
1628	:	002000	BIT10=002000		
1629	:	004000	BIT11=004000		
1630	:	010000	BIT12=010000		
1631	:	020000	BIT13=020000		
1632	:	040000	BIT14=040000		
1633	:	100000	BIT15=100000		

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OCTOBER 1976
DZBMDH.P11

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ROM CONTENTS TABLES

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1636 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 3
1637 ;BM873-YD.P11 BUTTON #1 - BOOTSTRAP USING THE PDP-11 SWITCH REGISTER
1638
1639
1640 ; 173000 ROMORG = 173000 ;SET ROM ORIGIN TO 773000
1641 ; 173000 .ROMORG ;BM873-YD OCCUPIES 773000-773777
1642
1643 004000 033727 ;173000 033727 BUTON1: BIT @#SWR,#BIT0 ;IS RIGHTMOST BIT ON?
1644 004002 177570 ;173002 177570
1645 004004 000001 ;173004 000001
1646 004006 001010 ;173006 001010 BNE LOWBIT ;IF THE BIT IS ON, BRANCH
1647 004010 013707 ;173010 013707 MOV @#SWR,PC ;JUMP TO THE ADDRESS IN THE SWITCH REGISTER
1648 004012 177570 ;173012 177570
1649 ;WITHOUT HAVING TOUCHED ANY OF R0 - R6
1650
1651 004014 111704 ;173014 111704 BUTON3: MOVB (PC),R4 ;R4 = 1 INDICATES THAT BUTTON #3 WAS PRESSED
1652 004016 005001 ;173016 005001 CLR R1 ;SET UNIT NUMBER TO ZERO
1653 004020 005005 ;173020 005005 CLR R5 ;CLEAR "LOGICAL SWITCH REGISTER"
1654 004022 000424 ;173022 000424 BR TCBOOT ;DO A DEFAULT BOOT STRAP FROM DECTAPE
1655
1656 004024 173000 ;173024 173000 .WORD ROMORG,PR7
1657 004026 000340 ;173026 000340
1658
1659 004030 013701 ;173030 013701 LOWBIT: MOV @#SWR,R1 ;R1 IS A COPY OF THE SWITCH REGISTER
1660 004032 177570 ;173032 177570
1661 004034 106301 ;173034 106301 ASLB R1 ;LEFT-ALIGN SPEED FIELD IN RIGHT BYTE
1662 004036 122701 ;173036 122701 CMPB #16*20,R1 ;IS THE SPEED 16 OR 17?
1663 004040 000340 ;173040 000340
1664 004042 101404 ;173042 101404 BLOS UNITNO ;IF SPEED IS 16 OR 17, BRANCH
1665 004044 122701 ;173044 122701 CMPB #3*20,R1 ;IS THE SPEED 0, 1, OR 2?
1666 004046 000060 ;173046 000060
1667 004050 101001 ;173050 101001 BHI UNITNO ;IF THE SPEED IS 0, 1, OR 2, BRANCH
1668 004052 005001 ;173052 005001 CLR R1 ;SPEED WAS 3-15; SET UNIT NUMBER = 0
1669 004054 000301 ;173054 000301 UNITNO: SWAB R1 ;MOVE UNIT NUMBER TO BITS 0-2
1670
1671 ; IT IS POSSIBLE TO MANUALLY SET THE DESIRED BOOTSTRAP UNIT NUMBER
1672 ; INTO THE RIGHTMOST THREE BITS OF R1, SET THE PDP-11 FRONT PANEL
1673 ; SWITCH REGISTER, AND THEN JUMP INTO THE ROM CODE AT THIS POINT.
1674
1675 004056 042701 ;173056 042701 BIC #1C7,R1 ;ISOLATE UNIT NUMBER IN R1
1676 004060 177770 ;173060 177770
1677 004062 013705 ;173062 013705 MOV @#SWR,R5 ;R5 IS NOW THE "LOGICAL SWITCH REGISTER"
1678 004064 177570 ;173064 177570
1679 004066 005004 ;173066 005004 CLR R4 ;R4 = 0 INDICATES THAT BUTTON #1 WAS PRESSED
1680 004070 105705 ;173070 105705 TSTB R5 ;SHOULD WE BOOT FROM DECTAPE OR RH11/RP04?
1681 004072 100507 ;173072 100507 BMI RPBOOT ;IF BIT 7 WAS ONE, BRANCH OFF TO THE RH11/RP04
1682 ;OTHERWISE, FALL THROUGH TO THE DECTAPE

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ROM CONTENTS TABLES

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1683 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 4
1684 ;BM873-YD.P11 DECTAPE BOOTSTRAP AND DUMP ROUTINES
1685
1686
1687 ; 177344 TCWC = 177344 ;TC11 DECTAPE WORD COUNT REGISTER
1688 ; 000001 TCGO = 1 ;TC11 "GO" BIT
1689 ; 000002 TCRNUM = 1*2 ;TC11 "READ BLOCK NUMBER" FUNCTION
1690 ; 000004 TCREAD = 2*2 ;TC11 "READ DATA" FUNCTION
1691 ; 000014 TCWRIT = 6*2 ;TC11 "WRITE DATA" FUNCTION
1692 ; 004000 TCREV = 4000 ;MOVE DECTAPE IN REVERSE DIRECTION
1693
1694 ; BOOTSTRAP (FROM DECTAPE) PARAMETERS
1695 ; 000400 TCBWDC = 10256 ;WORD COUNT FOR THE SECONDARY BOOTSTRAP
1696 ; 000000 TCBEND = 0 ;WHICH END OF THE DECTAPE (0 = FRONT; 1 = BACK)
1697
1698 ; DUMP (TO DECTAPE) PARAMETERS
1699 ; 070000 TCDWDC = 1028672 ;WORD COUNT FOR THE CORE DUMP TO DECTAPE
1700 ; 000001 TCDEND = 1 ;WHICH END OF THE DECTAPE (0 = FRONT; 1 = BACK)
1701
1702 ; GENERAL (BOOTSTRAP AND DUMP) DECTAPE PARAMETER
1703 ; 000024 TCRTRY = 1020 ;NUMBER OF RETRIES IN CASE OF ERROR
1704
1705 004074 012700 ;173074 012700 TCBOOT: MOV #<TCBEND*TCREV>!TCREAD!TCGO,R0 ;SET UP DATA-TRANSFER COMMAND
1706 004076 000005 ;173076 000005 MOV #-TCBWDC,R2 ;SET WORD COUNT TO 256 (512 BYTES)
1707 004100 012702 ;173100 012702 MOV #<<1-TCBEND>*TCREV>!TCRNUM!TCGO,R3 ;SET UP POSITION COMMAND
1708 004102 177400 ;173102 177400
1709 004104 012703 ;173104 012703
1710 004106 004003 ;173106 004003 SWAB R1 ;BRING UNIT NUMBER INTO THE LEFT BYTE
1711 004110 000301 ;173110 000301 BIS R1,R3 ;PUT UNIT NUMBER INTO POSITIONING COMMAND
1712 004112 050103 ;173112 050103 BIS R1,R0 ;PUT UNIT NUMBER INTO DATA-TRANSFER COMMAND
1713 004114 050100 ;173114 050100 TCSTRT: MOV #TCWC,R1 ;R1 NOW POINTS TO TC11 WORD COUNT REGISTER
1714 004116 012701 ;173116 012701
1715 004120 177344 ;173120 177344
1716 004122 012706 ;173122 012706 TLOOP: MOV #TCRTRY,SP ;INITIALIZE RETRY COUNT IN SP
1717 004124 000024 ;173124 000024
1718 004126 005705 ;173126 005705 TCBGIN: TST R5 ;TEST "INDEFINITE RETRY" BIT
1719 004130 100404 ;173130 100404 BMI TCRSET ;BRANCH IF "INDEFINITE RETRY" IS ENABLED
1720 004132 005306 ;173132 005306 DEC SP ;DECREMENT RETRY COUNT
1721 004134 100002 ;173134 100002 BPL TCRSET ;BRANCH IF RETRY COUNT NOT EXHAUSTED
1722 004136 000000 ;173136 000000 TCHALT: HALT ;RETRY COUNT IS EXHAUSTED FOR DECTAPE OPERATION
1723 004140 000770 ;173140 000770 BR TLOOP ;HE PRESSED "CONTINUE", SO TRY AGAIN
1724 004142 000005 ;173142 000005 TCRSET: RESET ;STOP ANYTHING IN PROGRESS, FOR NEXT TRY
1725 004144 010341 ;173144 010341 MOV R3,-(R1) ;INITIATE DECTAPE POSITIONING OPERATION
1726 004146 005711 ;173146 005711 TCWAIT: TST (R1) ;TEST FOR AN "ERROR"
1727 004150 100376 ;173150 100376 BPL TCWAIT ;LOOP UNTIL AN "ERROR" IS DETECTED
1728 004152 005721 ;173152 005721 TST (R1)+ ;MAKE R1 POINT TO THE WORD COUNT REGISTER
1729 004154 005761 ;173154 005761 TST -4(R1) ;IS THE ERROR "ENDZONE"?
1730 004156 177774 ;173156 177774
1731 004160 100362 ;173160 100362 BPL TCBGIN ;IF NOT, BRANCH BACK TO TRY AGAIN
1732 004162 010211 ;173162 010211 MOV R2,(R1) ;SET UP WORD COUNT FOR DATA-TRANSFER
1733 004164 010041 ;173164 010041 MOV R0,-(R1) ;INITIATE THE DATA-TRANSFER OPERATION
1734 004166 105711 ;173166 105711 TCDONE: TSTB (R1) ;TEST FOR "DONE"
1735 004170 100376 ;173170 100376 BPL TCDONE ;LOOP UNTIL THE "DONE" BIT SETS
1736 004172 005721 ;173172 005721 TST (R1)+ ;WAS AN "ERROR" DETECTED?

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1737	004174	100754	:173174	100754	BMI	TCBGIN	:IF SO, BRANCH BACK AND TRY AGAIN
1738	004176	005741	:173176	005741	TST	-(R1)	:MAKE R1 POINT TO THE COMMAND REGISTER
1739	004200	105011	:173200	105011	CLRB	(R1)	:STOP ALL DECTAPE MOTION
1740	004202	122700	:173202	122700	CMPB	#TCREAD!TCGO,RO	:WAS THIS A "NORMAL READ" OPERATION?
1741	004204	000005	:173204	000005			
1742	004206	001001	:173206	001001	BNE	TCSTOP	:IF NOT, GO STOP
1743	004210	000137	:173210	000137	GOTO0: JMP	2(PC)+	:JUMP TO PDP-11 LOCATION ZERO
1744	004212	000000	:173212	000000	TCSTOP: HALT		:SUCCESSFUL COMPLETION OF A "NON-READ" OPERATION
1745	004214	000776	:173214	000776	BR	TCSTOP	:SO THAT PRESSING "CONTINUE" WON'T GO ANYWHERE

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1746 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 5
1747 ;BM873-YD.P11 DECTAPE BOOTSTRAP AND DUMP ROUTINES
1748
1749 004216 010037 ;173216 010037 TCDUMP: MOV R0,@#ROTOR7 ;SAVE R0 IN PDP-11 MEMORY LOCATION 40
1750 004220 000040 ;173220 000040
1751 004222 000402 ;173222 000402 BR TCCONT ;BRANCH AROUND REQUIRED INTERRUPT VECTOR
1752
1753 004224 173000 ;173224 173000 .WORD ROMORG,PR7
1754 004226 000340 ;173226 000340
1755
1756 004230 010700 ;173230 010700 TCCONT: MOV PC,R0 ;USE R0 FOR A SUBROUTINE RETURN ADDRESS
1757 004232 000410 ;173232 000410 BR REGSAV ;GO TO THE "REGISTER SAVING" SUBROUTINE
1758 004234 012700 ;173234 012700 MOV #<TCDEND*TCREV>!TCWRT!TCGO,R0 ;SET UP (WRITE) TRANSFER COMMAND
1759 004236 004015 ;173236 004015
1760 004240 012702 ;173240 012702 MOV #-TCDWDC,R2 ;SET WORD-COUNT TO 28K WORDS
1761 004242 110000 ;173242 110000
1762 004244 012703 ;173244 012703 MOV #<<1-TCDEND>*TCREV>!TCRNUM!TCGO,R3 ;SET UP POSITION COMMAND
1763 004246 000003 ;173246 000003
1764 004250 005005 ;173250 005005 CLR R5 ;CLEAR "INDEFINITE RETRY" BIT
1765 004252 000721 ;173252 000721 BR TCSTRT ;BRANCH INTO DECTAPE ROUTINE
1766
1767
1768
1769
1770 ; THE FOLLOWING SUBROUTINE IS USED TO SAVE THE PDP-11 GENERAL REGISTERS
1771 ; IN PDP-11 MEMORY LOCATIONS 40-57.
1772
1773 ; THE CALLING SEQUENCE IS AS FOLLOWS:
1774 ;
1775 ;
1776 ;
1777 ;
1778 004254 010137 ;173254 010137 REGSAV: MOV R1,@#ROTOR7+2 ;SAVE R1 IN MEMORY LOCATION 42
1779 004256 000042 ;173256 000042
1780 004260 012701 ;173260 012701 MOV #ROTOR7+4,R1 ;R1 NOW POINTS TO MEMORY LOCATION 44
1781 004262 000044 ;173262 000044
1782 004264 010221 ;173264 010221 MOV R2,(R1)+ ;SAVE R2 IN MEMORY LOCATION 44
1783 004266 010321 ;173266 010321 MOV R3,(R1)+ ;SAVE R3 IN MEMORY LOCATION 46
1784 004270 010421 ;173270 010421 MOV R4,(R1)+ ;SAVE R4 IN MEMORY LOCATION 50
1785 004272 010521 ;173272 010521 MOV R5,(R1)+ ;SAVE R5 IN MEMORY LOCATION 52
1786 004274 010621 ;173274 010621 MOV SP,(R1)+ ;SAVE SP IN MEMORY LOCATION 54
1787 004276 010021 ;173276 010021 MOV R0,(R1)+ ;SAVE PC IN MEMORY LOCATION 56
1788 004300 000160 ;173300 000160 JMP 2(R0) ;RETURN TO THE CALLING ROUTINE
1789 004302 000002 ;173302 000002
1790

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1791	;BM873-YD		- KL10 (PDP-11) 256 WORD BOOTSTRAP ROM		VERSION 2(17)	MACY11 27(657)	18-DEC-74	11:59	PAGE 6
1792	;BM873-YD.P11		RH11/RP04 BOOTSTRAP AND DUMP ROUTINES						
1793									
1794									
1795	:	176700	RPCS1	=	176700	;ADDRESS OF RH11/RP04 CONTROL & STATUS REGISTER 1			
1796	:	000002	RPWC	=	2	;OFFSET TO RH11/RP04 WORD COUNT REGISTER			
1797	:	000006	RPDA	=	6	;OFFSET TO RH11/RP04 TRACK & SECTOR ADDRESS REGISTER			
1798	:	000010	RPCS2	=	10	;OFFSET TO RH11/RP04 CONTROL & STATUS REGISTER 2			
1799	:	000012	RPDS	=	12	;OFFSET TO RH11/RP04 DRIVE STATUS REGISTER			
1800	:	000032	RPOF	=	32	;OFFSET TO RH11/RP04 OFFSET REGISTER (CONTAINING FMT22)			
1801	:	000034	RPDC	=	34	;OFFSET TO RH11/RP04 DESIRED CYLINDER REGISTER			
1802									
1803	:	040000	RPTRE	=	BIT14	;"TRANSFER ERROR" BIT IN RPCS1			
1804	:	020000	RPMCPE	=	BIT13	;"MASSBUS CONTROL BUS PARITY ERROR" BIT IN RPCS1			
1805	:	004000	RPDVA	=	BIT11	;"DRIVE AVAILABLE" BIT IN RPCS1			
1806	:	100000	RPATA	=	BIT15	;"ATTENTION ACTIVE" BIT IN RPDS			
1807	:	040000	RPERR	=	BIT14	;"COMPOSITE ERROR" BIT IN RPDS			
1808	:	010000	RPFMT	=	BIT12	;"FMT22" (16-BIT WORDS) BIT IN RPOF			
1809									
1810	:	000021	RPPRST	=	21	;READ-IN PRESET			
1811	:	000061	RPWRIT	=	61	;WRITE DATA			
1812	:	000071	RPREAD	=	71	;READ DATA			
1813									
1814	:	000000	RPBFMT	=	0	;BOOTSTRAP FORMAT (0 = 18-BIT WORDS; 2 = 16-BIT WORDS)			
1815	:	000400	RPBWDC	=	↑D256	;WORD COUNT FOR THE SECONDARY BOOTSTRAP FROM THE RP04			
1816	:	000626	RPBCYL	=	↑D406	;BOOTSTRAP CYLINDER NUMBER			
1817	:	000000	RPBTRK	=	0	;BOOTSTRAP TRACK NUMBER			
1818	:	000000	RPBSCT	=	0	;BOOTSTRAP SECTOR NUMBER			
1819									
1820	:	000000	RPDFMT	=	0	;DUMP FORMAT (0 = 18-BIT WORDS; 2 = 16-BIT WORDS)			
1821	:	070000	RPDWDC	=	↑D28672	;WORD COUNT FOR THE CORE DUMP TO THE RP04			
1822	:	000631	RPDCYL	=	↑D409	;DUMP CYLINDER NUMBER			
1823	:					; THE FOLLOWING TWO ASSIGNMENTS PUT THE DUMP AT THE VERY END OF THE CYLINDER			
1824	:	000015	RPDTRK	=	↑D18-⟨⟨RPDWDC-1⟩/⟨⟨↑D20+RPDFMT⟩*↑D256⟩⟩	;DUMP TRACK NUMBER			
1825	:	000010	RPDSCT	=	↑D19+RPDFMT-⟨⟨⟨RPDWDC-1⟩/↑D256⟩-⟨⟨↑D18-RPDTRK⟩*⟨↑D20+RPDFMT⟩⟩⟩	;DUMP SECTOR NUMBER			
1826									
1827									
1828									
1829	004304	111704	;173304	111704	BUTON2: MOV	(PC),R4	;R4 = 5 INDICATES THAT BUTTON #2 WAS PRESSED		
1830	004306	005005	;173306	005005	CLR	R5	;CLEAR "LOGICAL SWITCH REGISTER"		
1831	004310	005001	;173310	005001	CLR	R1	;SET UNIT NUMBER TO ZERO		
1832									
1833	004312	012700	;173312	012700	RPBOOT: MOV	#+RPREAD*400	;!R+RPBSCT*10,R0		
1834	004314	034400	;173314	034400					
1835	004316	012702	;173316	012702	MOV	#+RPBWDC,R2			
1836	004320	177400	;173320	177400					
1837	004322	012703	;173322	012703	MOV	#+RPBFMT*40000	;!R+RPBTRK*2000,R3		
1838	004324	000626	;173324	000626					
1839	004326	050100	;173326	050100	BIS	R1,R0	;PUT THE UNIT NUMBER INTO R0		
1840	004330	012701	;173330	012701	RPSTRT: MOV	#+RPCS1,R1	;SET R1 TO THE LOWEST ADDRESS USED BY THE RH11		
1841	004332	176700	;173332	176700					

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1842 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM
1843 ;BM873-YD.P11 RH11/RPO4 BOOTSTRAP AND DUMP ROUTINES
1844
1845 004334 000005 ;173334 000005 RPLoop: RESET ;RESET IN CASE OF RETRY
1846 004336 010006 ;173336 010006 MOV RO,SP ;GET THE UNIT NUMBER INTO SP
1847 004340 042706 ;173340 042706 BIC #1C7,SP ;ISOLATE THE UNIT NUMBER
1848 004342 177770 ;173342 177770
1849 004344 010661 ;173344 010661 MOV SP,RPCS2(R1) ;TELL THE RH11 THE UNIT NUMBER
1850 004346 000010 ;173346 000010
1851 004350 032711 ;173350 032711 BIT #RPDVA,(R1) ;TRY TO SEIZE THIS RPO4 UNIT
1852 004352 004000 ;173352 004000
1853 004354 001767 ;173354 001767 BEQ RPLoop ;BRANCH IF WE HAVEN'T SEIZED IT
1854 004356 012721 ;173356 012721 MOV #RPPRST,(R1)+ ;DO A "READ-IN PRESET" FUNCTION
1855 004360 000021 ;173360 000021
1856 004362 010306 ;173362 010306 MOV R3,SP ;GET THE CYLINDER NUMBER INTO SP
1857 004364 042706 ;173364 042706 BIC #1C1777,SP ;ISOLATE THE CYLINDER NUMBER
1858 004366 176000 ;173366 176000
1859 004370 010661 ;173370 010661 MOV SP,RPDC-2(R1) ;TELL THE RPO4 THE CYLINDER NUMBER
1860 004372 000032 ;173372 000032
1861 004374 010306 ;173374 010306 MOV R3,SP ;GET THE FORMAT BIT AND TRACK NUMBER INTO SP
1862 004376 100003 ;173376 100003 BPL RPCONT ;BRANCH IF 20 SECTOR (18-BIT WORDS) FORMAT
1863 004400 012761 ;173400 012761 MOV #RPFMT,RPOF-2(R1) ;ESTABLISH 22 SECTOR (16-BIT WORDS) FORMAT
1864 004402 010000 ;173402 010000
1865 004404 000030 ;173404 000030
1866 004406 006206 ;173406 006206 RPCONT: ASR SP ;RIGHT ALIGN THE TRACK
1867 004410 006206 ;173410 006206 ASR SP ;NUMBER IN THE LEFT BYTE
1868 004412 105006 ;173412 105006 CLR B SP ;CLEAR THE RIGHT BYTE
1869 004414 150006 ;173414 150006 BIS B RO,SP ;PUT THE SECTOR NUMBER INTO THE RIGHT BYTE
1870 004416 106006 ;173416 106006 ROR B SP ;RIGHT ALIGN THE
1871 004420 106206 ;173420 106206 ASR B SP ;SECTOR NUMBER IN
1872 004422 106206 ;173422 106206 ASR B SP ;THE RIGHT BYTE
1873 004424 010661 ;173424 010661 MOV SP,RPDA-2(R1) ;TELL THE RH11 THE TRACK AND SECTOR NUMBERS
1874 004426 000004 ;173426 000004
1875 004430 010211 ;173430 010211 MOV R2,(R1) ;TELL THE RH11 THE WORD COUNT
1876 004432 010006 ;173432 010006 MOV RO,SP ;GET THE FUNCTION CODE INTO SP
1877 004434 105006 ;173434 105006 CLR B SP ;CLEAR THE RIGHT BYTE
1878 004436 000306 ;173436 000306 SWAB SP ;RIGHT ALIGN THE FUNCTION CODE
1879 004440 010641 ;173440 010641 MOV SP, -(R1) ;TELL THE RPO4 THE FUNCTION CODE
1880 004442 105711 ;173442 105711 RPDONE: TST B (R1) ;TEST FOR RH11 "READY"
1881 004444 100376 ;173444 100376 BPL RPDONE ;LOOP, WAITING FOR RH11 "READY"
1882 004446 032711 ;173446 032711 BIT #RPTRE!RPMCPE,(R1) ;TEST FOR RH11 ERROR BITS
1883 004450 060000 ;173450 060000
1884 004452 001330 ;173452 001330 BNE RPLoop ;IF ERROR, BRANCH BACK FOR RETRY
1885 004454 032761 ;173454 032761 BIT #RPATA!RPERR.RPDS(R1) ;TEST FOR RPO4 ERROR BITS
1886 004456 140000 ;173456 140000
1887 004460 000012 ;173460 000012
1888 004462 001324 ;173462 001324 BNE RPLoop ;IF ERROR, BRANCH BACK FOR RETRY
1889 004464 022706 ;173464 022706 CMP #RPREAD,SP ;WAS THE FUNCTION A "NORMAL READ"?
1890 004466 000071 ;173466 000071
1891 004470 001250 ;173470 001250 BNE TCSTOP ;IF NOT, BRANCH TO A HALT INSTRUCTION
1892 004472 022737 ;173472 022737 CMP #000240, @#0 ;WAS "000240" READ INTO LOCATION ZERO?
1893 004474 000240 ;173474 000240
1894 004476 000000 ;173476 000000
1895 004500 001643 ;173500 001643 BEG GOT00 ;IF SO, BRANCH TO LOCATION ZERO

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1896	004502	000000 ;173502	000000	HALT			;"000240" WAS NOT READ INTO LOCATION ZERO
1897	004504	000641 ;173504	000641	BR	GOTO0		;BRANCH TO LOCATION ZERO
1898							
1899							
1900	004506	010037 ;173506	010037	RPDUMP: MOV	RO,0#ROTOR7		;SAVE RO IN PDP-11 MEMORY LOCATION "ROTOR7"
1901	004510	000040 ;173510	000040				
1902	004512	010700 ;173512	010700	MOV	PC,RO		;USE RO FOR A SUBROUTINE RETURN ADDRESS
1903	004514	000657 ;173514	000657	BR	REGSAV		;GO TO THE "REGISTER SAVING" SUBROUTINE
1904	004516	012700 ;173516	012700	MOV	#<RPWRIT*400>!<RPDSCT*10>,RO		
1905	004520	030500 ;173520	030500				
1906	004522	012702 ;173522	012702	MOV	#-RPDWDC,R2		
1907	004524	110000 ;173524	110000				
1908	004526	012703 ;173526	012703	MOV	#<RPDFMT*40000>!<RPDTRK*2000>!RPDCYL,R3		
1909	004530	032631 ;173530	032631				
1910	004532	000676 ;173532	000676	BR	RPSTRT		
1911							

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1912 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 8
1913 ;BM873-YD.P11 DTE20 DEVICE REGISTER AND BIT DEFINITIONS
1914
1915
1916 ; 174400 DTEBAS=174400 ;BASE OF (FIRST) DTE20 DEVICE REGISTER BLOCK
1917 ; 000040 DTESIZ=000040 ;SPACING BETWEEN CONSECUTIVE DTE20'S
1918 ; 000004 DTEMAX=4 ;MAXIMUM NUMBER OF DTE20'S ON ONE PDP-11
1919
1920
1921 ; OFFSETS FROM THE BASE OF THE DTE20 DEVICE REGISTER BLOCK
1922 ; TO SPECIFIC 10/11 INTERFACE RAM LOCATIONS AND REGISTERS.
1923
1924 ; THE FIRST 12 REGISTERS ARE NOT INITIALIZED BY "INIT" (BECAUSE THEY ARE IN RAMS
1925 ; 000000 DLYCNT=00 ; DELAY COUNT (ADDRESS XXXX00)
1926 ; 000002 DEXWD3=02 ; DEPOSIT OR EXAMINE WORD 3 (ADDRESS XXXX02)
1927 ; 000004 DEXWD2=04 ; DEPOSIT OR EXAMINE WORD 2 (ADDRESS XXXX04)
1928 ; 000006 DEXWD1=06 ; DEPOSIT OR EXAMINE WORD 1 (ADDRESS XXXX06)
1929 ; 000010 TENAD1=10 ; 10 ADDRESS WORD 1 FOR DEX (ADDRESS XXXX10)
1930 ; 000012 TENAD2=12 ; 10 ADDRESS WORD 2 FOR DEX (ADDRESS XXXX12)
1931 ; 000014 T010BC=14 ; T010 BYTE COUNT (ADDRESS XXXX14)
1932 ; 000016 T011BC=16 ; T011 BYTE COUNT (ADDRESS XXXX16)
1933 ; 000020 T010AD=20 ; T010 PDP11 MEMORY ADDRESS (ADDRESS XXXX20)
1934 ; 000022 T011AD=22 ; T011 PDP11 MEMORY ADDRESS (ADDRESS XXXX22)
1935 ; 000024 T010DT=24 ; T010 PDP11 DATA WORD (ADDRESS XXXX24)
1936 ; 000026 T011DT=26 ; T011 PDP11 DATA WORD (ADDRESS XXXX26)
1937
1938 ; THE LAST 4 REGISTERS ARE INITIALIZED BY "INIT" (BECAUSE THEY ARE IN FLIP-FLOPS
1939 ; 000030 DIAG1=30 ; DIAGNOSTIC WORD 1 (ADDRESS XXXX30)
1940 ; 000032 DIAG2=32 ; DIAGNOSTIC WORD 2 (ADDRESS XXXX32)
1941 ; 000034 STATUS=34 ; 10/11 INTERFACE STATUS WORD (ADDRESS XXXX34)
1942 ; 000036 DIAG3=36 ; DIAGNOSTIC WORD 3 (ADDRESS XXXX36)
1943
1944
1945 ; THE FOLLOWING ARE THE ADDRESSES OF THE DTE20 INTERRUPT VECTORS
1946
1947 ; 000774 DTEIV1=774 ; INTERRUPT VECTOR FOR DTE20 #1
1948 ; 000770 DTEIV2=770 ; INTERRUPT VECTOR FOR DTE20 #2
1949 ; 000764 DTEIV3=764 ; INTERRUPT VECTOR FOR DTE20 #3
1950 ; 000760 DTEIV4=760 ; INTERRUPT VECTOR FOR DTE20 #4
1951
1952
1953 ; BIT ASSIGNMENTS FOR VARIOUS DTE20 REGISTERS USED BY THIS ROM CODE
1954
1955
1956 ; BIT ASSIGNMENTS FOR T010BC
1957
1958 ; 100000 INT11=BIT15 ; SET DONE AND INTERRUPT BOTH 10 AND 11
1959
1960 ; BIT ASSIGNMENTS FOR T011BC
1961
1962 ; 100000 INT10=BIT15 ; SET DONE AND INTERRUPT BOTH 10 AND 11
1963 ; 040000 ZS*JP=BIT14 ; STOP ON NULL (ZERO) CHARACTER
1964 ; 020000 T011BM=BIT13 ; BYTE SIZE FOR T0-11 BYTE TRANSFERS
1965

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1966 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 9
1967 ;BM873-YD.P11 DTE20 DEVICE REGISTER AND BIT DEFINITIONS
1968
1969 ;BIT ASSIGNMENTS FOR DIAG2 (WRITE)
1970 ; 000100 DRESET=BIT6 ;PERFORM DIAGNOSTIC CLEAR
1971
1972 ;BIT ASSIGNMENTS FOR DIAG3 (READ)
1973 ; 000020 DUPE=BIT4 ;DATO UNIBUS PARITY ERROR
1974 ; 000004 DURE=BIT2 ;DATO UNIBUS RECEIVE ERROR
1975 ; 000002 NUPE=BIT1 ;NPR UNIBUS PARITY ERROR
1976
1977 ;BIT ASSIGNMENTS FOR DIAG3 (WRITE)
1978
1979 ; 000020 CDD=BIT4 ;CLEAR DUPE AND DURE ERROR FLAGS
1980 ; 000002 CNUPE=BIT1 ;CLEAR NUPE ERROR FLAG
1981 ; 000001 T010BM=BIT0 ;BYTE SIZE FOR T0-10 BYTE TRANSFER
1982
1983 ;BIT ASSIGNMENTS FOR STATUS (WRITE)
1984
1985 ; 100000 DON10S=BIT15 ;SET T010 DONE
1986 ; 040000 DON10C=BIT14 ;CLEAR T010 DONE
1987 ; 020000 ERR10S=BIT13 ;SET T010 ERROR
1988 ; 010000 ERR10C=BIT12 ;CLEAR T010 ERROR
1989 ; 004000 INT11S=BIT11 ;RING THE PDP-11'S DOORBELL (INTERRUPTS THE -11)
1990 ; 002000 INT11C=BIT10 ;STOP RINGING THE PDP-11'S DOORBELL
1991 ; 001000 PERCLR=BIT9 ;CLEAR -11 MEMORY PARITY ERROR
1992 ; 000400 INT10S=BIT8 ;RING THE PDP-10'S DOORBELL (INTERRUPTS THE -10)
1993 ; 000200 DON11S=BIT7 ;SET T011 DONE
1994 ; 000100 DON11C=BIT6 ;CLEAR T011 DONE
1995 ; 000040 INTRON=BIT5 ;ENABLE DTE20 INTERRUPTS TO THE -11
1996 ; 000020 EBUSPC=BIT4 ;CLEAR "EBUS PARITY ERROR"
1997 ; 000010 INTR0F=BIT3 ;DISABLE THE PDP-11 INTERUPTS
1998 ; 000004 EBUSPS=BIT2 ;SET "EBUS PARITY ERROR"
1999 ; 000002 ERR11S=BIT1 ;SET T011 ERROR
2000 ; 000001 ERR11C=BIT0 ;CLEAR T011 ERROR
2001
2002 ;BIT ASSIGNMENTS FOR STATUS (READ)
2003
2004 ; 100000 T010DN=BIT15 ;T010 DONE
2005 ; 020000 T010ER=BIT13 ;TO 10 ERROR (NPR TIMEOUT OR BUS ERROR)
2006 ; 010000 RAMISO=BIT12 ;RAM WORD READ IS ALL ZEROS
2007 ; 004000 T011DB=BIT11 ;1 = THE PDP-11'S DOORBELL IS RINGING
2008 ; 002000 DXWRD1=BIT10 ;DEPOSIT OR EXAMINE WORD ONE
2009 ; 001000 MPE11=BIT9 ;PARITY ERROR WITHIN PDP-11 MEMORY
2010 ; 000400 T010DB=BIT8 ;1 = THE PDP-10'S DOORBELL IS RINGING
2011 ; 000200 T011DN=BIT7 ;T011 DONE
2012 ; 000100 EBSEL=BIT6 ;E BUFFER SELECT
2013 ; 000040 NULSTP=BIT5 ;NULL STOP
2014 ; 000020 BPARER=BIT4 ;EBUS PARITY ERROR
2015 ; 000010 RSTRCT=BIT3 ;THIS PDP-11 IS "RESTRICTED"
2016 ; 000004 DEXDON=BIT2 ;DEPOSIT OR EXAMINE DONE
2017 ; 000002 T011ER=BIT1 ;TO 11 ERROR (NPR TIMEOUT OR BUS ERROR)
2018 ; 000001 INTSON=BIT0 ;DTE20 INTERRUPTS (TO THE -11) ARE ENABLED

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2019 :BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 1
2020 ;BM873-YD.P11 PROCEDURE BY WHICH THE PDP-10 BOOTSTRAPS AND/OR DUMPS THE PDP-11

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THE FOLLOWING IS THE PROCEDURE WHICH THE KL10 EXECUTES IN ORDER TO DUMP AND/OR BOOTSTRAP THE PDP-11 THROUGH THE DTE20:

1. CLEAR THE DTE20 AND INITIATE A BM873 BUTTON #4 BOOTSTRAP OPERATION
- CONO [SR11B!CL11PT!CLT011!CLT010!PILDEN]
2. WAIT TO SEE PDP-11 POWER FAIL (AC LOW = TRUE) - CONI [DEAD11] = 1
3. WAIT TO SEE PDP-11 POWER RECOVER (AC LOW = FALSE) - CONI [DEAD11] = 0
4. WAIT AT LEAST ANOTHER 150 MILLISECONDS AND THEN CLEAR THE RELOAD -11 BUTTON
- CONO [CR11B]
5. SET BYTE COUNTER TO A SPECIAL CODE (1365 OCTAL) - DATA0 [1365]
6. RING PDP-11'S DOORBELL - CONO[TO11DB]
7. WAIT UNTIL "-10 RINGING -11'S DOORBELL" IS TURNED OFF BY THE -11
(I.E. UNTIL CONI[TO11DB] BECOMES ZERO).
8. ENABLE THE DTE20 TO USE PI 0 INTERRUPTS
(I.E. SET CONO[PILDEN!PIOENB]).
9. SET UP THE TO-10 BYTE POINTER (IN THE EPT) FOR THE FIRST 3.5K.
10. SET UP THE BYTE COUNTER FOR THE FIRST 3.5K, INDICATING
"INTERRUPT -10 ONLY" - DATA0 [1000]
11. WAIT FOR "TO-10 DONE" OR "TO-10 ERROR" - CONI [TO10DN!TO10ER]
12. NOTE WHETHER THERE WAS AN ERROR (CONI [TO10ER]) AND THEN TURN OFF
TO10DN AND TO10ER - CONO [CLT010]. IF ERROR, GO TO STEP 17.
13. IF END OF 28K, GO TO STEP 17.
14. SET UP TO-10 BYTE POINTER (IN THE EPT) FOR THE NEXT 3.5K.
15. SET UP THE BYTE COUNTER FOR THE NEXT 3.5K INDICATING
"INTERRUPT -10 ONLY" (DATA0 [1000]), UNLESS THIS IS THE
LAST 3.5K (OF 28K), IN WHICH CASE INDICATE "INTERRUPT
BOTH PROCESSORS" (DATA0 [TO10IB!1000]).
16. GO TO STEP 11.

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;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17)
;BM873-YD.P11 PROCEDURE BY WHICH THE PDP-10 BOOTSTRAPS AND/OR DUMPS THE PDP-11

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17. SET UP TO-11 BYTE POINTER (IN THE EPT) FOR "PDP-11 BOOTSTRAP".
NOTE THAT THE FIRST WORD OF THIS "PDP-11 BOOTSTRAP" MUST
BE THE BIT PATTERN 000240 (A PDP-11 NOP INSTRUCTION).
18. RING THE PDP-11'S DOORBELL - CONO [TO11DB]
19. WAIT FOR EITHER TO11DB TO GO OFF (CONI[TO11DB] = 0),
OR TO10DB TO COME ON (CONI[TO10DB] = 1).
20. IF NO ERROR WAS NOTED IN STEP 12, TO11DB SHOULD GO OFF
(TO10DB COMING ON INDICATES A MASSIVE SCREWUP).
IF AN ERROR WAS NOTED IN STEP 12, TO11DB GOING OFF INDICATES
THAT THE ERROR WAS "NON-FATAL" (NON-EX-MEM OR -11 MEMORY
PARITY) AND THE -11 IS PROCEEDING. TO10DB COMING ON INDICATES
THAT THE ERROR WAS "FATAL" AND THE -11 IS HALTED AT LOCATION 173714.
IN THIS LATTER CASE THE -10 MUST RESTART FROM STEP 1.
21. IF TO11DB WENT OFF, WAIT FOR "TO-11 DONE" OR "TO-11 ERROR"
- CONI [TO11DN!TO11ER]
22. NOTE WHETHER THERE WAS AN ERROR - CONI [TO11ER]
23. TURN OFF TO11DN AND TO11ER AND RING THE PDP-11'S DOORBELL
- CONO [TO11DB!CLTO11]
24. WAIT FOR EITHER TO11DB TO GO OFF (CONI[TO11DB] = 0),
OR TO10DB TO COME ON (CONI[TO10DB] = 1).
25. TO11DB GOING OFF INDICATES THAT THE PDP-11 FOUND NO ERRORS
AND IS TRANSFERRING CONTROL TO THE CODE WHICH WAS JUST
RECEIVED FROM THE -10. IN THIS CASE THE -10 SHOULD START
FOLLOWING THE PROTOCOL OF THIS CODE.
26. TO10DB COMING ON INDICATES THAT THE PDP-11 HAS FOUND AN
ERROR (OR THAT THE FIRST WORD TRANSMITTED WASN'T THE
BIT PATTERN 000240), AND THE PDP-11 IS HALTED AT LOCATION 173766.
IN THIS CASE THE -10 MUST RESTART FROM STEP 1.

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2120      ;BM873-YD      - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17)
2121      ;BM873-YD.P11  BUTTON #4 - BOOTSTRAP INITIATED BY THE PDP-10 (THROUGH DTE20)
2122
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2124      :           000130  DTECOR  =      130      ;CORE ADDRESS INTO WHICH TO STORE DTE20 REGS.
2125      :           000014  DTEREG  =      ↑D12      ;NUMBER OF DTE20 REGISTERS TO STORE
2126      :           000400  DTEWDC  =      ↑D256     ;WORD COUNT FOR SECONDARY BOOTSTRAP FROM THE -10
2127      ; ENTER HERE WHEN THE DTE20 PRESSES BUTTON #4 (BOOTSTRAP INITIATED
2128      ; BY THE PDP-10, THROUGH THE DTE20)
2129 004534 010037 ;173534 010037 BUTON4: MOV      RO,↑#ROTOR7 ;SAVE RO IN PDP-11 MEMORY LOCATION "ROTOR7"
2130 004536 000040 ;173536 000040
2131 004540 010700 ;173540 010700      MOV      PC,RO      ;USE RO FOR A SUBROUTINE RETURN ADDRESS
2132 004542 000644 ;173542 000644      BR       REGSAV     ;GO TO THE "REGISTER SAVING" SUBROUTINE
2133 004544 005005 ;173544 005005      CLR      R5         ;SET R5 = 0
2134 004546 012501 ;173546 012501      MOV      (R5)+,R1   ;SAVE LOCATION 0 IN R1
2135 004550 012503 ;173550 012503      MOV      (R5)+,R3   ;SAVE LOCATION 2 IN R3
2136 004552 012504 ;173552 012504      MOV      (R5)+,R4   ;SAVE LOCATION 4 IN R4
2137 004554 011500 ;173554 011500      MOV      (R5),RO    ;SAVE LOCATION 6 IN RO
2138 004556 012715 ;173556 012715      MOV      #PR7,(R5)  ;SET UP PRIORITY FOR NON-EX-MEM TRAP
2139 004560 000340 ;173560 000340
2140 004562 005745 ;173562 005745      TST     -(R5)       ;SET R5 = 4
2141 004564 012702 ;173564 012702 10$: MOV      #DTEBAS-DTESIZ,R2
2142 004566 174340 ;173566 174340
2143 004570 010715 ;173570 010715      MOV      PC,(R5)    ;STORE ADDRESS FOR NON-EX-MEM TRAP
2144 004572 010506 ;173572 010506      MOV      R5,SP      ;SET STACK POINTER = 4
2145 004574 062702 ;173574 062702 11$: ADD      #DTESIZ,R2 ;R2 POINTS TO THE NEXT DTE20
2146 004576 000040 ;173576 000040
2147 004600 105702 ;173600 105702      TSTB    R2
2148 004602 100770 ;173602 100770      BMI     10$         ;START LOOKING FROM THE BEGINNING AGAIN
2149 004604 032762 ;173604 032762      BIT     #TO11DB,STATUS(R2) ;IS THIS -10 RINGING THE -11'S DOORBELL?
2150 004606 004000 ;173606 004000
2151 004610 000034 ;173610 000034
2152 004612 001770 ;173612 001770      BEQ     11$         ;IF IT IS NOT, GO LOOK FOR ANOTHER -10
2153 004614 026217 ;173614 026217      CMP     TO10BC(R2),(PC) ;CHECK FOR A CODE (1365) FROM THE PDP-10
2154 004616 000014 ;173616 000014
2155      ;INDICATING THAT IT WANTS TO BOOTSTRAP THE -11
2156 004620 001365 ;173620 001365      BNE     11$
2157      ; NOTE THAT AT THIS POINT R2 CONTAINS THE ADDRESS OF THE DEVICE REGISTER
2158      ; BLOCK FOR THIS DTE20, THAT R5 = 4, AND THAT SP = 4
2159 004622 005725 ;173622 005725      TST     (R5)+       ;SET R5 = 6
2160 004624 010015 ;173624 010015      MOV      RO,(R5)    ;RESTORE THE CONTENTS OF LOCATION 6
2161 004626 010445 ;173626 010445      MOV      R4,-(R5)   ;RESTORE THE CONTENTS OF LOCATION 4
2162 004630 010345 ;173630 010345      MOV      R3,-(R5)   ;RESTORE THE CONTENTS OF LOCATION 2
2163 004632 010145 ;173632 010145      MOV      R1,-(R5)   ;RESTORE THE CONTENTS OF LOCATION 0
2164      ; NOTE: AT THIS TIME R5 = 0. THIS FACT WILL BE USED LATER.
2165 004634 012700 ;173634 012700      MOV      #DTECOR,RO ;RO = CORE ADDRESS FOR STORING DTE20 REGISTERS
2166 004636 000130 ;173636 000130
2167 004640 010204 ;173640 010204      MOV      R2,R4
2168 004642 012420 ;173642 012420 7$: MOV      (R4)+,(RO)+ ;SAVE THE NEXT DTE20 REGISTER IN CORE
2169 004644 022700 ;173644 022700      CMP     #<DTEREG*2>+DTECOR,RO ;HAVE WE FINISHED YET?
2170 004646 000160 ;173646 000160
2171 004650 101374 ;173650 101374      BHI     7$         ;LOOP UNTIL WE HAVE FINISHED

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2172 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 1
2173 ;BM873-YD.P11 BUTTON #4 - BOOTSTRAP INITIATED BY THE PDP-10 (THROUGH DTE20)
2174 ;
2175 004652 010201 ;173652 010201 MOV R2,R1 ;R1 = DTE20 DEVICE REGISTER BLOCK
2176 004654 062701 ;173654 062701 ADD #DIAG2,R1
2177 004656 000032 ;173656 000032
2178 004660 012721 ;173660 012721 MOV #DRESET,(R1)+ ;DO A "DIAGNOSTIC CLEAR" OF THE DTE20,
2179 004662 000100 ;173662 000100
2180 ; THE ABOVE OPERATION IS NECESSARY TO CLEAR THE "BYTE COUNT LOADED" FLAG
2181 ; AND SIMULTANEOUSLY TO TURN OFF "-10 RINGING -11'S DOORBELL".
2182 004664 005012 ;173664 005012 CLR (R2) ;SET DTE20 FOR NO DELAY
2183 004666 005062 ;173666 005062 CLR T010AD(R2) ;START WRITING -11 MEMORY INTO THE -10.
2184 004670 000020 ;173670 000020
2185 004672 032711 ;173672 032711 6$: BIT #T011DB,(R1) ;HAS THE -10 RUNG THE -11'S DOORBELL?
2186 004674 004000 ;173674 004000
2187 004676 001775 ;173676 001775 BEQ 6$ ;LOOP UNTIL IT HAS.
2188 004700 032762 ;173700 032762 BIT #DUPE!DURE!NUPE,DIAG3(R2) ;"FATAL" ERROR?
2189 004702 000026 ;173702 000026
2190 004704 000036 ;173704 000036
2191 004706 001403 ;173706 001403 BEQ 8$ ;BRANCH IF NO "FATAL" ERROR
2192 004710 012711 ;173710 012711 MOV #TC10DB,(R1) ;SIGNAL "FATAL" ERROR TO THE PDP-10
2193 004712 000400 ;173712 000400
2194 004714 000000 ;173714 000000 2$: HALT ;HALT DUE TO "FATAL" ERROR
2195 004716 012762 ;173716 012762 8$: MOV #DRESET,DIAG2(R2) ;RESET AFTER POSSIBLE PDP-11
2196 004720 000100 ;173720 000100
2197 004722 000032 ;173722 000032
2198 ; MEMORY PARITY ERROR OR NON-EX-MEM ERROR, AND ALSO TURN OFF
2199 ; "-10 RINGING -11'S DOORBELL".
2200 004724 005062 ;173724 005062 3$: CLR T011AD(R2) ;START INPUTTING AT LOCATION 0
2201 004726 000022 ;173726 000022
2202 004730 012762 ;173730 012762 MOV #INT10!<<-DTEWDC>&7777>,T011BC(R2) ;READ IN 256 WORDS
2203 004732 107400 ;173732 107400
2204 004734 000016 ;173734 000016
2205 004736 032711 ;173736 032711 1$: BIT #T011DB,(R1) ;HAS THE -10 RUNG THE -11'S DOORBELL?
2206 004740 004000 ;173740 004000
2207 004742 001775 ;173742 001775 BEQ 1$ ;LOOP UNTIL IT HAS.
2208 004744 132711 ;173744 132711 4$: BITB #T011DN:T011ER,(R1) ;IS THE TRANSMISSION FINISHED?
2209 004746 000202 ;173746 000202
2210 004750 001775 ;173750 001775 BEQ 4$ ;LOOP UNTIL IT IS FINISHED
2211 004752 100003 ;173752 100003 BPL 5$ ;IF "T011DN" ISN'T ON, "T011ER" MUST BE ON
2212 004754 022715 ;173754 022715 CMP #000240,(R5) ;CHECK FOR BIT PATTERN IN LOCATION ZERO
2213 004756 000240 ;173756 000240
2214 004760 001403 ;173760 001403 BEQ 9$ ;UNLESS THERE IS A "NOP" IT IS AN ERROR
2215 004762 012711 ;173762 012711 5$: MOV #T010DB,(R1) ;SIGNAL THE -10 THAT THERE WAS AN ERROR
2216 004764 000400 ;173764 000400
2217 004766 000000 ;173766 000000 12$: HALT ;THIS ERROR HALT IS BECAUSE EITHER "T011ER"
2218 ; IS ON, OR BECAUSE THE BIT PATTERN READ INTO LOCATION ZERO WASN'T "000240".
2219 004770 012762 ;173770 012762 9$: MOV #DRESET,DIAG2(R2) ;SIGNAL THE -10 THAT EVERYTHING IS OK
2220 004772 000100 ;173772 000100
2221 004774 000032 ;173774 000032
2222 004776 END.YD:
2223 004776 000115 ;173776 000115 JMP (R5) ;JUMP TO LOCATION ZERO
2224 ; 000001 .END

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2225 005000 MAP.YF:

;THE FOLLOWING IS A REPRODUCTION
;OF THE ROM PROGRAM FOR BM873YF.
;IT IS HERE FOR COMPARISON TO THE
;ACTUAL ROM AND FOR REFERENCE

;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 1

TITLE PAGE

BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)

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THIS IS THE CODE TO BE ENCODED IN THE BOOTSTRAP ROM ON THE BM873-YF BOARD

MODULE: BM873F
DATE: 17-JUN-75
AUTHOR: TOM PORCHER

ENABLE ABS,AMA

177776	PS=177776	;PROCESSOR STATUS REGISTER
177570	SWR=177570	;FRONT PANEL SWITCH REGISTER
000000	PRO=0*40	;PRIORITY LEVEL 0
000040	PR1=1*40	;PRIORITY LEVEL 1
000100	PR2=2*40	;PRIORITY LEVEL 2
000140	PR3=3*40	;PRIORITY LEVEL 3
000200	PR4=4*40	;PRIORITY LEVEL 4
000240	PR5=5*40	;PRIORITY LEVEL 5
000300	PR6=6*40	;PRIORITY LEVEL 6
000340	PR7=7*40	;PRIORITY LEVEL 7
000001	BIT0=000001	
000002	BIT1=000002	
000004	BIT2=000004	
000010	BIT3=000010	
000020	BIT4=000020	
000040	BIT5=000040	
000100	BIT6=000100	
000200	BIT7=000200	
000400	BIT8=000400	
001000	BIT9=001000	
002000	BIT10=002000	
004000	BIT11=004000	
010000	BIT12=010000	
020000	BIT13=020000	
040000	BIT14=040000	
100000	BIT15=100000	
177400	HIBYTE=177400	

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2276 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 1
2277 ;
2278 ; DIRECTIVE FUNCTION CODES
2279 ;
2280 ; 000001 DR.DTE=1. ;DTE EXAMINE/DEPOSIT/INITALIZE/DOORBELL FUNCTIONS
2281 ;
2282 ; DTE FUNCTION CODES (LOW ORDER BY BYTE)
2283 ;
2284 ; 000001 DF.DOR=1 ;DOOR BELL FUNCTION CODE
2285 ; 000002 DF.OFF=2 ;DTE OFF FUNCTION
2286 ; 000003 DF.ON=3 ;DTE ON FUNCTION
2287 ; 000004 DF.DMG=4 ;DEPOSIT MY GENERAL FUNCTION
2288 ; 000005 DF.EMG=5 ;EXAMINE MY GENERAL FUNCTION
2289 ; 000006 DF.EMN=6 ;EXAMINE MY FOR N FUNCTION
2290 ; 000007 DF.DMN=7 ;DEPOSIT MY FOR N FUNCTION
2291 ; 000010 DF.EHG=10 ;EXAMINE HIS GEN SECTION FUNCTION
2292 ; 000011 DF.EHM=11 ;EXAMINE HIS SECTION FOR ME FUNCTION
2293 ; 000012 DF.KLR=12 ;DIAGNOSTIC KL READ
2294 ; 000013 DF.KLW=13 ;DIAGNOSTIC KL WRITE (FUNCTION 13)
2295 ; 000014 DF.KLX=14 ;DIAGNOSTIC KL EXECUTE (FUNCTION 14)
2296 ; 000015 DF.PEX=15 ;PRIVILEGED EXAMINE (FUNCTION 15)
2297 ; 000016 DF.PDP=16 ;PRIVILEGED DEPOSIT (FUNCTION 16)
2298 ;
2299 ; CRASH CODES
2300 ;
2301 ; 000001 CC.ILD=1 ;ILLEGAL DIRECTIVE
2302 ; 000002 CC.EMT=2 ;ILLEGAL EMT
2303 ; 000003 CC.IDI=3 ;ILLEGAL DTE INTERRUPT
2304 ; 000004 CC.IOT=4 ;IOT TRAP
2305 ; 000005 CC.RES=5 ;RESERVED INSTRUCTION TRAP
2306 ; 000006 CC.TBT=6 ;T BIT OR BPT TRAP
2307 ; 000007 CC.TRP=7 ;TRAP INSTRUCTION TRAP
2308 ; 000010 CC.T04=10 ;TRAP TO 4
2309 ; 000011 CC.UNT=11 ;ILLEGAL TRAP (UNKNOWN TRAP)
2310 ; 000012 CC.MPE=12 ;MEMORY PARITY ERROR
2311 ; 000013 CC.NPF=13 ;RESTRICTED FRONT CAN'T EXECUTE BOOT PROTOCOL
2312 ; 000014 CC.PTB=14 ;PROTOCOL (PRIMARY) BROKEN
2313 ; 000015 CC.CST=15 ;CLOCK STOPPED
2314 ; 000016 CC.ILC=16 ;ILLEGAL COMMAND
2315 ; 000017 CC.IPO=17 ;INPUT TTY OVERFLOW
2316 ; 000020 CC.IAS=20 ;INCORRECT VALUE IN .SERFG
2317 ; 000021 CC.NCE=21 ;NOT ENOUGH ENTRIES IN CLOCK QUEUE
2318 ; 000022 CC.PIT=22 ;CAN'T EXIT PERMANENT TASK
2319 ; 000023 CC.UMP=23 ;LOAD REQUEST NOT IMPL YET
2320 ; 000024 CC.EPE=24 ;E BUS PARITY ERROR
2321 ; 000025 CC.NDE=25 ;NOT ENOUGH ENTRYS FOR DTE20
2322 ; 000026 CC.DEX=26 ;DEXDONE TIMEOUT
2323 ; 000027 CC.TET=27 ;TO TEN ERROR
2324 ; 000030 CC.ETE=30 ;TO ELEVEN ERROR
2325 ; 000031 CC.MTF=31 ;MARK TIME FAILURE
2326 ; 000032 CC.NON=32 ;NOT ENOUGH NODES
2327 ; 000033 CC.TSP=33 ;TEN STOPPED
2328 ; 000034 CC.UIE=34 ;UNIMPLEMENTED FUNCTION
2329 ; 000035 CC.ILQ=35 ;ILLEGAL QUEUE

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2330 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 1
2331 ;
2332 ;
2333 ; GENERAL PROCESSOR DEFINITIONS
2334 ;
2335 ; 000340 PRI7=340 ;PROCESSOR PRIORITY 7
2336 ;
2337 ;
2338 ; DTE20 REGISTER DEFINITIONS
2339 ;
2340 ; THESE LABELS ARE THOSE USED IN THE FRONT END INTERFACE SPEC
2341 ; EXCEPT STATUS WHICH CONFLICTS WITH PROTOCOL SPEC
2342 ;
2343 ; PDM# 200-200-012-00
2344 ;
2345 ;
2346 ; 174400 DLYCNT=174400 ;DELAY COUNT WORD
2347 ; 174402 DEXWD3=174402 ;DEPOSIT OR EXAMINE WORD 3
2348 ; 174404 DEXWD2=174404 ;DEPOSIT OR EXAMINE WORD 2
2349 ; 174406 DEXWD1=174406 ;DEPOSIT OR EXAMINE WORD 1
2350 ; 174410 TENAD1=174410 ;TEN ADDRESS WORD 1
2351 ; 174412 TENAD2=174412 ;TEN ADDRESS WORD 2
2352 ; 174414 T010BC=174414 ;TO-10 PDP-11 MEMORY ADDRESS
2353 ; 174416 T011BC=174416 ;TO-11 BYTE COUNT
2354 ; 174420 T010AD=174420 ;TO-10 PDP-11 MEMORY ADDRESS
2355 ; 174422 T011AD=174422 ;TO-11 PDP-11 MEMORY ADDRESS
2356 ; 174424 T010DT=174424 ;TO-10 PDP-11 DATA WORD
2357 ; 174426 T011DT=174426 ;TO-11 PDP-11 DATA WORD
2358 ; 174430 DIAG1=174430 ;DIAGNOSTIC WORD 1
2359 ; 174432 DIAG2=174432 ;DIAGNOSTIC WORD 2
2360 ; 174434 STAT=174434 ;STATUS WORD
2361 ; 174436 DIAG3=174436 ;DIAGNOSTIC WORD 3
2362 ;
2363 ;
2364 ; EXTERNAL PAGE DEFINITIONS (DEVICE DEFINITIONS)
2365 ;
2366 ;
2367 ; DTE DEFINITIONS
2368 ;
2369 ;
2370 ; REGISTER BIT DEFINITIONS
2371 ;
2372 ;
2373 ; TENAD1 DEFINITIONS
2374 ;
2375 ; 010000 DEP=010000 ;DEPOSIT (BIT 12)
2376 ; 004000 PRTOFF=004000 ;EXAMINE/DEPOSIT PROTECT OFF
2377 ; 100000 PHYS=100000 ;PHYSICAL EXAMINE
2378 ;
2379 ; T011BC DEFINITIONS
2380 ;
2381 ; 100000 IFLOP=100000 ;I FLIPFLOP BIT
2382 ; 040000 ZSTOP=040000 ;ZSTOP
2383 ; 020000 T011BM=020000 ;TO 11 BYTE MODE

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;BMB73F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 1

DIAG1 DEFINITIONS

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004000 DS04=004000 ;KL CLOCK ERROR STOP
002000 DS05=002000 ;RUN
001000 DS06=001000 ;HALT
000400 DEX=000400 ;DEPOSIT OR EXAMINE MAJOR STATE
000200 T010=C00200 ;TO 10
000200 DFUNC=000200
000100 T011=000100 ;TO-11 TRANSFER MAJOR STATE
000040 D1011=000040 ;DIAGNOSE 10/11 INTERFACE
000020 PULSE=000020 ;SINGLE CLOCK CYCLE
000010 DIKL10=000010 ;DIAGNOSTIC MODE SWITCH
000004 DSEND=000004 ;SEND DATA
000001 DCOMST=000001 ;DIAGNOSTIC COMMAND START
  
```

DIAG1 FUNCTIONS

```

000000 .STPCL=0 ;STOP THE KL CLOCK
001000 .STRCL=01*1000 ;START THE KL CLOCK
002000 .SSCLK=02*1000 ;SINGLE STEP THE M BOX CLOCK
003000 .SECLK=03*1000 ;SINGLE STEP THE EBOX CLOCK. LEAVES THE
;EBOX CLOCK FALSE AND EBOX SYNC TRUE.
;CAUSES (2,3) MBOX CLOCKS DEPENDING ON
;EBOX CLOCK INITIALLY (FALSE,TRUE).
;DOES NOT DEPEND ON 'T' FIELD OR MB WAIT.
004000 .CECLK=04*1000 ;CONDITIONALLY ISSUE AN EBOX CLOCK IF THE EBOX
;CLOCK IS TRUE. MAKES EBOX CLOCK FALSE.
;IF ISSUED IN THE MASTER RESET STATE.
;LEAVES EBOX SYNC TRUE.
005000 .BRCLK=05*1000 ;ISSUE A BURST OF THE CLOCKS. THE NUMBER
;OF MBOX CLOCKS DESIRED (1-255) HAS BEEN
;BEEN LOADED PREVIOUSLY BY FUNCTIONS LDBRR,LDBRL
;(42,43)
006000 .CLRMR=06*1000 ;CLEAR MASTER RESET STATE
007000 .SETMR=07*1000 ;SET MASTER RESET STATE. RUNNING THE CLOCK WHILE IN THIS
;STATE 'CLEARS' THE KL10.
010000 .CLRUN=10*1000 ;CLEAR THE RUN FLOP. MAKE THE MICRO CODE GO TO
;THE HALT-LOOP.
011000 .SETRN=11*1000 ;SET THE RUN FLOP. ALLOW REPEATED INSTRUCTION EXECUTION
012000 .CONBT=12*1000 ;SET THE CONTINUE FLOP (MOMENTARY). ALLOW THE
;MICRO CODE TO LEAVE THE HALT LOOP
014000 .IRLTC=14*1000 ;UNLATCH THE IR AND LOAD IT FROM THE AD.
015000 .DRLTC=15*1000 ;UNLATCH THE DRAM REGISTER AND ALLOW IT TO LOAD FROM THE
;RAMS
  
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```

2469 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)
2470 CONTROL RAM LOAD FUNCTIONS
2471 057000 .LCRM1=57*1000 ;EBUS CRAM
2472 :08-11 00-03
2473 :14-17 04-07
2474 :20-23 08-11
2475 :26-29 12-15
2476 :32-35 16-19
2477 056000 .LCRM2=56*1000 ;08-11 20-23
2478 :14-17 24-27
2479 :20-23 28-31
2480 :26-29 32-35
2481 :32-35 36-39
2482 055000 .LCRM3=55*1000 ;08-11 40-43
2483 :14-17 44-47
2484 :20-23 48-51
2485 :26-29 52-55
2486 :32-35 56-59
2487 054000 .LCRM4=54*1000 ;08 60
2488 :10 62
2489 :14 64
2490 :16 66
2491 :20 68
2492 :22 70
2493 :26 72
2494 :28 74
2495 :32 76
2496 :34 78
2497 053000 .LCRM5=53*1000 ;01-05 DISP 00-04
2498 052000 .LCRDL=52*1000 ;01-05 CRAM DIAG ADDRES 00-04
2499 051000 .LCRDR=51*1000 ;00-05 CRAM DIAG ADR 05-10
2500
2501 DRAM LOAD FUNCTIONS
2502
2503 060000 .LDRM1=60*1000 ;12-14 DRAM ADD-02, EVEN ADDRESSES
2504 :15-17 DRAM 800-02, EVEN ADDRESSES
2505 061000 .LDRM2=61*1000 ;12-14 DRAM ADD-02, ODD ADDRESSES
2506 :15-17 DRAM 800-02, ODD ADDRESSES
2507 062000 .LDRM3=62*1000 ;14-17 COMMON J01-04
2508 063000 .LDRJV=63*1000 ;15-17 J08-10, EVEN ADDRESSES
2509 :12 PARIT BIT, EVEN ADDRESSES
2510 064000 .LDRJD=64*1000 ;14 COMMON J07 (NOTE -- J05,6 DO NOT EXIST)
2511 :15-17 J08-10, ODD ADDRESSES
2512 :12 PARITY BIT, ODD ADDRESSES
2513
2514 IR, DRAM CONTROL FUNCTIONS
2515
2516 065000 .DSIOJ=65*1000 ;DISABLES SPECIAL DECODE OF OPCODES 254.7XX
2517 066000 .DSACF=66*1000 ;DISABLE IR AC OUTPUTS
2518 067000 .EIOJA=67*1000 ;ENABEL KL STYLE DECODING OF CODES AND AC'S
2519
2520 070000 .INICL=70*1000 ;INIT CHANNELS
2521
2522 071000 .WRMBX=71*1000 ;WRITE M-BOX

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2523 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 1
2524 ;
2525 ; 076000 .MEMRS=76*1000 ;SET KL10 MEM RESET FLOP
2526 ;
2527 ; 147000 .RCRM1=147*1000 ;READ C-RAM BITS 0-19
2528 ; 146000 .RCRM2=146*1000 ;READ C-RAM BITS 20-39
2529 ; 145000 .RCRM3=145*1000 ;READ C-RAM BITS 40-59
2530 ; 144000 .RCRM4=144*1000 ;READ C-RAM BITS 60-79
2531 ;
2532 ; 141000 .RCSPF=141*1000 ;READ SPEC FIELD OF C-RAM
2533 ;
2534 ; 135000 .RDJ71=135*1000 ;READ J07-J10 OF D-RAM
2535 ; 134000 .RDJ14=134*1000 ;READ J01-J04 OF D-RAM
2536 ; 133000 .RDMAB=133*1000 ;READ A & B FIELD OF D-RAM
2537 ;
2538 ; 164000 .CSHRG=164*1000
2539 ; 102000 .GFNR=102*1000
2540 ;
2541 ; ;NOTE CONSOLE SOFTWARE MUST PERFORM THIS AS A PART OF
2542 ; ;MASTER RESET CODE
2543 ;
2544 ; ;LOAD AR FUNCTION
2545 ;
2546 ; 077000 .LDAR=77*1000 ;LOAD THE AR FROM EBUS 0-35
2547 ;
2548 ; 150000 .PCAB1=150*1000 ;PC-ADDRESS BREAK REGISTERS
2549 ; 151000 .PCAB2=151*1000
2550 ; 152000 .PCAB3=152*1000
2551 ; 153000 .PCAB4=153*1000
2552 ;
2553 ; ;DIAG3 DEFINITIONS
2554 ;
2555 ;
2556 ; 100000 SWSLLT=100000 ;SWAP SELECT LEFT
2557 ; 040000 DPS4=040000 ;PARITY
2558 ; 000040 SCD=000040 ;SHIFT CAPTURED DATA
2559 ; 000020 DUPE= 000020 ;DATO UNIBUS PARITY ERROR
2560 ; 000020 CDD=000020 ;CLEAR DUPE AND DURE ERROR FLAGS
2561 ; 000010 WEP=000010 ;WRITE EVEN (BAD) PARITY
2562 ; 000004 DURE=000004 ;DATO UNIBUS RECEIVE ERROR
2563 ; 000002 NUPE=000002 ;NPR UNIBUS PARITY ERROR
2564 ; 000002 CNUPE=000002 ;CLEAR NUPE
2565 ; 000001 T010BM=000001 ;T0-10 BYTE TRANSFER MODE
2566 ;
2567 ; ;DIAG2 DEFINITIONS
2568 ;
2569 ;
2570 ; 100000 RFMAD0=100000 ;RFM ADDRESS BIT 0
2571 ; 040000 RFMAD1=040000 ;RFM ADDRESS BIT 1
2572 ; 040000 EDONES=040000 ;EBUS DONE
2573 ; 020000 RFMAD2=020000 ;RFM ADDRESS BIT 2
2574 ; 010000 RFMAD3=010000 ;RFM ADDRESS BIT 3
2575 ; 000100 DRESET=000100 ;DTE RESET

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2576 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)
2577 ;
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2627 ;
2628 ;
2629 ;

```

	STAT DEFINITIONS	
100000	T010DN=100000	;TO-10 NORMAL TERMINATION
100000	DON10S=100000	;NORMAL TERMINATION (DONE) TO 10
040000	DON10C=040000	;TO-10 NORMAL TERMINATION STATUS
020000	T010ER=020000	;TO-10 ERROR TERMINATION
020000	ERR10S=020000	;ERROR TERMINATION STATUS
010000	RAMIS0=010000	;RAM IS ZEROS
010000	ERR10C=010000	;CLEAR TO-10 ERROR TERMINATION
004000	T011DB=004000	; -10 REQUESTED -11 INTERRUPT
004000	INT11S=004000	;REQ 11 STATUS
002000	DXWRD1=002000	;DEXWORD 1
002000	INT11C=002000	; -10 REQUESTS -11 INTERRUPT STATUS
001000	MPE11=001000	; -11 MEMORY PARITY ERROR
001000	PERCLR=001000	;CLEAR -11 MEMORY PARITY ERROR FLAG STATUS
000400	T010DB=000400	; -11 REQUEST -10 INTERRUPT
000400	INT10S=000400	;REQUEST -10 INTERRUPT STATUS
000200	T011DN=000200	;TO-11 TRANSFER DONE
000200	DON11S=000200	;TO-11 NORMAL TERMINATION FLAG STATUS
000100	EBSEL=000100	;E BUFFER SELECT
000100	DON11C=000100	;TO-11 NORMAL TERMINATION FLAG STATUS
000040	NULSTP=000040	;NULL STOP
000040	INTRON=000040	;11 INTERRUPT ENABLE
000020	BPARER=000020	;EBUS PARITY ERROR
000020	EBUSPC=000020	;EBUS PARIT ERROR
000010	RM=000010	;RESTRICTED MODE
000010	INTROF=000010	;DISABLE PDP11 INTERRUPT
000004	DEXDON=000004	;DEPOSIT/EXAMINE DONE
000004	EBUSPS=000004	;EBUS PARITY ERROR SET
000002	T011ER=000002	;TO-11 BYTE ERROR TERMINATION
000002	ERR11S=000002	;TO-11 ERROR TERMINATION FLAG STATUS
000001	INTSON=000001	;INTERRUPTS ON
000001	ERR11C=000001	;CLEAR TO-11 ERROR TERMINATION FLAG STATUS
		DTE20 COMMUNICATION AREA OFFSETS (WORD NAMES)
000000	PIDENT=0	;PROCESSOR IDENTIFICATION WORD
000001	CHNPNT=1	;POINTER TO COMM AREA OF NEXT PROCESSOR (CIRC LIST)
000002	CYCLS=2	;CLOCK CPS COUNT
000003	TOD=3	;TIME OF DAY
000004	DATE=4	;DATE
000005	PSWW1=5	;PROCESSOR STATUS WORD1
000006	PSWW2=6	;PROCESSOR STATUS WORD2
000007	PSWW3=7	;PROCESSOR STATUS WORD3
000010	PSWW4=10	;PROCESSOR STATUS WORD4
000011	PSWW5=11	;PROCESSOR STATUS WORD5
000012	PSWW6=12	;PROCESSOR STATUS WORD6
000013	PSWW7=13	;PROCESSOR STATUS WORD7
000014	PSWW10=14	;PROCESSOR STATUS WORD10
000015	PSWW11=15	;PROCESSOR STATUS WORD11
000016	PSWW12=16	;PROCESSOR STATUS WORD12

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2630 ;BMB73F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 1
2631 ;
2632 000017 PSWW13=17 ;PROCESSOR STATUS WORD13
2633 000020 FORPRO=20 ;FOR PROCESSOR IDENTIFICATON WORD
2634 000021 PROPNT=21 ;POINTER TO COMM AREA OF THE PROCESSOR ASSOC WITH THIS BLOCK
2635 000022 STATUS=22 ;COMMUNICATION STATUS WORD
2636 000023 QSIZE=23 ;QUEUE SIZE WORD
2637 ;CTYOCW=24 ;CTY #0 COMMAND WORD
2638 ;CTYORW=25 ;CTY #0 RESPONSE WORD
2639 ;CTY1CW=26 ;CTY #1 COMMAND WORD
2640 ;CTY1RW=27 ;CTY #1 RESPONSE WORD
2641 ;MISCW=30 ;MISCELLANEOUS COMMAND WORD FOR NON-QUEUE PROTOCOL
2642 ;MISRW=31 ;MISCELLANEOUS RESPONSE WORD
2643 ; 000032 UNASG1=32 ;UNASSIGNED WORD1
2644 ; 000033 UNASG2=33 ;UNASSIGNED WORD2
2645 ; 000034 UNASG3=34 ;UNASSIGNED WORD3
2646 ; 000035 UNASG4=35 ;UNASSIGNED WORD4
2647 ; 000036 UNASG5=36 ;UNASSIGNED WORD5
2648 ; 000037 UNASG6=37 ;UNASSIGNED WORD6
2649 ;
2650 ; EPT ADDRESSES AS DEFINED IN BOOTS FOR USE IN THE
2651 ; SECONDARY PROTOCOL
2652 ;
2653 ; 000444 DTEFLG=444 ;OPERATION COMPLETE FLAG
2654 ; 000450 DTEF11=450 ;PDP-10 FROM PDP-11 ARGUMENT
2655 ; 000451 DTECMD=451 ;PDP-10 TO PDP-11 COMMAND WORD
2656 ; 000455 DTEMTD=455 ;MONITOR TTY OUTPUT COMPLETE FLAG
2657 ; 000456 DTEMTI=456 ;MONITOR TTY INPUT FLAG
2658 ;
2659 ;
2660 ; STATUS DEFINITONS
2661 ;
2662 ; 000001 TOIT=1 ;IN PROGRESS OF PROCESSING QUEUE
2663 ; 000002 TOIP=2 ;TO HIM INDIRECT IN PROGRESS

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```
2664      ;BMB73F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)  MACY11 27(657) 22-AUG-75 10:30 PAGE 2
2665      ;
2666      ;
2667      ;
2668      ;
2669      ;
2670      ;      000040  ROTOR7= 40      ;SAVE R0 TO R7 IN 40 TO 56
2671      ;
2672      ;      000130  DTESAV= 130    ;SAVE FIRST 12 DTE REGISTERS DLYCNT TO T011DT
2673      ;
2674      ;
2675      ;      000012  RETRY= 10.    ;DO 10 RETRIES BEFORE HALTING
2676      ;
2677      ;      173000  ROMORG= 173000 ;ROM STARTS AT 773000
2678      ;
2679      ;      ESTABLISH ROM ORIGIN
2680      ;
2681      ;      173000  .=ROMORG
```

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ROM CONTENTS TABLES

MACY11 27(657) 22-AUG-75 10:30 PAGE 3

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2682      ;BMB73F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)
2683      ;
2684      ;           EXTERNAL BUTTONS #1, #2, #3
2685      ;
2686      ;           BUTTON #1 -- LOAD USING SWITCH REGISTER
2687      ;
2688      005000 010037 ;173000 010037 BUTON1: MOV     RO,ROTOR7+0    ;SAVE RO IN LOCATION 40
2689      005002 000040 ;173002 000040          MOV     SWR,RO          ;GET SWITCH REGISTER
2690      005004 013700 ;173004 013700          BIT     #BIT0,RO        ;IS LOW-ORDER BIT SET?
2691      005006 177570 ;173006 177570          BNE    BUTONX          ;YES-- LOOK AT CONTENTS
2692      005010 032700 ;173010 032700          BR     REGSAV          ;NO-- SAVE R1-R7 IN 42-56, GO TO ADDRESS IN RO (FROM SWR
2693      005012 000001 ;173012 000001
2694      005014 001007 ;173014 001007
2695      005016 000557 ;173016 000557
2696      ;
2697      ;           BUTTON #3 -- LOAD BOOT FROM RX11 FLOPPY DISK
2698      ;
2699      005020 005000 ;173020 005000 BUTON3: CLR     RO          ;SAY LOAD FROM FLOPPY, UNIT 0
2700      005022 000404 ;173022 000404          BR     BUTONX          ;GO TO COMMON CODE FOR 3 BUTTONS
2701      ;
2702      ;           REQUIRED POWER-FAIL VECTOR
2703      ;
2704      005024 173000 ;173024 173000          .WORD  ROMORG,PR7
2705      005026 000340 ;173026 000340
2706      ;
2707      ;           BUTTON #2 -- LOAD BOOT FROM RPO4 DISK
2708      ;
2709      005030 012700 ;173030 012700 BUTON2: MOV     #BIT7,RO    ;BIT 7 MEANS LOAD FROM RPO4
2710      005032 000200 ;173032 000200          BR     BUTONX          ;FALL INTO COMMON CODE
2711      ;
2712      ;           RO IS SAVED IN R5 AS THE PARAMETER WORD PASSED TO BOOT
2713      ;           AND CONTAINS ONE OF THE FOLLOWING:
2714      ;
2715      ;           BIT 0 = 1      IF FROM SWITCH REGISTER
2716      ;           BIT 7 = 0      LOAD FROM RX11 FLOPPY DISK
2717      ;           BIT 7 = 1      LOAD FROM RPO4 DISK
2718      ;           BIT 15 = 1     INDEFINITE RETRY
2719      ;
2720      ;           NOTE THAT IF BUTTON #4 IS PRESSED, R5 WILL CONTAIN BIT 0 = 0. BIT 15 = 1
2721      ;
2722      ;
2723      005034 010005 ;173034 010005 BUTONX: MOV     RO,R5      ;SAVE PARAMETER FOR BOOT
2724      005036 106300 ;173036 106300          ASLB   RO              ;LEFT-ALIGN SPEED FIELD IN LOW BYTE
2725      005040 122700 ;173040 122700          CMPB  #16*BIT4,RO      ;IS SPEED 16 OR 17?
2726      005042 000340 ;173042 000340
2727      005044 101404 ;173044 101404          BLOS  10$             ;YES-- UNIT FIELD IS JNIT # TO BOOT FROM
2728      005046 122700 ;173046 122700          CMPB  #3*BIT4,RO      ;IS SPEED 0, 1, OR 2?
2729      005050 000060 ;173050 000060
2730      005052 101001 ;173052 101001          BHI   10$             ;YES-- UNIT IS UNIT TO USE
2731      005054 005000 ;173054 005000          CLR   RO              ;NO-- USE UNIT #0
2732      ;
2733      005056 000300 ;173056 000300 ios:   SWAB   RO          ;GET UNIT # IN LOW BYTE
2734      005060 042700 ;173060 042700          BIC   #1C7,RO        ;TRIM TO 3 BITS 2, 1, 0
2735      005062 177770 ;173062 177770

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2742 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 4
2743 ;
2744 ; RX11 FLOPPY DISK BOOTSTRAP AND DUMP ROUTINES
2745 ;
2746 ; RX11 REGISTER DEFINITIONS
2747 ;
2748 ; 177170 RXEPA= 177170 ;EXTERNAL PAGE ADDR OF FLOPPY
2749 ;
2750 ; 000000 RXCS= 0 ;OFFSET FOR CSR
2751 ; 100000 RXERR= BIT15 ;ERROR
2752 ; 000200 RXTREQ= BIT7 ;TRANSFER REQUEST
2753 ; 000040 RXDONE= BITS ;TRANSFER DONE
2754 ; 000020 RXUNIT= BIT4 ;UNIT NUMBER 1
2755 ; 000016 RXFUNC= BIT3:BIT2:BIT1 ;FUNCTION:
2756 ; 000000 RXFILL= 0 ; FILL SILO
2757 ; 000002 RXEMPT= 2 ; EMPTY SILO
2758 ; 000004 RXWRIT= 4 ; WRITE SECTOR
2759 ; 000006 RXREAD= 6 ; READ SECTOR
2760 ; 000016 RXRERR= 16 ; READ ERROR REGISTER
2761 ; 000001 RXGO= BIT0 ;GO BIT
2762 ; 000002 RXDB= 2 ;MULTI-PURPOSE DATA BUFFER REGISTER
2763 ;
2764 ;
2765 ; PARAMETERS
2766 ;
2767 ; 000001 RXBTRK= 1. ;BOOTSTRAP FROM TRACK 1
2768 ; 000001 RXBSCT= 1. ; SECTOR 1 (LOGICAL BLOCK 0)
2769 ;
2770 ; 000073 RXDTRK= 59. ;DUMP TO TRACK 59
2771 ; 000001 RXDSCT= 1. ; SECTOR 1
2772 ;
2773 ; NOTE THAT THE BOOTSTRAP IS WRITTEN IN LOGICAL BLOCK 0
2774 ; WHICH IS TRACK 1, SECTORS 1, 3, 5, 7. THE DUMP IS WRITTEN
2775 ; STARTING WITH TRACK 59, SECTOR 1, IN EVERY SECTOR (PHYSICAL
2776 ; SECTORS, NOT INTERLEAVED OR SKEWED).
2777 ;
2778 ;
2779 ; REGISTER USAGE:
2780 ; R0 -- READ OR WRITE FUNCTION. BIT 15 SET IF WRITE
2781 ; R1 -- ADDRESS OF RXCS
2782 ; R2 -- CURRENT TRACK (HIGH BYTE) SECTOR (LOW BYTE)
2783 ; R3 -- TRACK (HIGH BYTE) SECTOR (LOW BYTE)
2784 ; R4 -- DATA ADDRESS (TO READ OR WRITE)
2785 ; R5 -- PARAMETER WORD SAVED FROM INITIALIZATION
2786 ; SP -- RETRY COUNTER
2787 ;

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2788								
2789								; HERE TO BOOT FROM RX11 FLOPPY DISK-- UNIT # IN RO
2790								
2791								RXBOOT:
2792	005070	012703	;173070	012703	MOV			#<RXBTRK*BIT8>!<RXBSCT*BIT0>,R3
2793	005072	000401	;173072	000401				
2794	005074	005700	;173074	005700	TST	RO		; IS THIS UNIT # 0?
2795	005076	001402	;173076	001402	BEQ	10\$; YES-- USE 0
2796	005100	012700	;173100	012700	MOV	#RXUNIT,RO		; NO-- USE UNIT # 1
2797	005102	000020	;173102	000020				
2798	005104	052700	;173104	052700	10\$: BIS	#RXREAD+RXGO,RO		; SET READ FUNCTION IN RO
2799	005106	000007	;173106	000007				
2800								; BR RXSTRT ; FALL INTO START-UP

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2801      ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 4
2802      ;
2803      ;
2804      ; HERE TO START RX11 ON A TRANSFER, EITHER DUMP OR BOOT
2805      ;
2806 005110 012706 ;173110 012706 RXSTRT: MOV      #RETRY,SP      ;SET RETRY COUNT
2807 005112 000012 ;173112 000012
2808 005114 012701 ;173114 012701      MOV      #RXEPA+RXCS,R1 ;ADDRESS CONTROL STATUS REGISTER FOR RX11
2809 005116 177170 ;173116 177170
2810      ; BR      RXRTRY      ;FALL THROUGH RETRY CHECK
2811      ;
2812      ; HERE ON ERROR TO RETRY
2813      ;
2814 005120 005705 ;173120 005705 RXRTRY: TST      R5      ;INDEFINITE RETRY?
2815 005122 100402 ;173122 100402      BMI      10$      ;YES-- TRY FAITHFULLY
2816 005124 005306 ;173124 005306      DEC      SP      ;NO-- DECREMENT RETRY COUNT
2817 005126 002475 ;173126 002475      BLT      RXEHLT      ;GIVE UP IF RUN OUT
2818      ;
2819 005130 000005 ;173130 000005 10$: RESET      ;CLEAR THE WORLD
2820 005132 005004 ;173132 005004      CLR      R4      ;ALWAYS START TRANSFER AT LOCATION ZERO
2821 005134 010302 ;173134 010302      MOV      R3,R2      ;GET START TRACK AND SECTOR
2822 005136 032711 ;173136 032711 20$: BIT      #RXDONE,(R1) ;WAIT UNTIL READY FOR FUNCTION
2823 005140 000040 ;173140 000040
2824 005142 001775 ;173142 001775      BEQ      20$      ;NOT YET-- WAIT
2825 005144 005700 ;173144 005700      TST      R0      ;THIS WRITE?
2826 005146 100454 ;173146 100454      BMI      RXFLSL      ;YES-- FILL SILO BEFORE WRITE
2827      ; BR      RXPERF      ;NO-- JUST DO FIRST READ
2828      ;
2829      ; HERE TO PERFORM READ OR WRITE, AS SPECIFIED IN R0
2830      ;
2831 005150 110011 ;173150 110011 RXPERF: MOVB      R0,(R1) ;DO READ OR WRITE
2832 005152 105711 ;173152 105711 10$: TSTB      (R1) ;READY?
2833 005154 100376 ;173154 100376      BPL      10$      ;NO-- WAIT
2834 005156 110261 ;173156 110261      MOVB      R2,RXDB(R1) ;SET SECTOR #
2835 005160 000002 ;173160 000002
2836 005162 105711 ;173162 105711 20$: TSTB      (R1) ;READY FOR TRACK?
2837 005164 100376 ;173164 100376      BPL      20$      ;NO-- WAIT
2838 005166 000302 ;173166 000302      SWAB      R2      ;YES-- GET TRACK #
2839 005170 110261 ;173170 110261      MOVB      R2,RXDB(R1) ;SET IT
2840 005172 000002 ;173172 000002
2841 005174 000302 ;173174 000302 30$: SWAB      R2      ;RESTORE HIGH TRACK, LOW SECTOR
2842 005176 032711 ;173176 032711      BIT      #RXERR!RXDONE,(R1) ;DONE OR ERROR?
2843 005200 100040 ;173200 100040
2844 005202 001775 ;173202 001775      BEQ      30$      ;NO-- WAIT
2845 005204 100745 ;173204 100745      BMI      RXRTRY      ;YES-- ERROR IN FUNCTION

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2846
2847
2848
2849 005205 005700 ;173206 005700
2850 005210 100421 ;173210 100421
2851
2852
2853
2854
2855 005212 012711 ;173212 012711
2856 005214 000003 ;173214 000003
2857
2858 005216 132711 ;173216 132711
2859 005220 000240 ;173220 000240
2860 005222 000402 ;173222 000402
2861
2862
2863
2864 005224 173000 ;173224 173000
2865 005226 000340 ;173226 000340
2866
2867 005230 001772 ;173230 001772
2868 005232 100003 ;173232 100003
2869 005234 116124 ;173234 116124
2870 005236 000002 ;173236 000002
2871 005240 000766 ;173240 000766
2872
2873
2874
2875
2876
2877 005242 122222 ;173242 122222
2878 005244 022704 ;173244 022704
2879 005246 001000 ;173246 001000
2880 005250 101337 ;173250 101337
2881 005252 005007 ;173252 005007
2882
2883
2884
2885
2886
2887 005254 005202 ;173254 005202
2888 005256 122702 ;173256 122702
2889 005260 000032 ;173260 000032
2890 005262 103003 ;173262 103003
2891 005264 105002 ;173264 105002
2892 005266 062702 ;173266 062702
2893 005270 000401 ;173270 000401
2894 005272 022704 ;173272 022704
2895 005274 160000 ;173274 160000
2896 005276 101516 ;173276 101516
2897

```

```

; DISK TRANSFER COMPLETE WITH NO ERRORS
;
; TST R0 ; THIS A WRITE?
; BMI RXW0N ; YES-- SEE IF DONE WITH DUMP
; BR RXEMSL ; NO-- READ-- EMPTY SILO
;
; READ COMPLETED-- EMPTY SILO TO MEMORY
;
; RXEMSL: MOV #RXEMPT+RXGO, (R1) ; START EMPTY
;
; 10$: BITB #RXTREQ!RXDONE, (R1) ; READY FOR WORD, OR TRANSFER DONE?
; BR 20$ ; BRANCH AROUND VECTOR
;
; REQUIRED POWER-FAIL VECTOR
;
; .WORD ROMORG, PR7
;
; 20$: BEQ 10$ ; NOT READY-- WAIT SOME MORE
; BPL RXRDON ; DONE-- GET ANOTHER SECTOR
; MOVB RXDB(R1), (R4)+ ; NOT DONE-- GET A BYTE FROM SILO TO MEMORY
; BR 10$ ; WAIT FOR NEXT BYTE
;
; SILO EMPTIED-- SEE IF WE ARE DONE WITH BOOTING
;
; RXRDON:
; $$$=.
; CMPB (R2)+, (R2)+
; CMP #256, *2, R4 ; HAVE WE READ ENOUGH?
;
; BHI RXPERF ; NO-- READ SOME MORE
; CLR PC ; YES-- GO TO LOCATION ZERO
;
; WRITE COMPLETED-- SEE IF DONE DUMPING
;
; RXW0N:
; $$$=.
; INC R2
; CMPB #26., R2 ; THIS LAST SECTOR ON TRACK?
;
; BHIS 10$ ; NO-- KEEP ON GOING
; CLRB R2 ; YES-- CLEAR SECTOR ADDRESS
; ADD #BIT8!BIT0, R2 ; BUMP TO NEXT TRACK, SECTOR 1
;
; 10$: CMP #1024.*28.*2, R4 ; ARE WE DONE WITH 28 K?
;
; BLOS HALTO ; YES-- GO HALT WITH R0= 0 IN DISPLAY
; BR RXFLSL ; NO-- FILL SILO WITH NEXT SECTOR

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2898
2899
2900
2901 005300 012711 ;173300 012711 RXFLSL: MOV #RXFILL+RXGO,(R1) ;SET TO FILL SILO
2902 005302 000001 ;173302 000001
2903
2904 005304 132711 ;173304 132711 ios: BITB #RXTREQ!RXDONE,(R1) ;READY FOR ANOTHER BYTE?
2905 005306 000240 ;173306 000240
2906 005310 001775 ;173310 001775 BEQ 10$ ;NO-- WAIT SOME MORE
2907 005312 100316 ;173312 100316 BPL RXPERF ;DONE-- GO PERFORM WRITE
2908 005314 112461 ;173314 112461 MOVB (R4)+,RXDB(R1) ;YES-- STORE ANOTHER BYTE IN SILO
2909 005316 000002 ;173316 000002
2910 005320 000771 ;173320 000771 BR 10$ ;WAIT UNTIL READY FOR ANOTHER
2911
2912 ; HERE ON ERROR AFTER RETRYING -- DISPLAY ERROR REGISTER AND HALT
2913
2914 005322 012711 ;173322 012711 RXEHLT: MOV #RXRERR+RXGO,(R1) ;DO A READ ERROR REGISTER FUNCTION
2915 005324 000017 ;173324 000017
2916 005326 032711 ;173326 032711 10$: BIT #RXDONE,(R1) ;WAIT UNTIL ERROR ASSEMBLED
2917 005330 000040 ;173330 000040
2918 005332 001775 ;173332 001775 BEQ 10$
2919 005334 016100 ;173334 016100 MOV RXDB(R1),R0 ;GET ERROR REGISTER
2920 005336 000002 ;173336 000002
2921 005340 000476 ;173340 000476 BR HALTED ;HALT AND DISPLAY ERRORS
2922
2923
2924 ; START -11 HERE TO DO A DUMP TO RX11 FLOPPY DISK
2925
2926 ; NOTE THAT R0-R7 HAVE ALREADY BEEN SAVED IN 40-56
2927 ; WHEN BUTTON #1 WAS PUSHED
2928
2929 ;173342
2930 005342 012703 ;173342 012703 RXDUMP: MOV #<RXDTRK*BIT8>!<RXDSCT*BIT0>,R3
2931 005344 035401 ;173344 035401
2932
2933 005346 012700 ;173346 012700 MOV #BIT15!RXWRIT+RXGO,R0 ;DO A WRITE
2934 005350 100005 ;173350 100005
2935 005352 005005 ;173352 005005 CLR R5 ;CLEAR INDEFINITE RETRY BIT
2936 005354 000655 ;173354 000655 BR RXSTRT ;START DUMP GOING
  
```

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2937 ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 5
2938 ;
2939 ; REGISTER SAVE ROUTINE
2940 ;
2941 ; REGSAV IS CALLED TO SAVE THE GENERAL REGISTERS R0-R7
2942 ; IN MEMORY AT 40-56 (LOCATION ROTOR7).
2943 ;
2944 ; CALLING SEQUENCE:
2945 ;     MOV     R0,ROTOR7+0
2946 ;     MOV     #RET,R0
2947 ;     BR     REGSAV
2948 ; RET: <RETURN HERE>
2949 ;
2950 ; ALL REGISTERS RESTORED
2951 ;
2952 ;
2953 005356 010037 ;173356 010037 REGSAV: MOV     R0,ROTOR7+16 ;SAVE R0 AS PC IN 56
2954 005360 000056 ;173360 000056
2955 005362 012700 ;173362 012700     MOV     #ROTOR7+16,R0 ;R0 NOW POINTS TO 56
2956 005364 000056 ;173364 000056
2957 005366 010640 ;173366 010640     MOV     SP,-(R0) ;SAVE SP IN 54
2958 005370 010540 ;173370 010540     MOV     R5,-(R0) ;SAVE R5 IN 52
2959 005372 010440 ;173372 010440     MOV     R4,-(R0) ;SAVE R4 IN 50
2960 005374 010340 ;173374 010340     MOV     R3,-(R0) ;SAVE R3 IN 46
2961 005376 010240 ;173376 010240     MOV     R2,-(R0) ;SAVE R2 IN 44
2962 005400 010140 ;173400 010140     MOV     R1,-(R0) ;SAVE R1 IN 42
2963 005402 014000 ;173402 014000     MOV     -(R0),R0 ;RESTORE R0 FROM 40
2964 005404 000177 ;173404 000177     JMP     @ROTOR7+16 ;GO TO SAVED PC
2965 005406 004446 ;173406 004446

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2966 ; BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)
2967 ;
2968 ; RPO4 DISK BOOTSTRAP AND DUMP ROUTINES
2969 ;
2970 ; RPO4 REGISTER DEFINITIONS
2971 ;
2972 ; 176700 RPEPA= 176700 ;EXTERNAL PAGE ADDRESS OF RPO4 REGISTERS
2973 ;
2974 ; 000000 RPCS1= 0 ;OFFSET FOR CSR #1
2975 ; 040000 RPTRE= BIT14 ;TRANSFER ERROR
2976 ; 020000 RPMCPE= BIT13 ;MASSBUS CONTROL PARITY ERROR
2977 ; 004000 RPDVA= BIT11 ;DRIVE AVAILABLE (TO -11)
2978 ; 000200 RPRDY= BIT7 ;FUNCTION COMPLETE
2979 ; 000076 RPFUNC= BITS!BIT4!BIT3!BIT2!BIT1 ;FUNCTION:
2980 ; 000020 RPPRST= 20 ; READ-IN PRESET
2981 ; 000060 RPWRIT= 60 ; WRITE DATA
2982 ; 000070 RPREAD= 70 ; READ DATA
2983 ; 000001 RPGO= BIT0 ;GO
2984 ; 000002 RPWC= 2 ;WORD COUNT REGISTER
2985 ; 000006 RPDA= 6 ;TRACK (HIGH BYTE) SECTOR (LOW BYTE)
2986 ; 000010 RPCS2= 10 ;CONTROL AND STATUS REGISTER #2
2987 ; 000007 RPUNIT= BIT2!BIT1!BIT0 ;UNIT #
2988 ; 000012 RPDS= 12 ;DRIVE STATUS REGISTER
2989 ; 100000 RPATA= BIT15 ;ATTENTION ACTIVE
2990 ; 040000 RPERR= BIT14 ;DRIVE ERROR
2991 ; 000034 RPDC= 34 ;DESIRED CYLINDER
2992 ;
2993 ; PARAMETERS
2994 ;
2995 ; 000000 RPBCYL= 0. ;BOOT FROM CYLINDER 0
2996 ; 000000 RPBRK= 0. ; TRACK 0
2997 ; 000000 RPSCT= 0. ; SECTOR 0
2998 ;
2999 ; 000631 RPDCYL= 409. ;DUMP TO CYLINDER 409
3000 ; 000015 RPDTRK= 13. ; TRACK 13
3001 ; 000010 RPSCT= 8. ; SECTOR 8
3002 ;
3003 ; REGISTER USAGE:
3004 ;
3005 ; R0 -- FUNCTION CODE (HIGH BYTE) UNIT # (LOW BYTE)
3006 ; BIT 15 SET IF WRITE
3007 ; R1 -- ADDRESS OF RPCS1
3008 ; R2 -- CYLINDER #
3009 ; R3 -- TRACK (HIGH BYTE) SECTOR (LOW BYTE)
3010 ; R4 -- WORD COUNT
3011 ; R5 -- PARAMETER WORD SAVED FROM INITIALIZATION
3012 ; SP -- RETRY COUNTER
3013 ;
3014 ;

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```
3015  
3016  
3017  
3018  
3019 005410 005002 ;173410  
3020 005412 005003 ;173412 005002  
3021 005414 052700 ;173414 005003  
3022 005416 034400 ;173416 052700  
                                ;173416 034400
```

RPBOOT: CLR R2
CLR R3
BIS *(<RPREAD+RPGO>*BIT8,RO :SET READ HIGH BYTE, UNIT # LOW BYTE

; HERE TO BOOT FROM RPO4-- UNIT # IN RO

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3023      ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 6
3024
3025 005420 012704 ;173420 012704      MOV      #-256.,R4      ;READ 256 WORDS TO BOOT
3026 005422 177400 ;173422 177400
3027      ;
3028      ;
3029      ; START RPO4 GOING ON EITHER DUMP OR BOOT
3030
3031 005424 012706 ;173424 012706 RPSTRT: MOV      #RETRY,SP      ;RETRY RETRY TIMES
3032 005426 000012 ;173426 000012
3033 005430 012701 ;173430 012701      MOV      #RPEPA+RPCS1,R1 ;ADDRESS RPCS1 IN R1
3034 005432 176700 ;173432 176700
3035      ;
3036      ;
3037      ; HERE ON ERROR TO RETRY
3038
3039 005434 005705 ;173434 005705 RPRTRY: TST      R5      ;INFINITE RETRY?
3040 005436 100402 ;173436 100402      BMI      10$      ;YES-- TRY AGAIN
3041 005440 005306 ;173440 005306      DEC      SP      ;RETRY COUNT EXHAUSTED?
3042 005442 002437 ;173442 002437      BLT      RPEHLT    ;YES-- GIVE UP
3043
3044 005444 000005 ;173444 000005 10$: RESET      :ZAP!!
3045 005446 110061 ;173446 110061      MOVB     R0,RPCS2(R1) ;SELECT PROPER UNIT #
3046 005450 000010 ;173450 000010
3047 005452 032711 ;173452 032711      BIT      #RPDVA,(R1) ;IS DRIVE AVAILABLE TO US?
3048 005454 004000 ;173454 004000
3049 005456 001766 ;173456 001766      BEQ      RPRTRY    ;NO-- TRY AGAIN
3050 005460 012711 ;173460 012711      MOV      #RPPRST+RPGO,(R1) ;DO 'READ-IN PRESET' FUNCTION
3051 005462 000021 ;173460 000021
3052 005464 010261 ;173464 010261      MOV      R2,RPDC(R1) ;SELECT PROPER CYLINDER
3053 005466 000034 ;173466 000034
3054 005470 010361 ;173470 010361      MOV      R3,RPDA(R1) ; AND TRACK AND SECTOR
3055 005472 000006 ;173472 000006
3056 005474 010461 ;173474 010461      MOV      R4,RPWC(R1) ;SET UP WORD COUNT TO PROPER VALUE
3057 005476 000002 ;173476 000002
3058      ;
3059      ; NOTE THAT IT IS NOT NECCESARY TO SET UP BUS
3060 005500 000300 ;173500 000300      SWAB     R0      ; ADDRESS, SINCE IT IS 0 AFTER READ-IN PRESET
3061 005502 110011 ;173502 110011      MOVB     R0,(R1)   ;GET FUNCTION CODE IN LOW BYTE
3062 005504 000300 ;173504 000300      SWAB     R0      ;START FUNCTION GOING
3063      ;
3064 005506 105711 ;173506 105711 20$: TSTB      (R1)      ;READY?
3065 005510 100376 ;173510 100376      BPL      20$      ;NO-- WAIT UNTIL IT IS
3066 005512 032711 ;173512 032711      BIT      #RPTRE!RPMCPE,(R1) ;TRANSFER OR MBC PARITY ERROR?
3067 005514 060000 ;173514 060000
3068 005516 001346 ;173516 001346      BNE      RPRTRY    ;YES-- ERROR-- TRY AGAIN
3069 005520 032761 ;173520 032761      BIT      #RPATA!RPERR,RPDS(R1) ;ATTN OR OTHER ERROR?
3070 005522 140000 ;173522 140000
3071 005524 000012 ;173524 000012
3072 005526 001342 ;173526 001342      BNE      RPRTRY    ;YES-- ERROR-- TRY AGAIN
3073 005530 005700 ;173530 005700      TST      R0      ;READ FUNCTION?
3074 005532 100247 ;173532 100247      BPL      CLRPC     ;YES-- BOOT-- GO TO LOCATION 0
3075      ;
3075      ;
3075      ; NO-- DUMP-- HALT WITH R0= 0 IN DISPLAY

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3076
3077
3078
3079 005534 005000 ;173534 005000 HALTO: CLR RO ;DISPLAY RO= 0 IF NO ERRORS
3080
3081 005536 000000 ;173536 000000 HALTED: HALT ;DIE
3082 005540 000776 ;173540 000776 BR HALTED ;STAY DEAD
3083
3084
3085
3086 005542 016100 ;173542 016100 RPEHLT: MOV RPD5(R1),RO ;DISPLAY DRIVE STATUS
3087 005544 000012 ;173544 000012
3088 005546 000773 ;173546 000773 BR HALTED ;R.I.P.
3089
3090
3091
3092
3093
3094
3095
3096
3097 005550 012702 ;173550 012702
3098 005552 000631 ;173552 000631
3099 005554 012703 ;173554 012703
3100 005556 006410 ;173556 006410
3101 005560 012700 ;173560 012700
3102 005562 130400 ;173562 130400
3103 005564 012704 ;173564 012704
3104 005566 110000 ;173566 110000
3105 005570 005005 ;173570 005005
3106 005572 000714 ;173572 000714

; HERE TO HALT AFTER A DUMP-- DISPLAY RO= 0 IF NO ERRORS
;
; HERE ON ERROR FROM RPO4 AFTER RETRYING-- DISPLAY DRIVE STATUS IN RO
;
; START -11 HERE TO DUMP TO RPO4 DISK
;
; NOTE THAT RO-R7 HAVE ALREADY BEEN SAVED IN 40-56
; BY PRESSING BUTTON #1.
RPDUMP:
MOV #RPDCYL,R2
MOV #<RPDTRK*BIT8>!<RPDSCT*BIT0>,R3
MOV #BIT15!<<RPWRIT+RPGO>*BIT8>,RO ;DO A WRITE. UNIT # 0
MOV #-<1024.*28.>,R4 ;SET TO DUMP 28 K
CLR R5 ;CLEAR INDEFINITE RETRY BIT
BR RPSTRT ;START DUMP GOING

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3107      ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)  MACY11 27(657) 22-AUG-75 10:30 PAGE 7
3108      ;
3109      ;
3110      ;           INTERNAL BUTTON #4 -- DUMP AND BOOTSTRAP THROUGH DTE20
3111      ;           DTE20 DEFINITIONS
3112      ;
3113      ;           NOTE THAT ALL DTE20 REGISTER DEFINITIONS AND BIT DEFINITIONS
3114      ;           ARE IN $DEF IN SYSMAC.SML
3115      ;
3116      ;           000040 DTESIZ= 40      ;EACH DTE OCCUPIES 20 WORDS IN EXTERNAL PAGE
3117      ;           000004 DTEMAX= 4      ;MAX OF 4 DTE'S ON A PDP-11
3118      ;
3119      ;
3120      ;           BUTTON #4 -- INITIATED BY '-10 RELOAD -11' BIT
3121      ;
3122      005574 010037 ;173574 010037 BUTON4: MOV      RO,ROTOR7+0      ;SAVE RO IN 40
3123      005576 000040 ;173576 000040
3124      005600 012700 ;173600 012700          MOV      #10$,RO      ;SET RETURN ADDRESS IN RO
3125      005602 173606 ;173602 173606
3126      005604 000664 ;173604 000664          BR       REGSAV      ;SAVE R1-R7
3127      ;
3128      ;           REGISTERS SAVED-- LOOK FOR THE DTE20 WHICH PUSHED THE BUTTON
3129      ;
3130      ;           THE DTE WHICH PUSHED THE BUTTON SHOULD HAVE THE DOORBELL
3131      ;           RINGING AND HAVE THE VALUE 1365 (OCTAL) IN IT'S
3132      ;           TO -10 BYTE COUNT TO10BC.
3133      ;
3134      ;           NXM (TIME-OUT) TRAP IS USED TO SKIP NON-EXISTANT DTE20'S.
3135      ;
3136      005606 005005 ;173606 005005 10$: CLR      R5      ;ADDRESS LOCATION ZERO
3137      005610 012500 ;173610 012500          MOV      (R5)+,RO      ;SAVE 0 IN RO
3138      005612 012501 ;173612 012501          MOV      (R5)+,R1      ;SAVE 2 IN R1
3139      005614 011502 ;173614 011502          MOV      (R5),R2      ;SAVE 4 IN R2
3140      005616 012725 ;173616 012725          MOV      #21$, (R5)+  ;SET NXM TRAP ADDRESS IN 4
3141      005620 173634 ;173620 173634
3142      005622 011503 ;173622 011503          MOV      (R5),R3      ;SAVE 6 IN R3
3143      005624 012715 ;173624 012715          MOV      #PR7,(R5)    ;SET PRIORITY FOR NXM TRAP
3144      005626 000340 ;173626 000340
3145      ;
3146      ;           LOOP THROUGH ALL DTE'S
3147      ;
3148      005630 012704 ;173630 012704 20$: MOV      #DLYCNT-DTESIZ,R4 ;POINT TO DTE # -1'S DELAY COJNT REGISTER
3149      005632 174340 ;173632 174340
3150      ;           ; (WILL BUMP TO # 0)

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3151
3152
3153
3154 005634 012706 ;173634 012706 21$: MOV #4,SP ;SET SP TO 4, STACK IS LOCATIONS 2 AND 0
3155 005636 000004 ;173636 000004
3156
3157 005640 062704 ;173640 062704 22$: ADD DTESIZ,R4 ;BUMP TO NEXT DTE'S EXTERNAL PAGE ADDRESS
3158 005642 000040 ;173642 000040
3159 005644 105704 ;173644 105704 TSTB R4 ;IS THIS THE END OF THE DTE'S?
3160 ; NOTE THAT THE LAST DTE IS AT 774540
3161 ; AND THAT NOW R4= 774600 IF END
3162 005646 100770 ;173646 100770 BMI 20$ ;YES-- START ALL OVER, UNTIL A DTE
3163 ; SAYS HE PUSHED THE BUTTON
3164 005650 032764 ;173650 032764 BIT #T011DB,STAT-DLYCNT(R4) ;DOORBELL RINGING?
3165 005652 004000 ;173652 004000
3166 005654 000034 ;173654 000034
3167 005656 001770 ;173656 001770 BEQ 22$ ;NO-- TRY NEXT DTE
3168 005660 026417 ;173660 026417 CMP T010BC-DLYCNT(R4),(PC) ;DOES THIS ONE HAVE 1365
3169 005662 000014 ;173662 000014
3170 ; IN IT'S TO -10 BYTE COUNT?
3171 005664 001365 ;173664 001365 BNE 22$ ;NO-- TRY ANOTHER DTE
3172
;

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3173      ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)  MACY11 27(657) 22-AUG-75 10:30 PAGE 7
3174      ;
3175      ; WE HAVE FOUND THE DTE WHICH PUSHED THE BUTTON
3176      ;
3177      ; ADDRESS OF DLYCNT REGISTER IS IN R4
3178      ;
3179 005666 010315 ;173666 010315      MOV      R3,(R5)      ;RESTORE LOCATION 6
3180 005670 010245 ;173670 010245      MOV      R2,-(R5)      ; 4
3181 005672 010145 ;173672 010145      MOV      R1,-(R5)      ; 2
3182 005674 010045 ;173674 010045      MOV      R0,-(R5)      ; 0
3183      ;
3184      ; SAVE FIRST 12 DTE REGISTERS DLYCNT TO T011DT
3185      ; IN LOCATIONS 130-156
3186      ;
3187 005676 012700 ;173676 012700      MOV      #DTE SAV,R0      ;POINT TO SAVE AREA
3188 005700 000130 ;173700 000130
3189 005702 012420 ;173702 012420 29$: MOV      (R4)+,(R0)+      ;SAVE A REGISTER
3190 005704 022700 ;173704 022700      CMP      #T011DT-DLYCNT+DTE SAV,R0 ;FINISHED?
3191 005706 000156 ;173706 000156
3192 005710 103374 ;173710 103374      BHS      29$      ;NO-- SAVE SOME MORE
3193      ;
3194      ; R4= T011DT+2
3195      ;
3196      ; SET R1= STATUS REGISTER
3197      ; R4= DIAG2 REGISTER
3198      ;
3199      ; DO 'DIAGNOSTIC RESET' TO CLEAR DOORBELL AND BYTE COUNT
3200      ; LOADED FLAG
3201      ;
3202      ; $$$=
3203 005712 005724 ;173712 005724      TST      (R4)+
3204 005714 010401 ;173714 010401      MOV      R4,R1      ; SO DOES R1
3205 005716 012700 ;173716 012700      MOV      #DRESET,R0      ;SETUP R0 FOR 'DIAGNOSTIC RESET'
3206 005720 000100 ;173720 000100
3207 005722 010021 ;173722 010021      MOV      R0,(R1)+      ;R1 POINTS TO STATUS REGISTER

```

JOB

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ROM CONTENTS TABLES

3208						
3209						
3210						
3211						
3212						
3213						
3214						
3215						
3216						
3217	005724	005061	:173724	005061		
3218	005726	177744	:173726	177744		
3219	005730	005061	:173730	005061		
3220	005732	177764	:173732	177764		
3221						
3222	005734	032711	:173734	032711	30\$:	
3223	005736	004000	:173736	004000		
3224	005740	001775	:173740	001775		
3225	005742	010014	:173742	010014		
3226						
3227						
3228						
3229						
3230						
3231						
3232	005744	005061	:173744	005061		
3233	005746	177766	:173746	177766		
3234	005750	012761	:173750	012761		
3235	005752	107400	:173752	107400		
3236	005754	177762	:173754	177762		
3237						
3238	005756	032711	:173756	032711	40\$:	
3239	005760	004000	:173760	004000		
3240	005762	001775	:173762	001775		
3241	005764	010014	:173764	010014		
3242	005766	012705	:173766	012705		
3243	005770	100000	:173770	100000		
3244						
3245	005772	005007	:173772	005007		
3246						

REGISTERS:

R0 -- DRESET (DIAGNOSTIC RESET FUNCTION)
R1 -- STAT (STATUS REGISTER)
R4 -- DIAG2 (DIAGNOSTIC REGISTER #2, WHERE DRESET IS)

THE -10 WILL NOW START READING -11 MEMORY, AS SOON AS WE SET THE TO -10 ADDRESS. WHEN FINISHED, THE -10 WILL RING OUR DOORBELL.

CLR DLYCNT-STAT(R1) ;SET DTE20 FOR MAXIMUM DELAY (ZERO)

CLR TOLOAD-STAT(R1) ;START DUMPING -11 MEMORY TO -10

; STARTING AT LOCATION 0

30\$: BIT #TO11DB,(R1) ;IS DOORBELL RINGING (TRANSFER COMPLETE)?

BEQ 30\$;NO-- WAIT FOR DOORBELL
MOV R0,(R4) ;YES-- CLEAR DOORBELL AND ERROR FLAGS

NOW THE -10 WILL GIVE US A 256 WORD BOOTSTRAP TO BE READ INTO -11 MEMORY STARTING AT LOCATION 0. WHEN FINISHED, THE -10 WILL RING OUR DOORBELL, AND WE WILL START EXECUTION OF THE LOADED CODE AT LOCATION 0.

CLR TO11AD-STAT(R1) ;START INPUT TO LOCATION 0

MOV #IFLOP!<<-256.>&7777>,TO11BC-STAT(R1) ;256 WORDS. INTERRUPT

40\$: BIT #TO11DB,(R1) ; -10 WHEN DONE ;DOORBELL RINGING (LOAD FINISHED)?

BEQ 40\$;NO-- WAIT UNTIL DONE
MOV R0,(R4) ;CLEAR DOORBELL RINGING
MOV #BIT15,R5 ;SET R5: BIT15= 1, BIT0= 0

CLR PC ; TO SAY BUTTON #4 PRESSED ;GO TO LOADED CODE, STARTING AT ; LOCATION 0

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ROM CONTENTS TABLES

```
3247      ;BM873F - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(657) 22-AUG-75 10:30 PAGE 8
3248      ;
3249      ;
3250      ;
3251      ;
3252      ;173774 000004      .PRINT <1000>-<.-ROMORG> ;FREE BYTES AT 1000
3253 005774 000000      ;173774      000      .BYTE 0
3254      ;173775      000      .BYTE 0
3255 005776 END.YF:      ;173776      000      .BYTE 0
3256 005776 000000      ;173777      000      .BYTE 0
3257      ;
3258      ;
3259      ;
3260      ;
3261      ;174000 000001 PASS2: .END
3262      ;
3263      ;
```

```

3264 006000 MAP.YG:
3265 ;THE FOLLOWING IS A REPRODUCTION
3266 ;OF THE ROM PROGRAM FOR BM873YG.
3267 ;IT IS HERE FOR COMPARISON TO THE
3268 ;ACTUAL ROM AND FOR REFERENCE
3269 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 1
3270
3271 ; .TITLE BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM
3272 ;
3273 ; THIS IS THE CODE TO BE ENCODED IN THE BOOTSTRAP ROM ON THE BM873-YG BOARD
3274 ;
3275 ;
3276 ; MODULE: BM873G
3277 ;
3278 ; DATE: JUNE 1976
3279 ;
3280 ; AUTHOR: RICH MURATORI
3281 ;
3282 ;
3283 ; COPYRIGHT (C) 1976 DIGITAL EQUIPMENT CORPORATION
3284 ; ALL RIGHTS RESERVED
3285 ;
3286 ;
3287 ; .ENABLE ABS,AMA
3288 ;
3289 ; ASCII CHARACTER DEFINITIONS
3290 ;
3291 ; 000040 SPACE= 40 ;ASCII SPACE
3292 ; 000001 SYN= 1 ;ASCII SYNC
3293 ; 000012 LF= 12 ;ASCII LINE FEED
3294 ; 000015 CR= 15 ;ASCII CARRIAGE RETURN
3295 ; 000054 COMMA= 54 ;ASCII COMMA
3296 ; 000006 ACK= 6 ;ASCII ACKNOWLEDGE
3297 ; 000025 NAK= 25 ;ASCII NEG ACKNOWLEDGE
3298 ;
3299 ; BUFFER AREAS
3300 ;
3301 ; 002100 LINBUF= 2100 ;LINE INPUT BUFFER
3302 ; 002310 DEABUF= 2310 ;DEASCIIIZED INPUT BUFFER
3303 ;
3304 ; DL11E REGISTER DEFINITIONS
3305 ;
3306 ; 176000 DLRCR= 176000 ;DL11E RECEIVER STATUS REGISTER
3307 ; 176002 DLRBUF= 176002 ;DL11E RECEIVER BUFFER
3308 ; 176004 DLXCSR= 176004 ;DL11E TRANSMITTER STATUS REGISTER
3309 ; 176006 DLXBUF= 176006 ;DL11E TRANSMISSION BUFFER
3310 ;
3311 ; 100000 BIT15=100000
3312 ; 000340 PR7=7*40 ;PRIORITY LEVEL 7
3313 ;
3314 ; DTE20 REGISTER DEFINITIONS
3315 ;
3316 ; 174400 DLYCNT=174400 ;DELAY COUNT WORD
3317 ; 174414 TO103C=174414 ;TO-10 PDP-11 MEMCRY ADDRESS
  
```

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3318	:	174416	T011BC=174416	; TO-11 BYTE COUNT
3319	:	174420	T010AD=174420	; TO-10 PDP-11 MEMORY ADDRESS
3320	:	174422	T011AD=174422	; TO-11 PDP-11 MEMORY ADDRESS
3321	:	174426	T011DT=174426	; TO-11 PDP-11 DATA WORD
3322	:	174434	STAT=174434	; STATUS WORD
3323	:			T011BC REGISTER BIT DEFINITIONS
3324	:			

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ROM CONTENTS TABLES

```
3325 ;BM873G - K.10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 1-1
3326
3327 ;          100000 IFLOP=100000 ;I FLIPFLOP BIT
3328
3329
3330          ;          DIAG2 DEFINITIONS
3331
3332 ;          000100 DRESET=000100 ;DTE RESET
3333
3334          ;          STAT REGISTER DEFINITIONS
3335
3336 ;          004000 T011DB=004000 ;-10 REQUESTED -11 INTERRUPT
3337
3338          ;          DEFINITIONS . . .
3339
3340
3341 ;          000040 ROTOR7= 40 ;SAVE R0 TO R7 IN 40 TO 56
3342
3343 ;          000130 DTESAV= 130 ;SAVE FIRST 12 DTE REGISTERS DLYCNT TO T011DT
3344 ;          ;          IN LOCATIONS 130-156
3345
3346 ;          173000 ROMORG= 173000 ;ROM STARTS AT 773000
3347
3348          ;          ESTABLISH ROM ORIGIN
3349
3350 ;          173000          .=ROMORG
```

```

3351 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 2
3352 ;
3353 ;
3354 ;
3355 ;
3356 ;
3357 ;
3358 ;
3359 ;
3360 ;
3361 ;
3362 ;
3363 ;
3364 ;
3365 ;
3366 ;
3367 ;
3368 ;
3369 ;
3370 ;
3371 006000 000005 ;173000 000005
3372 006002 012706 ;173002 012706
3373 006004 002000 ;173004 002000
3374 006006 012701 ;173006 012701
3375 006010 173374 ;173010 173374
3376 006012 105737 ;173012 105737
3377 006014 176004 ;173014 176004
3378 006016 100375 ;173016 100375
3379 006020 000403 ;173020 000403
3380 ;
3381 ;
3382 ;
3383 006022 000000 ;173022 000000
3384 006024 173000 ;173024 173000
3385 006026 000340 ;173026 000340
3386 ;
3387 ;
3388 ;
3389 006030 112137 ;173030 112137
3390 006032 176006 ;173032 176006
3391 006034 105711 ;173034 105711
3392 006036 001365 ;173036 001365
3393 006040 005005 ;173040 005005
3394 ;
3395 ;
3396 006042 012701 ;173042 012701
3397 006044 002100 ;173044 002100
3398 006046 105737 ;173046 105737
3399 006050 176000 ;173050 176000
3400 006052 100375 ;173052 100375
3401 ;
3402 ;
3403 ;
3404 ;

```

```

.SBTTL BOOT FROM MASTER FRONT END
;EXTERNAL BUTTON #1 -- LOAD FROM MASTER FRONT END VIA DL11E
;DEPRESSING BUTTON #1 CAUSES A LOADER UTILITY PROGRAM (DGQDE) TO BE LOADED
;TO ACCOMPLISH THIS, THE FOLLOWING CONDITIONS MUST EXIST:
; 1) THE LOADER UTILITY PROGRAM DGQDD MUST BE RUNNING UNDER KLDCP
;    IN THE MASTER FRONT END.
; 2) THE '.A11' FILE FOR DGQDE MUST BE AVAILABLE ON THE SELECTED LOAD
;    MEDIUM IN THE MASTER FRONT END.
; 3) THE MASTER FRONT END AND THE SECONDARY FRONT END MUST BE CONNECTED
;    THROUGH DL11E'S AND A NULL MODEM.
; 4) THE SECONDARY FRONT END MUST HAVE A TTY CONNECTED TO IT.
;SEND BOOTSTRAP REQUEST TO MASTER FRONT END VIA THE DL11E. THE
;REQUEST IS IN THE FORM 'B <CR><LF>', WHICH CALLS FOR THE
;BOOTING OVER OF DGQDE.A11.
BUTON1: RESET ;CLEAR THE WORLD
MOV #2000,SP ;SETUP STACK POINTER
MOV #DGQDE,R1 ;ADDRESS OF SYNC + BOOT REQUEST
SENDIT: TSTB @#DLXCSR ;IS DL11E READY TO TRANSMIT
BPL SENDIT ;LOOP UNTIL IT IS
BR IS ;BRANCH AROUND POWER -FAIL VECTOR
;*****
;REQUIRED POWER-FAIL VECTOR - MUST BE AT 173024
;
.WORD 0 ;FILLER
.WORD ROMORG,PR7
;*****
IS: MOV (R1)+,@#DLXBUF ;LOAD A CHAR INTO OUTPUT BUFFER
TSTB (R1) ;ANY MORE CHARS TO SEND?
BNE SENDIT ;BRANCH IF MORE CHARS TO SEND
CLR R5 ;CLEAR SYNC RECEIVED FLAG
;WAIT TO RECEIVE BOOT PROGRAM (DGQDE.A11), ONE ASCIIZED CHAR AT
;A TIME, ONE LINE AT A TIME.
NXTLIN: MOV #LINBUF,R1 ;ADDRESS OF LINE INPUT BUFFER
NXTCHR: TSTB @#DLRCSR ;CHAR RECEIVED YET?
BPL NXTCHR ;BRANCH IF STILL TO WAIT
;PROCESS THE RECEIVED ASCIIZED CHAR. IGNORE ALL CHARS UNTIL A SYNC
;SIGNAL IS RECEIVED. A LINE FEED MARKS THE END OF A LINE. THE MAX
;NUMBER OF CHARS PER LINE IS 131, MORE THAN THAT IS AN ERROR.

```

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3405	006054	113711	;173054	113711	2\$:	MOVB	2#DLRBUF,(R1)	;READ CHAR INTO LINE INPUT BUFFER
3406	006056	176002	;173056	176002				
3407	006060	142711	;173060	142711		BICB	#200,(R1)	;CLEAR HIGH ORDER BIT OF CHAR
3408	006062	000200	;173062	000200				
3409	006064	001770	;173064	001770		BEQ	NXTCHR	;BRANCH IF YES, IGNORE NULLS
3410	006066	121127	;173066	121127		CMPB	(R1),#SYN	;IS CHAR THE SYNC SIGNAL
3411	006070	000001	;173070	000001				
3412	006072	001413	;173072	001413		BEQ	3\$;BRANCH IF YES
3413	006074	005705	;173074	005705		TST	R5	;HAS SYNC ALREADY BEEN RECEIVED?
3414	006076	001763	;173076	001763		BEQ	NXTCHR	;BRANCH IF NOT, IGNORE CHAR
3415	006100	122127	;173100	122127		CMPB	(R1)+,#LF	;IS CHAR A LINE FEED?
3416	006102	000012	;173102	000012				
3417	006104	001410	;173104	001410		BEQ	PACKIT	;BRANCH IF YES, END OF LINE

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ROM CONTENTS TABLES

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3418 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 2-1
3419
3420 006106 020127 ;173106 020127 CMP R1,#LINBUF+132. ;HAVE WE REACHED THE END OF THE BUFFER?
3421 006110 002304 ;173110 002304
3422 006112 003755 ;173112 003755 BLE NXTCHR ;BRANCH IF NOT, GET REST OF LINE
3423 006114 004737 ;173114 004737 JSR PC,NAKSND ;SEND A NEG ACKNOWLEDGE
3424 006116 173346 ;173116 173346
3425 006120 000000 ;173120 000000 HALT ;TOO MANY CHARS IN A LINE
3426 ;
3427 006122 005205 ;173122 005205 3$: INC R5 ;SET SYNC RECEIVED FLAG
3428 006124 000750 ;173124 000750 BR NXTCHR ;GO GET NEXT CHAR
3429 ;
3430 ;UNSCRAMBLE THE ASCIIZED CHARS INTO 16-BIT WORDS. THE FORMAT OF A
3431 ;LINE IS E WRDCNT,LADDR,DATA,DATA,...,DATA,CHKSUM<CR><LF>
3432 ;WHERE WRDCNT IS THE WORD COUNT
3433 ;LADDR IS THE LOAD ADDRESS
3434 ;DATA IS LOAD DATA
3435 ;CHKSUM IS THE CHECKSUM
3436 ;
3437 006126 012703 ;173126 012703 PACKIT: MOV #DEABUF,R3 ;GET ADDRESS OF DE-ASCIIZED BUFFER
3438 006130 002310 ;173130 002310
3439 006132 012701 ;173132 012701 MOV #LINBUF,R1 ;GET ADDRESS OF INPUT BUFFER
3440 006134 002100 ;173134 002100
3441 006136 122127 ;173136 122127 CMPB (R1)+,#'E' ;FIRST CHAR IN LINE SHOULD BE AN 'E'
3442 006140 000105 ;173140 000105
3443 006142 001403 ;173142 001403 BEQ 1$ ;BRANCH IF IT IS
3444 006144 004737 ;173144 004737 JSR PC,NAKSND ;SEND A NEG ACKNOWLEDGE
3445 006146 173346 ;173146 173346
3446 006150 000000 ;173150 000000 HALT ;INCORRECT LINE SYNTAX, FIRST CHAR NOT AN E
3447 ;
3448 006152 122127 ;173152 122127 1$: CMPB (R1)+,#SPACE ;SECOND CHAR SHOULD BE A SPACE
3449 006154 000040 ;173154 000040
3450 006156 001403 ;173156 001403 BEQ NXTWRD ;BRANCH IF IT IS
3451 006160 004737 ;173160 004737 JSR PC,NAKSND ;SEND A NEG ACKNOWLEDGE
3452 006162 173346 ;173162 173346
3453 006164 000000 ;173164 000000 HALT ;INCORRECT LINE SYNTAX, 2ND CHAR NOT A SPACE
3454 ;
3455 006166 005002 ;173166 005002 NXTWRD: CLR R2 ;CLEAR WORD FORMER
3456 006170 112100 ;173170 112100 1$: MOVB (R1)+,R0 ;READ CHAR FROM LINE BUFFER
3457 006172 122700 ;173172 122700 CMPB #CR,R0 ;IS CHAR A CARRIAGE RETURN
3458 006174 000015 ;173174 000015
3459 006176 001774 ;173176 001774 BEQ 1$ ;BRANCH IF YES
3460 006200 122700 ;173200 122700 CMPB #LF,R0 ;IS CHAR A LINE FEED
3461 006202 000012 ;173202 000012
3462 006204 001422 ;173204 001422 BEQ 3$ ;BRANCH IF IT IS
3463 006206 122700 ;173206 122700 CMPB #COMMA,R0 ;IS CHAR A COMMA
3464 006210 000054 ;173210 000054
3465 006212 001415 ;173212 001415 BEQ 2$ ;BRANCH IF IT IS
3466 006214 006302 ;173214 006302 ASL R2 ;SHIFT WORD OVER TO MAKE ROOM FOR
3467 006216 006302 ;173216 006302 ASL R2 ;NEXT CHAR
3468 006220 006302 ;173220 006302 ASL R2
3469 006222 000402 ;173222 000402 BR 4$ ;BRANCH AROUND POWER-FAIL VECTOR
3470 ;*****
3471 ;REQUIRED POWER-FAIL VECTOR - MUST BE AT 173224

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```
3472  
3473 006224 173000 ;173224 173000 .WORD ROMORG,PR7  
3474 006226 000340 ;173226 000340  
3475 ;  
3476 ;*****  
3477 ;  
3478 006230 006302 ;173230 006302 4$: ASL R2  
3479 006232 006302 ;173232 006302 ASL R2  
3480 006234 006302 ;173234 006302 ASL R2  
3481 006236 042700 ;173236 042700 BIC #100,R0 ;CLEAR ASCIIZED BIT  
3482 006240 000100 ;173240 000100  
3483 006242 050002 ;173242 050002 BIS R0,R2 ;INSERT NEW CHAR INTO WORD  
3484 006244 000751 ;173244 000751 BR 1$ ;GO GET NEXT CHAR  
3485 ;  
3486 006246 010223 ;173246 010223 2$: MOV R2,(R3)+ ;STORE WORD IN BUFFER
```

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3487 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 2-2
3488
3489 006250 000746 ;173250 000746 BR NXTWRD ;GO FORM NEXT WORD
3490
3491 006252 010223 ;173252 010223 3$: MOV R2,(R3)+ ;STORE CHECKSUM IN BUFFER
3492 ;
3493 ;VERIFY THAT THE CHECKSUM IS ZERO.
3494 006254 012702 ;173254 012702 CHCKIT: MOV #DEABUF,R2 ;ADDRESS OF BUFFER
3495 006256 002310 ;173256 002310
3496 006260 005000 ;173260 005000
3497 006262 062200 ;173262 062200 1$: CLR R0 ;CLEAR CHECKSUM
3498 006264 020203 ;173264 020203 ADD (R2)+,R0 ;ADD NEXT WORD TO CHECKSUM
3499 006266 002775 ;173266 002775 CMP R2,R3 ;REACHED END OF BUFFER YET
3500 006270 005700 ;173270 005700 BLT 1$ ;BRANCH IF NOT
3501 006272 001403 ;173272 001403 TST R0 ;IS CHECKSUM = 0?
3502 006274 004737 ;173274 004737 BEQ LOADIT ;BRANCH IF YES
3503 006276 173346 ;173276 173346 JSR PC,NAKSND ;SEND A NEG ACKNOWLEDGE
3504 006300 000000 ;173300 000000 HALT ;CHECKSUM ERROR
3505 ;
3506 ;LOAD THE RECEIVED DATA WORDS INTO THE DESIGNATED PLACE IN MEMORY.
3507 ;A WORD COUNT OF ZERO INDICATES A TRANSFER BLOCK. START EXECUTING
3508 ;THE LOADED PROGRAM AT THE SPECIFIED ADDRESS.
3509 006302 013700 ;173302 013700 LOADIT: MOV DEABUF,R0 ;GET LOAD WORD COUNT
3510 006304 002310 ;173304 002310
3511 006306 001413 ;173306 001413 BEQ 2$ ;BRANCH IF IT'S ZERO (A TRANSFER BLOCK)
3512 006310 012702 ;173310 012702 MOV #DEABUF+4,R2 ;ADDRESS OF FIRST DATA WORD
3513 006312 002314 ;173312 002314
3514 006314 013701 ;173314 013701 MOV DEABUF+2,R1 ;GET LOAD ADDRESS
3515 006316 002312 ;173316 002312
3516 006320 112221 ;173320 112221 1$: MOVB (R2)+,(R1)+ ;MOVE DATA FROM BUFFER TO MEMORY
3517 006322 112221 ;173322 112221 MOVB (R2)+,(R1)+ ;MOVE DATA FROM BUFFER TO MEMORY
3518 006324 005300 ;173324 005300 DEC R0 ;DECREMENT WORD COUNT
3519 006326 003374 ;173326 003374 BGT 1$ ;BRANCH UNTIL ALL DATA IS LOADED
3520 006330 004737 ;173330 004737 JSR PC,ACKSND ;GO SEND AN ACK
3521 006332 173354 ;173332 173354
3522 006334 000642 ;173334 000642 BR NXTLIN ;GO GET NEXT LINE
3523 ;
3524 006336 004737 ;173336 004737 2$: JSR PC,ACKSND ;GO SEND AN ACK
3525 006340 173354 ;173340 173354
3526 006342 013707 ;173342 013707 MOV DEABUF+2,PC ;START ADDRESS OF LOADED PROGRAM
3527 006344 002312 ;173344 002312
3528 ;
3529 ;
3530 ;NAKSND IS USED TO SEND A NEG ACK BACK TO THE MASTER FRONT END.
3531 ;ACKSND IS USED TO SEND AN ACK.
3532 006346 012700 ;173346 012700 NAKSND: MOV #NAK,R0 ;SETUP ASCII NEG ACK
3533 006350 000025 ;173350 000025
3534 006352 000402 ;173352 000402 BR RESPND ;GO SEND IT
3535 006354 112700 ;173354 112700 ACKSND: MOVB #ACK,R0 ;SETUP ASCII ACK
3536 006356 000006 ;173356 000006
3537 006360 105737 ;173360 105737 RESPND: TSTB @DLXCSR ;IS TRANSMITTER READY?
3538 006362 176004 ;173362 176004
3539 006364 100375 ;173364 100375 BPL RESPND ;WAIT TIL IT IS
3540 006366 110037 ;173366 110037 MOVB R0,@DLXBUF ;SEND ACK/NAK

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3541	006370	176006	:173370	176006				
3542	006372	000207	:173372	000207	RTS	PC		;RETURN TO CALLING ROUTINE
3543		.						
3544	006374	041001	:173374	001	DGQDE:	.BYTE	SYN	
3545		.	:173375	102		.ASCIZ	/B/<CR><LF>	
3546	006376	005015	:173376	005015				
3547	006400	000000	:173400	000				
3548		.	:173401	000	.BYTE	0		
3549	006402	000000	:173402	000	.BYTE	0		
3550		.	:173403	000	.BYTE	0		
3551	006404	000000	:173404	000	.BYTE	0		
3552		.	:173405	000	.BYTE	0		
3553	006406	000000	:173406	000	.BYTE	0		
3554		.	:173407	000	.BYTE	0		
3555	006410	000000	:173410	000	.BYTE	0		

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3556 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 2-3
3557
3558 :173411 000 .BYTE 0
3559 006412 000000 :173412 000 .BYTE 0
3560 :173413 000 .BYTE 0
3561 006414 000000 :173414 000 .BYTE 0
3562 :173415 000 .BYTE 0
3563 006416 000000 :173416 000 .BYTE 0
3564 :173417 000 .BYTE 0
3565 006420 000000 :173420 000 .BYTE 0
3566 :173421 000 .BYTE 0
3567 006422 000000 :173422 000 .BYTE 0
3568 :173423 000 .BYTE 0
3569 006424 000000 :173424 000 .BYTE 0
3570 :173425 000 .BYTE 0
3571 006426 000000 :173426 000 .BYTE 0
3572 :173427 000 .BYTE 0
3573 006430 000000 :173430 000 .BYTE 0
3574 :173431 000 .BYTE 0
3575 006432 000000 :173432 000 .BYTE 0
3576 :173433 000 .BYTE 0
3577 006434 000000 :173434 000 .BYTE 0
3578 :173435 000 .BYTE 0
3579 006436 000000 :173436 000 .BYTE 0
3580 :173437 000 .BYTE 0
3581 006440 000000 :173440 000 .BYTE 0
3582 :173441 000 .BYTE 0
3583 006442 000000 :173442 000 .BYTE 0
3584 :173443 000 .BYTE 0
3585 006444 000000 :173444 000 .BYTE 0
3586 :173445 000 .BYTE 0
3587 006446 000000 :173446 000 .BYTE 0
3588 :173447 000 .BYTE 0
3589 006450 000000 :173450 000 .BYTE 0
3590 :173451 000 .BYTE 0
3591 006452 000000 :173452 000 .BYTE 0
3592 :173453 000 .BYTE 0
3593 006454 000000 :173454 000 .BYTE 0
3594 :173455 000 .BYTE 0
3595 006456 000000 :173456 000 .BYTE 0
3596 :173457 000 .BYTE 0
3597 006460 000000 :173460 000 .BYTE 0
3598 :173461 000 .BYTE 0
3599 006462 000000 :173462 000 .BYTE 0
3600 :173463 000 .BYTE 0
3601 006464 000000 :173464 000 .BYTE 0
3602 :173465 000 .BYTE 0
3603 006466 000000 :173466 000 .BYTE 0
3604 :173467 000 .BYTE 0
3605 006470 000000 :173470 000 .BYTE 0
3606 :173471 000 .BYTE 0
3607 006472 000000 :173472 000 .BYTE 0
3608 :173473 000 .BYTE 0
3609 006474 000000 :173474 000 .BYTE 0

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3610			;173475	000	.BYTE	0
3611	006476	000000	;173476	000	.BYTE	0

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```
3612 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 2-4
3613
3614 :173477 000 .BYTE 0
3615 006500 000000 :173500 000 .BYTE 0
3616 :173501 000 .BYTE 0
3617 006502 000000 :173502 000 .BYTE 0
3618 :173503 000 .BYTE 0
3619 006504 000000 :173504 000 .BYTE 0
3620 :173505 000 .BYTE 0
3621 006506 000000 :173506 000 .BYTE 0
3622 :173507 000 .BYTE 0
3623 006510 000000 :173510 000 .BYTE 0
3624 :173511 000 .BYTE 0
3625 006512 000000 :173512 000 .BYTE 0
3626 :173513 000 .BYTE 0
3627 006514 000000 :173514 000 .BYTE 0
3628 :173515 000 .BYTE 0
3629 006516 000000 :173516 000 .BYTE 0
3630 :173517 000 .BYTE 0
3631 006520 000000 :173520 000 .BYTE 0
3632 :173521 000 .BYTE 0
3633 006522 000000 :173522 000 .BYTE 0
3634 :173523 000 .BYTE 0
3635 006524 000000 :173524 000 .BYTE 0
3636 :173525 000 .BYTE 0
3637 006526 000000 :173526 000 .BYTE 0
3638 :173527 000 .BYTE 0
3639 006530 000000 :173530 000 .BYTE 0
3640 :173531 000 .BYTE 0
3641 006532 000000 :173532 000 .BYTE 0
3642 :173533 000 .BYTE 0
3643 006534 000000 :173534 000 .BYTE 0
3644 :173535 000 .BYTE 0
3645 006536 000000 :173536 000 .BYTE 0
3646 :173537 000 .BYTE 0
3647 ; .EVEN
```

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;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 3

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;
;          .SBTTL REGISTER SAVE ROUTINE
;          REGISTER SAVE ROUTINE
;          REGSAV IS CALLED TO SAVE THE GENERAL REGISTERS R0-R7
;          IN MEMORY AT 40-56 (LOCATION ROTOR7).
;          CALLING SEQUENCE:
;          MOV      R0,ROTOR7+0
;          MOV      #RET,R0
;          BR       REGSAV
;          RET:    <RETURN HERE>
;          ALL REGISTERS RESTORED
;
;          ;          173540          .ROMORG+540
3667 006540 010037 ;173540 010037 REGSAV: MOV      R0,ROTOR7+16 ;SAVE R0 AS PC IN 56
3668 006542 000056 ;173542 000056
3669 ;
3670 006544 012700 ;173544 012700          MOV      #ROTOR7+16,R0 ;R0 NOW POINTS TO 56
3671 006546 000056 ;173546 000056
3672 ;
3673 006550 010640 ;173550 010640          MOV      SP,-(R0) ;SAVE SP IN 54
3674 006552 010540 ;173552 010540          MOV      R5,-(R0) ;SAVE R5 IN 52
3675 006554 010440 ;173554 010440          MOV      R4,-(R0) ;SAVE R4 IN 50
3676 006556 010340 ;173556 010340          MOV      R3,-(R0) ;SAVE R3 IN 46
3677 006560 010240 ;173560 010240          MOV      R2,-(R0) ;SAVE R2 IN 44
3678 006562 010140 ;173562 010140          MOV      R1,-(R0) ;SAVE R1 IN 42
3679 006564 014000 ;173564 014000          MOV      -(R0),R0 ;RESTORE R0 FROM 40
3680 006566 000177 ;173566 000177          JMP      @ROTOR7+16 ;GO TO SAVED PC
3681 006570 004264 ;173570 004264
3682 ;
3683 006572 000000 ;173572 000000          .WORD   0          ;FILLER WORD

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3684 ;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 4
3685 ;
3686 ; .SBTTL DUMP AND BOOTSTRAP THROUGH DTE20
3687 ; INTERNAL BUTTON #4 -- DUMP AND BOOTSTRAP THROUGH DTE20
3688 ;
3689 ; 000040 DTESIZ= 40 ;EACH DTE OCCUPIES 20 WORDS IN EXTERNAL PAGE
3690 ;
3691 ; BUTTON #4 -- INITIATED BY '-10 RELOAD -11' BIT
3692 ;
3693 ; 173574 ;.=ROMORG+574
3694 ;
3695 006574 010037 ;173574 010037 BUTON4: MOV RO,ROTOR7+0 ;SAVE RO IN 40
3696 006576 000040 ;173576 000040
3697 006600 012700 ;173600 012700 MOV #10$,RO ;SET RETURN ADDRESS IN RO
3698 006602 173606 ;173602 173606
3699 006604 000755 ;173604 000755 BR REGSAV ;SAVE R1-R7
3700 ;
3701 ; REGISTERS SAVED-- LOOK FOR THE DTE20 WHICH PUSHED THE BUTTON
3702 ;
3703 ; THE DTE WHICH PUSHED THE BUTTON SHOULD HAVE THE DOORBELL
3704 ; RINGING AND HAVE THE VALUE 1365 (OCTAL) IN IT'S
3705 ; TO -10 BYTE COUNT TO10BC.
3706 ;
3707 ; NXM (TIME-OUT) TRAP IS USED TO SKIP NON-EXISTANT DTE20'S.
3708 ;
3709 006606 005005 ;173606 005005 10$: CLR R5 ;ADDRESS LOCATION ZERO
3710 006610 012500 ;173610 012500 MOV (R5)+,RO ;SAVE 0 IN RO
3711 006612 012501 ;173612 012501 MOV (R5)+,R1 ;SAVE 2 IN R1
3712 006614 011502 ;173614 011502 MOV (R5),R2 ;SAVE 4 IN R2
3713 006616 012725 ;173616 012725 MOV #21$, (R5)+ ;SET NXM TRAP ADDRESS IN 4
3714 006620 173634 ;173620 173634
3715 006622 011503 ;173622 011503 MOV (R5),R3 ;SAVE 6 IN R3
3716 006624 012715 ;173624 012715 MOV #PR7, (R5) ;SET PRIORITY FOR NXM TRAP
3717 006626 000340 ;173626 000340
3718 ;
3719 ; LOOP THROUGH ALL DTE'S
3720 ;
3721 006630 012704 ;173630 012704 20$: MOV #DLYCNT-DTESIZ,R4 ;POINT TO DTE # -1'S DELAY COUNT REGISTER
3722 006632 174340 ;173632 174340
3723 ; (WILL BUMP TO # 0)
3724 ;
3725 ; HERE ON NXM TRAP-- RESET SP AND TRY NEXT DTE
3726 ;
3727 006634 012706 ;173634 012706 21$: MOV #4,SP ;SET SP TO 4, STACK IS LOCATIONS 2 AND 0
3728 006636 000004 ;173636 000004
3729 ;
3730 006640 062704 ;173640 062704 22$: ADD #DTESIZ,R4 ;BUMP TO NEXT DTE'S EXTERNAL PAGE ADDRESS
3731 006642 000040 ;173642 000040
3732 006644 105704 ;173644 105704 TSTB R4 ;IS THIS THE END OF THE DTE'S?
3733 ; ; NOTE THAT THE LAST DTE IS AT 774540
3734 ; ; AND THAT NOW R4= 774600 IF END
3735 006646 100770 ;173646 100770 BMI 20$ ;YES-- START ALL OVER, UNTIL A DTE
3736 ; ; SAYS HE PUSHED THE BUTTON
3737 006650 032764 ;173650 032764 BIT #TO11DB, STAT-DLYCNT(R4) ;DOORBELL RINGING?

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3738	006652	004000	;173652	004000		
3739	006654	000034	;173654	000034		
3740	006656	001770	;173656	001770	BEQ	22\$;NO-- TRY NEXT DTE
3741	006660	026417	;173660	026417	CMP	T010BC-DLYCNT(R4), (PC) ;DOES THIS ONE HAVE 1365
3742	006662	000014	;173662	000014		
3743		:				
3744	006664	001365	;173664	001365	BNE	22\$; IN IT'S TO -10 BYTE COUNT?
3745		:				;NO-- TRY ANOTHER DTE

NO7

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006666 010315 ;173666 010315
006670 010245 ;173670 010245
006672 010145 ;173672 010145
006674 010045 ;173674 010045

006676 012700 ;173676 012700
006700 000130 ;173670 000130
006702 012420 ;173702 012420
006704 022700 ;173704 022700
006706 000156 ;173706 000156
006710 103374 ;173710 103374

006712 005724 ;173712 005724
006714 010401 ;173714 010401
006716 012700 ;173716 012700
006720 000100 ;173720 000100
006722 010021 ;173722 010021

WE HAVE FOUND THE DTE WHICH PUSHED THE BUTTON
ADDRESS OF DLYCNT REGISTER IS IN R4

MOV R3,(R5) ;STORE LOCATION 6
MOV R2,-(R5) ;4
MOV R1,-(R5) ;2
MOV R0,-(R5) ;0

SAVE FIRST 12 DTE REGISTERS DLYCNT TO T011DT
IN LOCATIONS 130-156

MOV #DTESAV,R0 ;POINT TO SAVE AREA
29\$: MOV (R4)+,(R0)+ ;SAVE A REGISTER
CMP #T011DT-DLYCNT+DTESAV,R0 ;FINISHED?
BHS 29\$;NO-- SAVE SOME MORE

R4= T011DT+2

SET R1= STATUS REGISTER
R4= DIAG2 REGISTER

DO 'DIAGNOSTIC RESET' TO CLEAR DOORBELL AND BYTE COUNT
LOADED FLAG

TST (R4)+
MOV R4,R1 ;SO DOES R1
MOV #DRESET,R0 ;SETUP R0 FOR 'DIAGNOSTIC RESET'
MOV R0,(R1)+ ;R1 POINTS TO STATUS REGISTER

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;BM873G - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM MACY11 27(663) 1-JUN-76 09:14 PAGE 6

3782							
3783							
3784							
3785							
3786							
3787							
3788							
3789							
3790							
3791							
3792							
3793	006724	005061	;173724	005061			
3794	006726	177744	;173726	177744			
3795	006730	005061	;173730	005061			
3796	006732	177764	;173732	177764			
3797							
3798	006734	032711	;173734	032711	30\$:	BIT	#T011DB,(R1) ; IS DOORBELL RINGING (TRANSFER COMPLETE)?
3799	006736	004000	;173736	004000			
3800	006740	001775	;173740	001775		BEQ	30\$; NO-- WAIT FOR DOORBELL
3801	006742	010014	;173742	010014		MOV	RD,(R4) ; YES-- CLEAR DOORBELL AND ERROR FLAGS
3802							
3803							
3804							
3805							
3806							
3807							
3808	006744	005061	;173744	005061		CLR	T011AD-STAT(R1) ; START INPUT TO LOCATION 0
3809	006746	177766	;173746	177766			
3810	006750	012761	;173750	012761		MOV	#IFLOP!(<<-256.>&7777),T011BC-STAT(R1) ; 256 WORDS, INTERRUPT
3811	006752	107400	;173752	107400			
3812	006754	177762	;173754	177762			
3813							
3814	006756	032711	;173756	032711	40\$:	BIT	#T011DB,(R1) ; -10 WHEN DONE DOORBELL RINGING (LOAD FINISHED)?
3815	006760	004000	;173760	004000			
3816	006762	001775	;173762	001775		BEQ	40\$; NO-- WAIT UNTIL DONE
3817	006764	010014	;173764	010014		MOV	RD,(R4) ; CLEAR DOORBELL RINGING
3818	006766	012705	;173766	012705		MOV	#BIT15,R5 ; SET R5: BIT15= 1, BIT0= 0
3819	006770	100000	;173770	100000			
3820							
3821	006772	005007	;173772	005007		CLR	PC ; TO SAY BUTTON #4 PRESSED
3822							
3823							
3824							
3825							
3826							
3827	006774	000000;	;173774	000		.BYTE	0
3828			;173775	000		.BYTE	0
3829	006776	END.YG:					
3830	006776	000000;	;173776	000		.BYTE	0
3831			;173777	000		.BYTE	0
3832				000001		.END	

FILL TO END OF ROM

3833 007000
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MAP.YH:
;THE FOLLOWING IS A REPRODUCTION
;OF THE ROM PROGRAM FOR BM873YH.
;IT IS HERE FOR COMPARISON TO THE
;ACTUAL ROM AND FOR REFERENCE
;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 1
;
; .SBTTL TITLE PAGE
; .TITLE BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)
; COPYRIGHT (C) 1975, 1976 DIGITAL EQUIPMENT CORPORATION
; ALL RIGHTS RESERVED
; THIS IS THE CODE TO BE ENCODED IN THE BOOTSTRAP ROM ON THE BM873-YH BOARD
; MODULE: BM873H
; DATE: 10-MAR-76
; AUTHOR: TOM PORCHER
;
; .ENABLE ABS,AMA
; .LIST MEB
; .MCALL \$DEF
; \$DEF
; 000000

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;
; .SBTTL  MACROS AND DEFINITIONS
;
; MACRO TO FILL TO A LOCATION (RELATIVE TO ROM ORIGIN) WITH ZERO BYTES
;
; .MACRO  FILLTO  LOC
; .IFGE <LOC>-<.-ROMORG>
; .IFG <LOC>-<.-ROMORG>
; .IFDF PASS2
; .PRINT <LOC>-<.-ROMORG> ;FREE BYTES AT LOC
; .ENDC
; .REPT <LOC>-<.-ROMORG>
; .BYTE  0
; .ENDR
; .IFF
; .ERROR <.-ROMORG>-<LOC> ;BOUNDARY EXCEEDED AT LOC
; .ENDC
; .ENDM  FILLTO
;
; MACRO TO DO 'MOV #XXX,DEST' OR 'CLR DEST' IF XXX IS ZERO
;
; .MACRO  MOVD   XXX,DEST
; .IFEQ XXX
; CLR   DEST
; .IFF
; MOV   #XXX,DEST
; .ENDC
; .ENDM  MOVD
;
; MACRO TO ADD A SMALL NUMBER TO A REGISTER
; GENERATES ONE OF THE FOLLOWING:
; CMP   -(REG),-(REG) ; -4
; TST   -(REG)        ; -2
; CMPB  -(REG),-(REG) ; -2 (REGISTER MAY BE ODD)
; DEC   REG            ; -1
; <NOTHING>          ; 0
; INC   REG            ; 1
; TST   (REG)+         ; 2
; CMPB  (REG)+,(REG)+ ; 2 (REGISTER MAY BE ODD)
; CMP   (REG)+,(REG)+ ; 4
; ADD   #XXX,REG      ; ANYTHING ELSE
;
; USE THIS MACRO WITH CAUTION, SINCE IT REFERENCES MEMORY
; AND ALSO DOES NOT SET THE CONDITION CODES PROPERLY
;
; .MACRO  ADDX   XXX,REG,ODD
$$$=
; .IFEQ XXX+4
; .IF B <ODD>

```

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;
;

.ENDC CMP -(REG),-(REG)

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```

3916 ;
3917 ;
3918 ; .ENDC
3919 ; .IFEQ XXX+2
3920 ; .IF B <ODD>
3921 ; TST -(REG)
3922 ; .IFF
3923 ; CMPB -(REG),-(REG)
3924 ; .ENDC
3925 ; .ENDC
3926 ; .IFEQ XXX+1
3927 ; DEC REG
3928 ; .ENDC
3929 ; .IFEQ XXX
3930 ; $$$=$$$+2
3931 ; .ENDC
3932 ; .IFEQ XXX-1
3933 ; INC REG
3934 ; .ENDC
3935 ; .IFEQ XXX-2
3936 ; .IF B <ODD>
3937 ; TST (REG)+
3938 ; .IFF
3939 ; CMPB (REG)+,(REG)+
3940 ; .ENDC
3941 ; .ENDC
3942 ; .IFEQ XXX-4
3943 ; .IF B <ODD>
3944 ; CMP (REG)+,(REG)+
3945 ; .ENDC
3946 ; .ENDC
3947 ; .IFEQ $$$-
3948 ; ADD #XXX,REG
3949 ; .ENDC
3950 ; .ENDM ADDX
3951 ;
3952 ;
3953 ; DEFINITIONS . . .
3954 ;
3955 ; 000040 ROTOR7= 40 ;SAVE R0 TO R7 IN 40 TO 56
3956 ;
3957 ; 000130 DTESAV= 130 ;SAVE FIRST 12 DTE REGISTERS DLYCNT TO T011DT
3958 ; ; IN LOCATIONS 130-156
3959 ;
3960 ; 000014 RETRY= 12. ;DO 12 RETRIES BEFORE HALTING
3961 ;
3962 ; .IFNDF TESTVR
3963 ; 173000 ROMORG= 173000 ;ROM STARTS AT 773000
3964 ; .IFF
3965 ; ROMORG= 073000 ;IF TEST, START AT 73000 INSTEAD
3966 ; 000 .ENDC
3967 ;
3968 ; ESTABLISH ROM ORIGIN
3969 ;

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3970
3971

;
;

001 .IF DF TESTVR
 .=ROMORG-2


```

3978 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 3
3979 ;
3980 ;.SBTTL EXTERNAL BUTTONS #1, #2, #3
3981 ;
3982 ;: BUTTON #1 -- LOAD USING SWITCH REGISTER
3983 ;:
3984 ;: BUTON1:
3985 007000 010037 ;173000 010037 MOV RO,ROTOR7+0 ;SAVE RO IN LOCATION 40
3986 007002 000040 ;173002 000040
3987 007004 013700 ;173004 013700 MOV SWR,RO ;GET SWITCH REGISTER
3988 007006 177570 ;173006 177570
3989 007010 032700 ;173010 032700 BIT #BIT0,RO ;IS LOW-ORDER BIT SET?
3990 007012 000001 ;173012 000001
3991 007014 001007 ;173014 001007 BNE BUTONX ;YES-- LOOK AT CONTENTS
3992 007016 000513 ;173016 000513 BR REGSAV ;NO-- SAVE R1-R7 IN 42-56, GO TO ADDRESS IN RO (FROM SWR)
3993 ;:
3994 ;: BUTTON #3 -- LOAD BOOT FROM RX11 FLOPPY DISK
3995 ;:
3996 ;: BUTON3:
3997 007020 005000 ;173020 005000 CLR RO ;SAY LOAD FROM FLOPPY, UNIT 0
3998 007022 000404 ;173022 000404 BR BUTONX ;GO TO COMMON CODE FOR 3 BUTTONS
3999 ;:
4000 ;: REQUIRED POWER-FAIL VECTOR
4001 ;:
4002 ;: FILLTO 24
4003 007024 173000 ;173024 173000 .WORD ROMORG,PR7
4004 007026 000340 ;173026 000340
4005 ;:
4006 ;: BUTTON #2 -- LOAD BOOT FROM RPO4 DISK
4007 ;:
4008 ;: BUTON2:
4009 007030 012700 ;173030 012700 MOV #BIT7,RO ;BIT 7 MEANS LOAD FROM RPO4
4010 007032 000200 ;173032 000200 BR BUTONX ;FALL INTO COMMON CODE
4011 ;:
4012 ;: RO IS SAVED IN R5 AS THE PARAMETER WORD PASSED TO BOOT
4013 ;: AND CONTAINS ONE OF THE FOLLOWING:
4014 ;:
4015 ;: BIT 0 = 1 IF FROM SWITCH REGISTER
4016 ;: BIT 7 = 0 LOAD FROM RX11 FLOPPY DISK (OR TC11 DECTAPE)
4017 ;: BIT 7 = 1 LOAD FROM RPO4 DISK
4018 ;: BIT 15 = 1 INDEFINITE RETRY
4019 ;:
4020 ;:
4021 ;: BUTONX:
4022 007034 010005 ;173034 010005 MOV RO,R5 ;SAVE PARAMETER FOR BOOT
4023 007036 106300 ;173036 106300 ASLB RO ;LEFT-ALIGN SPEED FIELD IN LOW BYTE
4024 007040 122700 ;173040 122700 CMPB #3*BIT4,RO ;IS SPEED 0, 1, OR 2?
4025 007042 000060 ;173042 000060
4026 007044 101001 ;173044 101001 BHI 10$ ;YES-- UNIT IS UNIT TO USE
4027 007046 005000 ;173046 005000 CLR RO ;NO-- USE UNIT #0
4028 ;:
4029 007050 000300 ;173050 000300 10$: SWAB RO ;GET UNIT # IN LOW BYTE
4030 007052 042700 ;173052 042700 BIC #1C7,RO ;TRIM TO 3 BITS 2, 1, 0
4031 007054 177770 ;173054 177770

```


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ROM CONTENTS TABLES

4043 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 3-1
4044
4045 007070 005037 ;173070 005037 CLR 6 ; . .
4046 007072 000006 ;173072 000006 ;
4047 ; BR RXBOOT ;TRY FLOPPY FIRST

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;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 4

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4100
4101

```

;
; .SBTTL RX11 FLOPPY DISK BOOTSTRAP ROUTINES
;
; RX11 REGISTER DEFINITIONS
;
; 177170 RXEPA= 177170 ;EXTERNAL PAGE ADDR OF FLOPPY
;
; 000000 RXCS= 0 ;OFFSET FOR CSR
; 100000 RXERR= BIT15 ;ERROR
; 000200 RXTREQ= BIT7 ;TRANSFER REQUEST
; 000040 RXDONE= BIT5 ;TRANSFER DONE
; 000020 RXUNIT= BIT4 ;UNIT NUMBER 1
; 000016 RXFUNC= BIT3!BIT2!BIT1 ;FUNCTION:
; 000000 RXFILL= 0 ; FILL SILO
; 000002 RXEMPT= 2 ; EMPTY SILO
; 000004 RXWRIT= 4 ; WRITE SECTOR
; 000006 RXREAD= 6 ; READ SECTOR
; 000016 RXRERR= 16 ; READ ERROR REGISTER
; 000001 RXGO= BIT0 ;GO BIT
; 000002 RXDB= 2 ;MULTI-PURPOSE DATA BUFFER REGISTER

```

NOTE THAT THE BOOTSTRAP IS WRITTEN IN LOGICAL BLOCK 0 WHICH IS TRACK 1, SECTORS 1, 3, 5, 7. ONLY SECTOR 1 IS READ BY THE ROM.

REGISTER USAGE:

- R0 -- READ FUNCTION WITH UNIT SELECT SET
- R1 -- ADDRESS OF RXCS
- R2 -- ADDRESS OF RXDB
- R3 -- UNIT #
- R4 -- DATA ADDRESS (TO READ OR WRITE)
- R5 -- PARAMETER WORD SAVED FROM INITIALIZATION
- SP -- RETRY COUNTER

HERE TO BOOT FROM RX11 FLOPPY DISK-- UNIT # IN R0

RXBOOT:

```

MOV #RETRY, SP ;SET RETRY COUNT
MOV #RXEPA+RXCS, R1 ;ADDRESS CONTROL STATUS REGISTER FOR RX11
MOV R0, R3 ;COPY UNIT #
BR RXRTRY ;FALL THROUGH RETRY CHECK

```

HERE ON ERROR TO RETRY

RXRTRY:

```

TST R5 ;INDEFINITE RETRY?
BMI RXRSET ;YES-- TRY FAITHFULLY
DEC SP ;NO-- DECREMENT RETRY COUNT

```

```

; 173074
007074 012706 ; 173074 012706
007076 000014 ; 173076 000014
007100 012701 ; 173100 012701
007102 177170 ; 173102 177170
007104 010003 ; 173104 010003
;
; 173106
007106 005705 ; 173106 005705
007110 100402 ; 173110 100402
007112 005306 ; 173112 005306

```

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4102 007114 002445 ;173114 002445
4103
4104
4105

BLT RXEHLT

;GIVE UP IF RUN OUT

;
; HERE TO START TRANSFER
;

NO8

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4106 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 4-1
4107
4108 ;173116 RXRSET:
4109 007116 000005 ;173116 000005 RESET ;CLEAR THE WORLD
4110 ;173120 20$:
4111 007120 032711 ;173120 032711 BIT #RXDONE,(R1) ;WAIT UNTIL READY FOR FUNCTION
4112 007122 000040 ;173122 000040
4113 007124 001775 ;173124 001775 BEQ 20$ ;NOT YET-- WAIT
4114 ; BR RXPERF ;JUST DO FIRST READ
4115 ;
4116 ; HERE TO PERFORM READ, UNIT # IN R0
4117 ;
4118 ;173126 RXPERF:
4119 007126 010300 ;173126 010300 MOV R3,R0 ;GET UNIT #
4120 007130 001402 ;173130 001402 BEQ 5$ ;ZERO-- USE ZERO
4121 007132 012700 ;173132 012700 MOV #RXUNIT,R0 ;NON-ZERO-- ASSUME UNIT #1
4122 007134 000020 ;173134 000020
4123 ;173136 5$:
4124 007136 052700 ;173136 052700 BIS #RXREAD+RXGO,R0 ;SET READ FUNCTION
4125 007140 000007 ;173140 000007
4126 ;
4127 ;173142 MOV R1,R2 ;COPY ADDRESS OF RXCS
4128 007144 010022 ;173144 010022 MOV R0,(R2)+ ;START READ FUNCTION, R2 NOW POINTS TO RXDB
4129 ;173146 10$:
4130 007146 105711 ;173146 105711 TSTB (R1) ;READY?
4131 007150 100376 ;173150 100376 BPL 10$ ;NO-- WAIT
4132 007152 012712 ;173152 012712 MOV #1,(R2) ;SET SECTOR #
4133 007154 000001 ;173154 000001
4134 ;173156 20$:
4135 007156 105711 ;173156 105711 TSTB (R1) ;READY FOR TRACK?
4136 007160 100376 ;173160 100376 BPL 20$ ;NO-- WAIT
4137 007162 012712 ;173162 012712 MOV #1,(R2) ;SET TRACK #
4138 007164 000001 ;173164 000001
4139 ;173166 30$:
4140 007166 032711 ;173166 032711 BIT #RXERR!RXDONE,(R1) ;DONE OR ERROR?
4141 007170 100040 ;173170 100040
4142 007172 001775 ;173172 001775 BEQ 30$ ;NO-- WAIT
4143 007174 100744 ;173174 100744 BMI RXRTRY ;YES-- ERROR IN FUNCTION
4144 ;
4145 ; READ COMPLETED-- EMPTY SILO TO MEMORY
4146 ;
4147 ;173176 RXEMSL:
4148 007176 012711 ;173176 012711 MOV #RXEMPT+RXGO,(R1) ;START EMPTY
4149 007200 000003 ;173170 000003
4150 007202 005004 ;173202 005004 CLR R4 ;ALWAYS START TRANSFER AT LOCATION ZERO
4151 ;173204 10$:
4152 007204 132711 ;173204 132711 BITB #RXTREQ!RXDONE,(R1) ;READY FOR WORK, OR TRANSFER DONE?
4153 007206 000240 ;173206 000240
4154 007210 001775 ;173210 001775 BEQ 10$ ;NOT READY-- WAIT A LITTLE MORE
4155 007212 100153 ;173212 100153 BPL CLRPC ;DONE-- GO TO LOCATION 0
4156 007214 111224 ;173214 111224 MOVB (R2),(R4)+ ;NOT DONE-- GET A BYTE FROM SILO TO MEMORY
4157 007216 000772 ;173216 000772 BR 10$ ;WAIT FOR NEXT BYTE
4158 ;
4159 ; REQUIRED POWER-FAIL VECTOR

```

4160									
4161			;173220			FILLTO	224		
4162	007220	000000	;173220	000		.BYTE	0		
4163			;173221	000		.BYTE	0		
4164	007222	000000	;173222	000		.BYTE	0		
4165			;173223	000		.BYTE	0		
4166	007224	173000	;173224	173000		.WORD	ROMORG,PR7		
4167	007226	000340	;173226	000340					
4168									
4169									

; HERE ON ERROR AFTER RETRYING -- DISPLAY ERROR REGISTER AND HALT

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;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 4-2

4170							
4171							
4172							
4173							
4174	007230	012711	:173230	012711	RXEHLT:	MOV	#RXRERR+RXGO,(R1) ;DO A READ ERROR REGISTER FUNCTION
4175	007232	000017	:173230	000017			
4176			:173232		10\$:		
4177	007234	032711	:173234	032711		BIT	#RXDONE,(R1) ;WAIT UNTIL ERROR ASSEMBLED
4178	007236	000040	:173234	000040			
4179	007240	001775	:173236	001775		BEQ	10\$
4180	007242	011200	:173240	011200		MOV	(R2),R0 ;GET ERROR REGISTER
4181	007244	000541	:173242	000541		BR	HALTED ;HALT AND DISPLAY ERRORS
			:173244				


```

4212 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 6
4213
4214 :
4215 ;
4216 ; TC11 REGISTER DEFINITIONS
4217 ;
4218 ; TCEPA= 177340 ;EXTERNAL PAGE ADDRESS OF TC-11
4219 :
4220 ; TCST= 0 ;STATUS REGISTER
4221 ; 100000 ;TCENDZ= BIT15 ;END-ZONE DETECTED
4222 ; 000002 ;TCCM= 2 ;COMMAND REGISTER
4223 ; 100000 ;TCERR= BIT15 ;ERROR
4224 ; 004000 ;TCREV= BIT11 ;REVERSE DIRECTION (TOWARD FORWARD END-ZONE)
4225 ; 003400 ;TCUNIT= BIT10!BIT9!BIT8 ;UNIT SELECT
4226 ;
4227 ; TCRDY= BIT7 ;READY
4228 ; 000016 ;TCFUNC= BIT3!BIT2!BIT1 ;FUNCTION:
4229 ; 000000 ; TCSATM= 0*BIT1 ; STOP ALL TAPE MOTION
4230 ; 000002 ; TCRNUM= 1*BIT1 ; READ BLOCK NUMBER
4231 ; 000004 ; TCREAD= 2*BIT1 ; READ DATA
4232 ; 000001 ;TCGO= BIT0 ;START FUNCTION
4233 ; 000004 ;TCWC= 4 ;WORD COUNT REGISTER
4234 ; 000006 ;TCBA= 6 ;BUS ADDRESS REGISTER
4235 ;
4236 ; REGISTER USAGE:
4237 ; RO -- UNIT #
4238 ; RI -- ADDRESS OF TCCM
4239 ; RS -- PARAMETER WORD SAVED FROM INITIALIZATION
4240 ;
4241 ; HERE TO START ROM TO BOOT FROM DECTAPE # 0, AS IF
4242 ; DECTAPE BUTTON WERE PUSHED, IN CASE FLOPPY EXISTS.
4243 ;
4244 ;TCBOTO:
4245 007300 005000 ;173300 005000 CLR RO ;HERE TO START WITH A FLOPPY, FROM UNIT 0
4246 007302 005005 ;173302 005005 CLR RS
4247 ; BR TCBOOT ;GO BOOT
4248 ;
4249 ; HERE TO BOOT FROM BLOCK 0 OF DECTAPE, UNIT # IN RO
4250 ;
4251 ;TCBOOT:
4252 007304 012706 ;173304 012706 MOV #RETRY,SP ;INIT RETRY COUNTER
4253 007306 000014 ;173306 000014 MOV #TCEPA+TCCM,R1 ;POINT TO COMMAND REGISTER
4254 007310 012701 ;173310 012701
4255 007312 177342 ;173312 177342 BR TCRTRY ;TRY IT
4256 ;
4257 ; HERE ON ERROR TO RETRY
4258 ;
4259 ;TCRTRY:
4260 ;173314
4261 007314 005705 ;173314 005705 TST R5 ;INDEFINITE RETRY?
4262 007316 100402 ;173316 100402 BMI 10$ ;YES-- TRY HARDER
4263 007320 005306 ;173320 005306 DEC SP ;NO-- DECREMENT COUNT
4264 007322 002427 ;173322 002427 BLT TCEHLT ;TOO MANY-- GIVE UP
4265 ;173324
10$:

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4266	007324	000005	;173324	000005	RESET		;CLEAR TC11
4267	007326	010003	;173326	010003	MOV	R0,R3	;GET UNIT NUMBER
4268	007330	000303	;173330	000303	SWAB	R3	;TO BITS 10-8
4269	007332	010304	;173332	010304	MOV	R3,R4	;COPY FOR READ FUNCTION

```

4270 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 6-1
4271
4272 007334 052703 ;173334 052703 BIS #TCREV+TCRNUM+TCGO,R3 ;START TAPE TOWARD FOWARD END-ZONE (BLOCK 0)
4273 007336 004003 ;173336 004003
4274 007340 010311 ;173340 010311 MOV R3,(R1) ;. . .
4275 ;173342 20$:
4276 007342 005711 ;173342 005711 TST (R1) ;ERROR?
4277 007344 100376 ;173344 100376 BPL 20$ ;NO-- WAIT FOR END-ZONE ERROR
4278 007346 005761 ;173346 005761 TST TCST-TCCM(R1) ;END-ZONE UP YET?
4279 007350 177776 ;173350 177776
4280 007352 100360 ;173352 100360 BPL TCRTY ;NO-- MUST BE OTHER ERROR
4281 ;
4282 007354 012761 ;173354 012761 MOV #-256.,TCWC-TCCM(R1) ;SET WORD COUNT
4283 007356 177400 ;173356 177400
4284 007360 000002 ;173360 000002
4285 ;
4286 007362 052704 ;173362 052704 BIS #TCREAD+TCGO,R4 ;NOTE THAT "RESET" CLEARS BUS ADDRESS REGISTER.
4287 007364 000005 ;173364 000005 ;START READ, FORWARD
4288 007366 010411 ;173366 010411 MOV R4,(R1) ;. . .
4289 ;173370 30$:
4290 007370 105711 ;173370 105711 TSTB (R1) ;TRANSFER DONE?
4291 007372 100376 ;173372 100376 BPL 30$ ;NO-- WAIT SOME MORE
4292 007374 005711 ;173374 005711 TST (R1) ;YES-- ERROR?
4293 007376 100746 ;173376 100746 BMI TCRTY ;YES-- RETRY
4294 007400 000460 ;173400 000460 BR CLRPC ;NO-- DONE-- GOTO LOCATION C
4295 ;
4296 ; HERE ON TC11 ERROR
4297 ;
4298 ;173402 †CEHLT:
4299 007402 016100 ;173402 016100 MOV TCST-TCCM(R1),R0 ;GET STATUS REGISTER
4300 007404 177776 ;173404 177776
4301 007406 000460 ;173406 000460 BR HALTED ;AND STOP

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4302 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 7
4303 ;
4304 ; .SBTTL RPO4 DISK BOOTSTRAP ROUTINES
4305 ;
4306 ; RPO4 REGISTER DEFINITIONS
4307 ;
4308 ; 176700 RPEPA= 176700 ;EXTERNAL PAGE ADDRESS OF RPO4 REGISTERS
4309 ;
4310 ; 000000 RPCS1= 0 ;OFFSET FOR CSR #1
4311 ; 040000 RPTRE= BIT14 ;TRANSFER ERROR
4312 ; 020000 RPMCPE= BIT13 ;MASSBUS CONTROL PARITY ERROR
4313 ; 004000 RPDVA= BIT11 ;DRIVE AVAILABLE (TO -11)
4314 ; 000200 RPRDY= BIT7 ;FUNCTION COMPLETE
4315 ; 000076 RPFUNC= BITS!BIT4!BIT3!BIT2!BIT1 ;FUNCTION:
4316 ; 000020 RPPRST= 20 ; READ-IN PRESET
4317 ; 000060 RPWRIT= 60 ; WRITE DATA
4318 ; 000070 RPREAD= 70 ; READ DATA
4319 ; 000001 RPGR= BIT0 ;GO
4320 ; 000002 RPWC= 2 ;WORD COUNT REGISTER
4321 ; 000006 RPDA= 6 ;TRACK (HIGH BYTE) SECTOR (LOW BYTE)
4322 ; 000010 RPCS2= 10 ;CONTROL AND STATUS REGISTER #2
4323 ; 000007 RPUNIT= BIT2!BIT1!BIT0 ;UNIT #
4324 ; 000012 RPDS= 12 ;DRIVE STATUS REGISTER
4325 ; 100000 RPATA= BIT15 ;ATTENTION ACTIVE
4326 ; 040000 RPERR= BIT14 ;DRIVE ERROR
4327 ; 000014 RPER1= 14 ;ERROR REGISTER #1
4328 ; 000020 RPFER= BIT4 ;FORMAT ERROR
4329 ; 000032 RPOF= 32 ;OFFSET REGISTER
4330 ; 010000 RPFM22= BIT12 ;22 SECTOR (16 BIT) FORMAT
4331 ; 004000 RPECCI= BIT11 ;INHIBIT ECC CORRECTION
4332 ; 000034 RPDC= 34 ;DESIRED CYLINDER
4333 ;
4334 ; REGISTER USAGE:
4335 ; R0 -- UNIT #
4336 ; R1 -- ADDRESS OF RPCS1
4337 ; R2 -- DATA FOR RPOF: RPECCI (ECC INHIBIT), RPFM22 (22 SECTOR FORMAT)
4338 ; R5 -- PARAMETER WORD SAVED FROM INITIALIZATION
4339 ; SP -- RETRY COUNTER
4340 ;
4341 ; HERE TO BOOT FROM RPO4-- UNIT # IN R0
4342 ;
4343 ; START RPO4 GOING ON BOOT
4344 ;
4345 ;
4346 ;
4347 ; RPBOOT:
4348 007410 012706 ;173410 012706 MOV #RETRY,SP ;RETRY RETRY TIMES
4349 007412 000014 ;173412 000014
4350 007414 012701 ;173414 012701 MOV #RPEPA+RPCS1,R1 ;ADDRESS RPCS1 IN R1
4351 007416 176700 ;173416 176700
4352 007420 012702 ;173420 012702 MOV #RPECCI,R2 ;SET ECC INHIBIT, 20 SECTOR MODE
4353 007422 004000 ;173422 004000
4354 ;
4355 ; BR RPRTRY ;FALL THROUGH RETRY CODE

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4361 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 7-1
4362
4363 007430 005306 ;173430 005306 DEC SP ;RETRY COUNT EXHAUSTED?
4364 007432 002444 ;173432 002444 BLT RPEHLT ;YES-- GIVE UP
4365 ;173434
10$:
4366 007434 000005 ;173434 000005 RESET ;ZAP!!
4367 007436 110061 ;173436 110061 MOVB RD,RPCS2(R1) ;SELECT PROPER UNIT #
4368 007440 000010 ;173440 000010
4369 007442 032711 ;173442 032711 BIT #RPDVA,(R1) ;IS DRIVE AVAILABLE TO US?
4370 007444 004000 ;173444 004000
4371 007446 001766 ;173446 001766 BEQ RPRTRY ;NO-- TRY AGAIN
4372 007450 012711 ;173450 012711 MOV #RPPRST+RPGO,(R1) ;DO 'READ-IN PRESET' FUNCTION
4373 007452 000021 ;173452 000021
4374 007454 005061 ;173454 005061 CLR RPDC(R1) ;SET CYLINDER 0
4375 007456 000034 ;173456 000034
4376 007460 005061 ;173460 005061 CLR RPDA(R1) ; TRACK 0, SECTOR 0
4377 007462 000006 ;173462 000006
4378 007464 050261 ;173464 050261 BIS R2,RPOF(R1) ;SET INHIBIT ECC, 22-SECTOR FORMAT (IF FORMAT ERROR)
4379 007466 000032 ;173466 000032
4380 007470 012761 ;173470 012761 MOV #-256.,RPMC(R1) ;SET UP WORD COUNT TO PROPER VALUE
4381 007472 177400 ;173472 177400
4382 007474 000002 ;173474 000002
4383 ;
;NOTE THAT IT IS NOT NECCESARY TO SET UP BUS
4384 ; ; ADDRESS, SINCE IT IS 0 AFTER READ-IN PRESET
4385 007476 012711 ;173476 012711 MOV #RPREAD+RPGO,(R1) ;START READ FUNCTION
4386 007500 000071 ;173470 000071
4387 ;173502
20$:
4388 007502 105711 ;173502 105711 TSTB (R1) ;READY?
4389 007504 100376 ;173504 100376 BPL 20$ ;NO-- WAIT UNTIL IT IS
4390 007506 032761 ;173506 032761 BIT #RPFER,RPER1(R1) ;FORMAT ERROR?
4391 007510 000020 ;173510 000020
4392 007512 000014 ;173512 000014
4393 007514 001403 ;173514 001403 BEQ 30$ ;NO-- TPY AGAIN
4394 007516 052702 ;173516 052702 BIS #RPFM22,R2 ;YES-- TRY FOR 22 SECTOR FLAVOR
4395 007520 010000 ;173520 010000
4396 007522 000740 ;173522 000740 BR RPRTRY ;TRY AGAIN
4397
30$:
4398 ;173524
4399 007524 032711 ;173524 032711 BIT #RPTRE!RPMCPE,(R1) ;TRANSFER OR MBC PARITY ERROR?
4400 007526 060000 ;173526 060000
4401 007530 001335 ;173530 001335 BNE RPRTRY ;YES-- ERROR-- TRY AGAIN
4402 007532 032761 ;173532 032761 BIT #RPATA!RPERR,RPDS(R1) ;ATTN OR OTHER ERROR?
4403 007534 140000 ;173534 140000
4404 007536 000012 ;173536 000012
4405 007540 001331 ;173540 001331 BNE RPRTRY ;YES-- ERROR-- TRY AGAIN
4406 ; BR CLRPC ;NO ERRORS-- GO TO LOCATION 0
4407 ;
; HERE TO GO TO 0
4408 ;
4409 ;
4410 ;
CLRPC:
4411 007542 005007 ;173542 005007 CLR PC ;JMP 0
4412 ;
; HERE ON ERROR FROM RP04 AFTER RETRYING-- DISPLAY DRIVE STATUS IN RD
4413 ;
4414 ;

```

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4415			;173544	RPEHLT:			
4416	007544	016100	;173544 016100		MOV	RPDS(R1),R0	;DISPLAY DRIVE STATUS
4417	007546	000012	;173546 000012				
4418				:	BR	HALTED	;R.I.P.
4419				:			
4420			;173550	HALTED:			
4421	007550	000000	;173550 000000		HALT		;DIE
4422	007552	000776	;173552 000776		BR	HALTED	;STAY DEAD

;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 8

: .SBTTL INTERNAL BUTTON #4 -- DUMP AND BOOTSTRAP THROUGH DTE20

: DTE20 DEFINITIONS

: NOTE THAT ALL DTE20 REGISTER DEFINITIONS AND BIT DEFINITIONS
: ARE IN \$DEF IN SYSMAC.SML

: ;
: 000040 DTESIZ= 40 ;EACH DTE OCCUPIES 20 WORDS IN EXTERNAL PAGE
: 000004 DTEMAX= 4 ;MAX OF 4 DTE'S ON A PDP-11

: BUTTON #4 -- INITIATED BY '-10 RELOAD -11' BIT

: BUTON4:
: 007554 010037 ;173554 010037 MOV R0,ROTOR7+0 ;SAVE R0 IN 40
: 007556 000040 ;173556 000040 MOV #10\$,R0 ;SET RETURN ADDRESS IN R0
: 007560 012700 ;173560 012700 MOV #10\$,R0 ;SET RETURN ADDRESS IN R0
: 007562 173566 ;173562 173566 BR REGSAV ;SAVE R1-R7
: 007564 000630 ;173564 000630

: REGISTERS SAVED-- LOOK FOR THE DTE20 WHICH PUSHED THE BUTTON

: THE DTE WHICH PUSHED THE BUTTON SHOULD HAVE THE DOORBELL
: RINGING AND HAVE THE VALUE 1365 (OCTAL) IN IT'S
: TO -10 BYTE COUNT T010BC.

: NXM (TIME-OUT) TRAP IS USED TO SKIP NON-EXISTANT DTE20'S.

: 10\$:
: 007566 005005 ;173566 005005 CLR R5 ;ADDRESS LOCATION ZERO
: 007570 012500 ;173570 012500 MOV (R5)+,R0 ;SAVE 0 IN R0
: 007572 012501 ;173572 012501 MOV (R5)+,R1 ;SAVE 2 IN R1
: 007574 011502 ;173574 011502 MOV (R5),R2 ;SAVE 4 IN R2
: 007576 012725 ;173576 012725 MOV #21\$, (R5)+ ;SET NXM TRAP ADDRESS IN 4
: 007600 173612 ;173570 173612
: 007602 011503 ;173602 011503 MOV (R5),R3 ;SAVE 6 IN R3
: 007604 005015 ;173604 005015 CLR (R5) ;SET PS FOR TRAP

: LOOP THROUGH ALL DTE'S

: 20\$:
: 007606 012704 ;173606 012704 MOV #DLYCNT-DTESIZ,R4 ;POINT TO DTE # -1'S DELAY COUNT REGISTER
: 007610 174340 ;173610 174340 ; (WILL BUMP TO # 0)

: HERE ON NXM TRAP-- RESET SP AND TRY NEXT DTE

: 21\$:
: 007612 012706 ;173612 012706 MOV #4,SP ;SET SP TO 4, STACK IS LOCATIONS 2 AND 0
: 007614 000004 ;173614 000004

: 22\$:
: 007616 062704 ;173616 062704 ADD #DTESIZ,R4 ;BUMP TO NEXT DTE'S EXTERNAL PAGE ADDRESS

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4477	007620	000040	;173620	000040			
4478	007622	105704	;173622	105704	TSTB	R4	; IS THIS THE END OF THE DTE'S?
4479		:					; NOTE THAT THE LAST DTE IS AT 774540
4480		:					; AND THAT NOW R4= 774600 IF END
4481	007624	100770	;173624	100770	BMI	20\$; YES-- START ALL OVER, UNTIL A DTE
4482		:					; SAYS HE PUSHED THE BUTTON
4483	007626	032764	;173626	032764	BIT	*T011DB,STAT-DLYCNT(R4)	; DOORBELL RINGING?
4484	007630	004000	;173630	004000			
4485	007632	000034	;173632	000034			
4486	007634	001770	;173634	001770	BEQ	22\$; NO-- TRY NEXT DTE

N09

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;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 8-1

```

4487      ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 8-1
4488
4489 007636 026417 ;173636 026417          CMP      T010BC-DLYCNT(R4),(PC) ;DOES THIS ONE HAVE 1365
4490 007640 000014 ;173640 000014
4491      ;
4492 007642 001365 ;173642 001365          BNE      29$          ;NO-- TRY ANOTHER DTE
4493      ;
4494      ; WE HAVE FOUND THE DTE WHICH PUSHED THE BUTTON
4495      ;
4496      ; ADDRESS OF DLYCNT REGISTER IS IN R4
4497      ;
4498 007644 010315 ;173644 010315          MOV      R3,(R5)          ;RESTORE LOCATION 6
4499 007646 010245 ;173646 010245          MOV      R2,-(R5)          ; 4
4500 007650 010145 ;173650 010145          MOV      R1,-(R5)          ; 2
4501 007652 010045 ;173652 010045          MOV      R0,-(R5)          ; 0
4502      ;
4503      ; SAVE FIRST 12 DTE REGISTERS DLYCNT TO T011DT
4504      ; IN LOCATIONS 130-156
4505      ;
4506 007654 012700 ;173654 012700          MOV      #DTESAV,R0          ;POINT TO SAVE AREA
4507 007656 000130 ;173656 000130
4508      ;
4509 007660 012420 ;173660 012420          MOV      (R4)+,(R0)+          ;SAVE A REGISTER
4510 007662 022700 ;173662 022700          CMP      #T011DT-DLYCNT+DTESAV,R0 ;FINISHED?
4511 007664 000156 ;173664 000156
4512 007666 103374 ;173666 103374          BHS      29$          ;NO-- SAVE SOME MORE
4513      ;
4514      ; R4= T011DT+2
4515      ;
4516      ; SET R1= STATUS REGISTER
4517      ; R4= DIAG2 REGISTER
4518      ;
4519      ; DO 'DIAGNOSTIC RESET' TO CLEAR DOORBELL AND BYTE COUNT
4520      ; LOADED FLAG
4521      ;
4522      ;
4523 007670 005724 ;173670 005724          ADDX    DIAG2-T011DT-2,R4 ;R4 POINTS TO DIAG2 REGISTER
4524 007672 010401 ;173672 010401          TST     (R4)+
4525 007674 012700 ;173674 012700          MOV     R4,R1          ; SO DOES R1
4526 007676 000100 ;173676 000100          MOV     #DRESET,R0          ;SETUP R0 FOR 'DIAGNOSTIC RESET'
4527 007700 010021 ;173700 010021          MOV     R0,(R1)+          ;R1 POINTS TO STATUS REGISTER
4528      ;
4529      ;
4530      ; REGISTERS:
4531      ; R0 -- DRESET (DIAGNOSTIC RESET FUNCTION)
4532      ; R1 -- STAT (STATUS REGISTER)
4533      ; R4 -- DIAG2 (DIAGNOSTIC REGISTER #2, WHERE DRESET IS)
4534      ;
4535      ; THE -10 WILL NOW START READING -11 MEMORY, AS SOON AS WE SET
4536      ; THE TO -10 ADDRESS. WHEN FINISHED, THE -10 WILL RING OUR DOORBELL.
4537 007702 005061 ;173702 005061          CLR     DLYCNT-STAT(R1) ;SET DTE20 FOR MAXIMUM DELAY (ZERO)
4538 007704 177744 ;173704 177744
4539 007706 005061 ;173706 005061          CLR     T010AD-STAT(R1) ;START DUMPING -11 MEMORY TO -10
4540 007710 177764 ;173710 177764

```

B10

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```
4541 ; ; STARTING AT LOCATION 0
4542 ;:173712 30$:
4543 007712 032711 ;:173712 032711 BIT #T011DB,(R1) ; IS DOORBELL RINGING (TRANSFER COMPLETE)?
4544 007714 004000 ;:173714 004000
4545 007716 001775 ;:173716 001775 BEQ 30$ ; NO-- WAIT FOR DOORBELL
4546 007720 010014 ;:173720 010014 MOV R0,(R4) ; YES-- CLEAR DOORBELL AND ERROR FLAGS
4547 ;
4548 ; NOW THE -10 WILL GIVE US A 256 WORD BOOTSTRAP TO BE READ
4549 ; INTO -11 MEMORY STARTING AT LOCATION 0. WHEN FINISHED.
```

C10

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4550 ;BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23) MACY11 27(666) 17-AUG-76 16:19 PAGE 8-2
4551
4552 ; THE -10 WILL RING OUR DOORBELL, AND WE WILL START EXECUTION
4553 ; OF THE LOADED CODE AT LOCATION 0.
4554 ;
4555 007722 005061 ;173722 005061 CLR T011AD-STAT(R1) ;START INPUT TO LOCATION 0
4556 007724 177766 ;173724 177766
4557 007726 012761 ;173726 012761 MOV #IFLOP!<<-256.>&7777>,T011BC-STAT(R1) ;256 WORDS, INTERRUPT
4558 007730 107400 ;173730 107400
4559 007732 177762 ;173732 177762
4560 ; ; -10 WHEN DONE
4561 ;173734 40$: BIT #T011DN,(R1) ;TRANSFER COMPLETE?
4562 007734 032711 ;173734 032711
4563 007736 000200 ;173736 000200
4564 007740 001775 ;173740 001775 BEQ 40$ ;NO-- WAIT UNTIL DONE
4565 007742 005007 ;173742 005007 CLR PC ;GO TO LOADED CODE, STARTING AT
4566 ; ; LOCATION 0

```

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4567      :BM873H - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 3(23)  MACY11 27(666) 17-AUG-76 16:19 PAGE 9
4568
4569      ;                               .SBTTL  FILL TO END OF ROM
4570
4571      ;
4572      ;173744      FILLTO 1000
4573  007744  000000  ;173744      000      .BYTE  0
4574      ;173745      000      .BYTE  0
4575  007746  000000  ;173746      000      .BYTE  0
4576      ;173747      000      .BYTE  0
4577  007750  000000  ;173750      000      .BYTE  0
4578      ;173751      000      .BYTE  0
4579  007752  000000  ;173752      000      .BYTE  0
4580      ;173753      000      .BYTE  0
4581  007754  000000  ;173754      000      .BYTE  0
4582      ;173755      000      .BYTE  0
4583  007756  000000  ;173756      000      .BYTE  0
4584      ;173757      000      .BYTE  0
4585  007760  000000  ;173760      000      .BYTE  0
4586      ;173761      000      .BYTE  0
4587  007762  000000  ;173762      000      .BYTE  0
4588      ;173763      000      .BYTE  0
4589  007764  000000  ;173764      000      .BYTE  0
4590      ;173765      000      .BYTE  0
4591  007766  000000  ;173766      000      .BYTE  0
4592      ;173767      000      .BYTE  0
4593  007770  000000  ;173770      000      .BYTE  0
4594      ;173771      000      .BYTE  0
4595  007772  000000  ;173772      000      .BYTE  0
4596      ;173773      000      .BYTE  0
4597  007774  000000  ;173774      000      .BYTE  0
4598      ;173775      000      .BYTE  0
4599  007776  END. YH:
4600  007776  000000  ;173776      000      .BYTE  0
4601      ;173777      000      .BYTE  0
4602      ;
4603      ;
4604      ;
4605      ;174000      PASS2:
4606      ;                               000001      .ENC

```

E10

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4607	010000	000177	MAP.Y.: .BLKW	127.
4608	010376	000001	END.Y.: .BLKW	1
4609	010400	000177	MAP.YX: .BLKW	127.
4610	010776	000001	END.YX: .BLKW	1

F10

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4611
4612
4613
4614
4615 011000
4616 011000 012706 001100
4617 011004 005026
4618 011006 022706 001136
4619 011012 001374
4620 011014 012706 001100
4621 011020 012737 017372 000020
4622 011026 012737 000340 000022
4623 011034 012737 017466 000030
4624 011042 012737 000340 000032
4625 011050 012737 020016 000034
4626 011056 012737 000340 000036
4627 011064 012767 011064 170014
4628 011072 005067 001246
4629 011076 005067 001232
4630 011102 012706 001100
4631 011106 005067 170104
4632 011112 005037 000000
4633 011116 012767 011102 005404
4634 011124 012737 000006 000004
4635 011132 005037 000006
4636 011136 005067 004710
4637 011142 005737 000042
4638 011146 001002
4639 011150 000167 000522
4640 011154 013746 000004
4641 011160 012737 012350 000004
4642 011166 005737 173000
4643 011172 000240
4644 011174 012637 000004
4645 011200 026737 170174 173000
4646 011206 001034
4647 011210 013746 000004
4648 011214 012737 011236 000004
4649 011222 005737 173400
4650 011226 000240
4651 011230 012637 000004
4652 011234 000421
4653 011236 022626
4654 011240 012637 000004
4655 011244 012767 001400 001062
4656 011252 012767 001776 001056
4657 011260 012767 173376 001060
4658 011266 012767 000101 005356
4659 011274 000167 001266
4660 011300
4661 011300 026737 170474 173000
4662 011306 001016
4663 011310 012767 002000 001016
4664 011316 012767 002776 001012

;*****
;      INITIALIZATION AND START UP OF PROGRAM.
;*****
RESTRT:
MOV    #SCMTAG,R6      ;FIRST LOCATION TO BE CLEARED
CLR    (R6)+           ;CLEAR MEMORY LOCATION
CMP    #STKS,R6       ;DONE?
BNE    .-6            ;LOOP BACK IF NO
MOV    #STACK,SP      ;SETUP THE STACK POINTER
MOV    #SCOPE,@#IOTVEC ;IOT VECTOR FOR SCOPE ROUTINE
MOV    #340,@#IOTVEC+2 ;LEVEL 7
MOV    #ERROR,@#EMTVEC ;EMT VECTOR FOR ERROR ROUTINE
MOV    #340,@#EMTVEC+2 ;LEVEL 7
MOV    #STRAP,@#TRAPVEC ;TRAP VECTOR FOR TRAP CALLS
MOV    #340,@#TRAPVEC+2 ;LEVEL 7
MOV    #. SLPADR      ;INITIALIZE THE LOOP ADDRESS FOR SCPE
CLR    INITFG         ;INITIALIZE TO ASK WHICH TYPE
CLR    TABLE        ;INITIALIZE TO ASK WHICH TYPE
START: MOV    #STACK,SP ;SET THE STACK POINTER
CLR    LSTERR        ;CLEAR ERROR FLG REPORT
CLR    @#0           ;SET FOR UNEXPECTED TRAP TO ADD 0
MOV    #START,FRG.NO ;GET READY FOR PWR FAIL BEFORE FIRST TEST.
MOV    #6,@#4        ;SET TIME OUT TRAP VECTOR
CLR    @#6           ;SET TIME OUT STATUS TO 0
CLR    FLAG4        ;CLEAR TEST 4 INITIAL FLAG
TST   @#42          ;AM I RUNNING UNDER ACT-11??
BNE    .+6          ;BR IF *WE ARE* UNDER ACT-11!!
JMP   CONT         ;JUMP IF NOT ACT-11
MOV    @#4-(SP)     ;SAV TRAP POINTER
MOV    #NOROM,@#4   ;PUT IN A NEW ONE
TST   @#173000     ;TRY TO READ THE ROM
NOP    ;WAIT FOR POSSIBLE TRAP
MOV    (SP)+,@#4    ;IF NO TRAP RESTORE POINTER
CMP    MAP.YA,@#173000 ;DOES 1ST WORD COMPARE?
BNE    64$         ;CHECK NEXT MAP
MOV    @#4-(SP)     ;SAVE LOC 4
MOV    #65$,@#4    ;SET FOR TIMEOUT
TST   @#173400     ;READ FROM 173400
NOP    ;IF NO TIMEOUT, NOT YA
MOV    (SP)+,@#4    ;RESTORE LOC 4
BR    64$
65$:  CMP    (SP)+,(SP)+ ;ADJUST STACK
MOV    (SP)+,@#4    ;RESTORE LOC 4
MOV    #MAP.YA,TABLE ;1ST MAP ADDR
MOV    #END.YA,ALLEND ;LAST MAP ADDR
MOV    #173376,LASTA ;LAST ROM ADDR
MOV    #000101,VERSON ;SET ROM TYPE
JMP   PRG1         ;START TEST 1

64$:  CMP    MAP.YB,@#173000 ;DOES 1ST WORD COMPARE?
BNE    69$         ;CHECK NEXT MAP
MOV    #MAP.YB,TABLE ;1ST MAP ADDR
MOV    #END.YB,ALLEND ;LAST MAP ADDR

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G10

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4665	011324	012767	173776	001014		MOV	#173776, LASTA	; LAST ROM ADDR
4666	011332	012767	000102	005312		MOV	#000102, VERNON	; SET ROM TYPE
4667	011340	000167	001222			JMP	PRG1	; START TEST 1
4668	011344				69\$:			
4669	011344	026737	171430	173000		CMP	MAP.YC, @#173000	; DOES 1ST WORD COMPARE?
4670	011352	001036				BNE	74\$; CHECK NEXT MAP
4671	011354	013746	000004			MOV	@#4, -(SP)	; SAVE LOC 4
4672	011360	012737	011404	000004		MOV	#76\$, @#4	; SET FOR TIMEOUT
4673	011366	026737	172006	173400		CMP	MAP.YC+400, @#173400	; IS IT YC?
4674	011374	001004				BNE	77\$; BR IF NOT YC
4675	011376	012637	000004			MOV	(SP)+, @#4	; RESTORE LOC 4
4676	011402	000404				BR	78\$; YES IT IS A YC
4677	011404	022626			76\$:	CMP	(SP)+, (SP)+	; ADJUST STACK
4678	011406	012637	000004		77\$:	MOV	(SP)+, @#4	; RESTORE LOC 4
4679	011412	000416				BR	74\$; CHECK NEXT MAP
4680	011414				78\$:			
4681	011414	012767	003000	000712		MOV	#MAP.YC, TABLE	; 1ST MAP ADDR
4682	011422	012767	003776	000706		MOV	#END.YC, ALLEND	; LAST MAP ADDR
4683	011430	012767	173776	000710		MOV	#173776, LASTA	; LAST ROM ADDR
4684	011436	012767	000103	005206		MOV	#000103, VERNON	; SET ROM TYPE
4685	011444	000167	001116			JMP	PRG1	; START TEST 1
4686	011450				74\$:			
4687	011450	026737	172324	173000		CMP	MAP.YD, @#173000	; DOES 1ST WORD COMPARE?
4688	011456	001016				BNE	79\$; CHECK NEXT MAP
4689	011460	012767	004000	000646		MOV	#MAP.YD, TABLE	; 1ST MAP ADDR
4690	011466	012767	004776	000642		MOV	#END.YD, ALLEND	; LAST MAP ADDR
4691	011474	012767	173776	000644		MOV	#173776, LASTA	; LAST ROM ADDR
4692	011502	012767	000104	005142		MOV	#000104, VERNON	; SET ROM TYPE
4693	011510	000167	001052			JMP	PRG1	; START TEST 1
4694	011514				79\$:			
4695	011514	026737	173260	173000		CMP	MAP.YF, @#173000	; DOES 1ST WORD COMPARE?
4696	011522	001016				BNE	84\$; CHECK NEXT MAP
4697	011524	012767	005000	000602		MOV	#MAP.YF, TABLE	; 1ST MAP ADDR
4698	011532	012767	005776	000576		MOV	#END.YF, ALLEND	; LAST MAP ADDR
4699	011540	012767	173776	000600		MOV	#173776, LASTA	; LAST ROM ADDR
4700	011546	012767	000106	005076		MOV	#000106, VERNON	; SET ROM TYPE
4701	011554	000167	001006			JMP	PRG1	; START TEST 1
4702	011560				84\$:			
4703	011560	026737	174214	173000		CMP	MAP.YG, @#173000	; DOES 1ST WORD COMPARE?
4704	011566	001016				BNE	89\$; CHECK NEXT MAP
4705	011570	012767	006000	000536		MOV	#MAP.YG, TABLE	; 1ST MAP ADDR
4706	011576	012767	006776	000532		MOV	#END.YG, ALLEND	; LAST MAP ADDR
4707	011604	012767	173776	000534		MOV	#173776, LASTA	; LAST ROM ADDR
4708	011612	012767	000107	005032		MOV	#000107, VERNON	; SET ROM TYPE
4709	011620	000167	000742			JMP	PRG1	; START TEST 1
4710	011624				89\$:			
4711	011624	026737	175150	173000		CMP	MAP.YH, @#173000	; DOES 1ST WORD COMPARE?
4712	011632	001016				BNE	94\$; CHECK NEXT MAP
4713	011634	012767	007000	000472		MOV	#MAP.YH, TABLE	; 1ST MAP ADDR
4714	011642	012767	007776	000466		MOV	#END.YH, ALLEND	; LAST MAP ADDR
4715	011650	012767	173776	000470		MOV	#173776, LASTA	; LAST ROM ADDR
4716	011656	012767	000110	004766		MOV	#000110, VERNON	; SET ROM TYPE
4717	011664	000167	000676			JMP	PRG1	; START TEST 1
4718	011670				94\$:			

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4719	011670	104400	012450		TYPE	,NMATCH	;NOT BMB73YA OR B OR C OR D OR F OR G OR H
4720	011674	000000			HALT		
4721	011676	005767	000442	CONT:	TST	INITFG	;IS THIS THE FIRST TIME START UP?
4722	011702	001157			BNE	3\$;BR IF NOT FIRST TIME HERE.
4723	011704	005167	000434		COM	INITFG	;SET THE FLAG
4724	011710	104400	013160	2\$:	TYPE	,BMB73X	;TYPE THE QUESTION.
4725	011714	104412			RDLIN		
4726	011716	012602			MOV	(SP)+,R2	
4727	011720	011202			MOV	(R2),R2	;PLACE CHARACTER INTO R2.
4728	011722	022702	000052		CMP	#52,R2	;WAS * HIT??
4729	011726	001011			BNE	64\$;BR IF NO
4730	011730	012767	010000	000376	MOV	#MAP.Y.,TABLE	;SET FOR START OF TABLE
4731	011736	012767	010376	000372	MOV	#END.Y.,ALLEND	;SET END OF TABLE
4732	011744	012767	173376	000374	MOV	#173376,LASTA	;SET LAST ROM ADDR
4733	011752						
4734	011752	022702	000101	64\$:	CMP	#101,R2	;WAS A HIT??
4735	011756	001011			BNE	65\$;BR IF NO
4736	011760	012767	001400	000346	MOV	#MAP.YA, TABLE	;SET FOR START OF TABLE
4737	011766	012767	001776	000342	MOV	#END.YA,ALLEND	;SET END OF TABLE
4738	011774	012767	173376	000344	MOV	#173376,LASTA	;SET LAST ROM ADDR
4739	012002						
4740	012002	022702	000102	65\$:	CMP	#102,R2	;WAS B HIT??
4741	012006	001011			BNE	66\$;BR IF NO
4742	012010	012767	002000	000316	MOV	#MAP.YB, TABLE	;SET FOR START OF TABLE
4743	012016	012767	002776	000312	MOV	#END.YB,ALLEND	;SET END OF TABLE
4744	012024	012767	173776	000314	MOV	#173776,LASTA	;SET LAST ROM ADDR
4745	012032						
4746	012032	022702	000103	66\$:	CMP	#103,R2	;WAS C HIT??
4747	012036	001011			BNE	67\$;BR IF NO
4748	012040	012767	003000	000266	MOV	#MAP.YC, TABLE	;SET FOR START OF TABLE
4749	012046	012767	003776	000262	MOV	#END.YC,ALLEND	;SET END OF TABLE
4750	012054	012767	173776	000264	MOV	#173776,LASTA	;SET LAST ROM ADDR
4751	012062						
4752	012062	022702	000104	67\$:	CMP	#104,R2	;WAS D HIT??
4753	012066	001011			BNE	68\$;BR IF NO
4754	012070	012767	004000	000236	MOV	#MAP.YD, TABLE	;SET FOR START OF TABLE
4755	012076	012767	004776	000232	MOV	#END.YD,ALLEND	;SET END OF TABLE
4756	012104	012767	173776	000234	MOV	#173776,LASTA	;SET LAST ROM ADDR
4757	012112						
4758	012112	022702	000106	68\$:	CMP	#106,R2	;WAS F HIT??
4759	012116	001011			BNE	69\$;BR IF NO
4760	012120	012767	005000	000206	MOV	#MAP.YF, TABLE	;SET FOR START OF TABLE
4761	012126	012767	005776	000202	MOV	#END.YF,ALLEND	;SET END OF TABLE
4762	012134	012767	173776	000204	MOV	#173776,LASTA	;SET LAST ROM ADDR
4763	012142						
4764	012142	022702	000107	69\$:	CMP	#107,R2	;WAS G HIT??
4765	012146	001011			BNE	70\$;BR IF NO
4766	012150	012767	006000	000156	MOV	#MAP.YG, TABLE	;SET FOR START OF TABLE
4767	012156	012767	006776	000152	MOV	#END.YG,ALLEND	;SET END OF TABLE
4768	012164	012767	173776	000154	MOV	#173776,LASTA	;SET LAST ROM ADDR
4769	012172						
4770	012172	022702	000110	70\$:	CMP	#110,R2	;WAS H HIT??
4771	012176	001011			BNE	71\$;BR IF NO
4772	012200	012767	007000	000126	MOV	#MAP.YH, TABLE	;SET FOR START OF TABLE

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4773 012206 012767 007776 000122      MOV      #END.YH,ALLEND ;SET END OF TABLE
4774 012214 012767 173776 000124      MOV      #173776,LASTA ;SET LAST ROM ADDR
4775 012222                71$:
4776 012222 010267 004424      MOV      R2,VERSION ;STORE VERSION TYPE..
4777 012226 005767 000102      TST     TABLE ;HAS A MAP BEEN SELECTED?
4778 012232 001003      BNE     3$ ;BR IF OK...
4779 012234 104400 013235      TYPE    ,BM.ERR ;TYPE ERROR
4780 012240 000623      BR      2$ ;GO AND GET CORRECT MAP.
4781 012242 104400 016174      3$: TYPE    ,MSG3 ;TYPE MESSAGE FOR TEST NUMBER
4782 012246 104412      X.X.: RDLIN
4783 012250 012602      MOV      (SP)+,R2
4784 012252 011203      MOV      (R2),R3 ;MOV THE CHAR TO R3
4785 012254 022703 000061      2$: CMP      #61,R3 ;WAS 1 HIT??
4786 012260 001002      BNE     4$ ;BR IF NO
4787 012262 000167 000300      JMP     PRG1 ;GOTO PRG 1
4788 012266 022703 000062      4$: CMP      #62,R3 ;WAS 2 HIT??
4789 012272 001002      BNE     5$ ;BR IF NO
4790 012274 000167 001012      JMP     PRG2 ;GOTO PRG 2
4791 012300 022703 000063      5$: CMP      #63,R3 ;WAS 3 HIT??
4792 012304 001002      BNE     6$ ;BR IF NO
4793 012306 000167 001740      JMP     PRG3 ;GOTO PRG3
4794 012312 022703 000064      6$: CMP      #64,R3 ;WAS 4 HIT??
4795 012316 001002      BNE     3$ ;BR IF NO
4796 012320 000167 002732      JMP     PRG4 ;GOTO PRG 4
4797 012324 104400 016400      3$: TYPE    ,M.QM ;NEITHER 1 OR 2 OR 3 OR 4 WAS HIT
4798 012330 000167 176444      JMP     RESTRT ;TYPE "" GO TO THE BEGINING.
4799 012334 000000      TABLE: 0
4800 012336 000000      ALLEND: 0
4801 012340 010400      EXTMAP: MAP.YX
4802 012342 010776      EXTEND: END.YX
4803 012344 000000      INITFG: 0
4804 012346 000000      LASTA: 0
4805 012350 104400 012360      NOROM: TYPE    ,NOROMS ;TYPE CAN'T FIND A RESPONSE
4806 012354 000000      HALT     ;NO LOADER INSTALLED?
4807 012356 06J776      BR      -2
4808 012360 005015 051124 050101      NOROMS: .ASCII <15><12>/TRAP TO 4 ON 1ST READ OF 173000/
         012421 015 044412 020123      .ASCIZ <15><12>/IS LOADER INSTALLED?/
         012450 005015 040503 023516      NMATCH: .ASCII <15><12>/CAN'T IDENTIFY LOADER AS YA,YB,YC,YD,YF,YG OR YH AFTER/
         012540 005015 046503 020120      .ASCIZ <15><12>/CMP WITH LOC 173000/
         .EVEN
    
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4809 ;PROGRAM 1
4810 ;THE PURPOSE OF PROGRAM 1 IS TO READ THE ROM AND
4811 ;VERIFY THAT THE DATA IS CORRECT. ALL ADDRESSES
4812 ;ARE READ, EXCEPT THE TRAP VECTOR, FIVE TIMES.
4813 ;
4814 ;THE SECOND PART OF THIS TEST VERIFIES THAT TRYING
4815 ;TO WRITE THE ROM RESULTS IN A TIME OUT TRAP.
4816 ;ALL ADDRESS ARE WRITTEN WITH A -1
4817 ;,AND ARE EXPECTED TO TRAP.
4818
4819 012566 012767 012566 003734 PRG1:  MOV  #PRG1,PRG.NO ;SET FOR PWR FAIL
4820 012574 012767 000500 166416      MOV  #500,ICOUNT ;DO THIS TEST 500(8) TIMES.
4821 012602 012737 016532 000004 PRG.1:  MOV  #NO.TRAP,2#4 ;SET FOR UNEXPECTED TRAP.
4822 012610 012700 173000      MOV  #173000,RO ;SET BEGGINING ADDRESS
4823 012614 012767 012640 166264      MOV  #2$,SLPADR ;IF SW14=1; GOTO 2$ WHEN SCOPE IS HIT
4824 012622 016704 177506      MOV  TABLE,R4 ;SET START OF MAP
4825 012626 016767 177514 000322      MOV  LASTA,LAST ;SET LAST ADDRESS
4826 012634 012703 000005      1$:  MOV  #5,R3 ;DO EACH ADDRESS 5 TIMES.
4827 012640 022700 173024      2$:  CMP  #173024,RO ;DON'T DO THE VECTOR ADD.
4828 012644 001001      BNE  20$ ;BR IF NOT THE VECTOR ADD.
4829 012646 022024      CMP  (RO)+,(R4)+ ;UPDATE TO NEXT ADDRESS
4830 012650 022700 173224      20$:  CMP  #173224,RO ;DON'T DO THE TRAP VECTORS
4831 012654 001001      BNE  21$ ;NO THIS ISN'T A TRAP VECTOR.
4832 012656 022024      CMP  (RO)+,(R4)+ ;UPDATE THE POINTERS..
4833 012660 010467 166240      21$:  MOV  R4,$GDDAT ;READ THE ADDRESS
4834 012664 010067 166236      MOV  RO,$BDDAT ;READ THE SOFTWARE ADDRESS
4835 012670 011067 166332      MOV  (RO),TEMP4
4836 012674 011467 166324      MOV  (R4),TEMP3
4837 012700 026767 166320 166320      CMP  TEMP3,TEMP4
4838 012706 001401      BEQ  22$ ;BR IF GOOD
4839 012710 104001      ERROR 1 ;INCORRECT COMPARISON.
4840 012712 032767 004000 164650 22$:  BIT  #BIT11,SWR ;QUICK PASS.?
4841 012720 001002      BNE  23$ ;BR IF YES
4842 012722 005303      DEC  R3 ;HAS THAT ADD BEEN READ 5 TIMES?
4843 012724 001345      BNE  2$ ;BR IF NOT 5 TIMES
4844
4845 012726 026700 000224      23$:  CMP  LAST,RO ;WAS LAST ADDRESS CHECKED?
4846 012732 001403      BEQ  10$ ;BR IF YES
4847 012734 000004      SCOPE ;LOCK ON THIS ADDRESS IF SW14=1
4848 012736 022024      CMP  (RO)+,(R4)+ ;UPDATE THE POINTERS.
4849 012740 000735      BR   1$ ;CONTINUE THE TEST.
4850
4851 012742 032767 000001 164620 10$:  BIT  #BIT0,SWR ;EXTENDED WORD TO BE CHECKED?
4852 012750 001413      BEQ  3$ ;BR IF NO CHECKING.
4853 012752 022767 173776 000176      CMP  #173776,LAST ;IS ALL THE TEST DONE?
4854 012760 001407      BEQ  3$ ;BR IF YES.
4855 012762 012767 173776 000166      MOV  #173776,LAST ;SET LAST ADDRESS.
4856 012770 016704 177344      MOV  EXTMAP,R4 ;SET EXTENDED MAP.
4857 012774 005720      TST  (RO)+ ;POP POINTER
4858 012776 000716      BR   1$ ;GO DO THE TEST.

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4859                                     ;TEST THAT WRITTING ROM RESULTS IN A TIME OUT
4860                                     ;TRAP.
4861
4862 013000 012767 013024 166100 3$:   MOV    #5$, $LPADR      ; IF SW14=1 GOTO 5$ WHEN SCOPE IS HIT
4863 013006 012700 173000                MOV    #173000,RO      ; SET RO WITH BASE ADDRESS OF ROM
4864 013012 012737 013060 000004        MOV    #6$, 2#4       ; SET FOR TIME OUT TRAP
4865 013020 012703 000005                4$:   MOV    #5, R3      ; DO EACH ADD 5 TIMES
4866 013024 022700 173024                5$:   CMP    #173024,RO   ; CHECK FOR A TRAP VECTOR
4867 013030 001001                        BNE    24$           ; BR IF NOT VECTOR
4868 013032 005720                        TST    (RO)+         ; UPDATE THE REGISTER POINTER
4869 013034 022700 173224                24$:  CMP    #173224,RO   ; CHECK FOR THE OTHER VECTOR
4870 013040 001001                        BNE    25$           ; BR IF NOT THE VECTOR
4871 013042 005720                        TST    (RO)+         ; UPDATE THE POINTER
4872 013044 012710 177777                25$:  MOV    #-1, (RO)    ; WRITE ROM WITH A -1
4873 013050 000240                        NOP                                ; WAIT ONE INSTR. TIME
4874 013052 010067 166150                MOV    RO, TEMP4
4875 013056 104002                        ERROR 2              ; WRITING ROM DIDN'T TIME OUT.
4876 013060 012706 001100                6$:   MOV    #STACK,SP  ; RESTORE STACK
4877 013064 032767 004000 164476        BIT    #BIT11,SWR    ; QUICK PASS?
4878 013072 001002                        BNE    30$
4879 013074 005303                        DEC    R3             ; DO EACH ADD 5 TIMES
4880 013076 001352                        BNE    5$            ; NOT DONE WITH THIS ONE YET.
4881
4882 013100 032767 000001 164462 30$:   BIT    #BIT0,SWR     ; EXTENDED 128. WORDS TO BE CHECKED?
4883 013106 001404                        BEQ    31$           ; BR IF NO
4884 013110 022700 173776                CMP    #173776,RO   ; HAVE ALL 256. WORDS BEEN CHECKED?
4885 013114 001407                        BEQ    7$            ; BR IF ALL DONE
4886 013116 000403                        BR     32$           ; KEEP GOING
4887 013120 026700 177222                31$:  CMP    LASTA,RO    ; ALL DONE??
4888 013124 001403                        BEQ    7$            ; HAVE ALL 128. WORDS DONE?
4889 013126 000004                        32$:  SCOPE              ; CHECK SW14 FOR FREEZE!!
4890 013130 005720                        TST    (RO)+         ; UPDATE TO NEXT ADDRESS
4891 013132 000732                        BR     4$            ; GO DO IT AGAIN
4892 013134 005367 166060                7$:   DEC    ICOUNT     ; ITERATION COUNT DONE?
4893 013140 001004                        BNE    8$            ; BR IF NOT DONE.
4894 013142 004767 003424                JSR    PC,EOP        ; TYPE END MESSAGE
4895 013146 000167 177414                JMP    PRG1          ; GO DO IT AGAIN.
4896 013152 000167 177424                8$:   JMP    PRG.1        ; GO RESTART.
4897 013156 000000                LAST: 0
4898
4899 013160 005015 040515 047111  BM873X: .ASCII <15><12>/MAINDEC-11-DZBMDH/
      013203      015 042012 053105      .ASCII <15><12>/DEVICE VERSION/
      013223      015 041012 034115      .ASCIZ <15><12>/BM873-Y/
      013235      015 025012 040454  BM.ERR: .ASCIZ <15><12>/*.A,B,C,D,F,G,H ONLY./
      013265      040 020040 042526  VERS:  .ASCIZ / VERSION: BM873-Y/
      013312      .EVEN

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4900          ;PROGRAM 2
4901          ;BLIND READ FROM ROM.
4902          ;THIS PROGRAM WILL DUMP THE CONTENTS OF THE ROM OUT
4903          ;PERFORMING NO CHECKING AT ALL.
4904          ;PLEASE NOTE: NO CHECKING IS DONE.
4905
4906 013312 012767 013312 003210 PRG2:  MOV    #PRG2,PRG.NO    ;SET FOR POWER FAIL
4907 013320 012737 016532 000004      MOV    #NO.TRAP,2#4    ;SET FOR UNEXPECTED TRAP TO 4
4908 013326 016767 177014 177622      MOV    LASTA, LAST
4909 013334 062767 000002 177614      ADD    #2, LAST
4910 013342 012700 173000          21$:  MOV    #173000,RO    ;SET RO WITH THE STARTING ROM ADD.
4911 013346 016703 176762          MOV    TABLE,R3     ;SET POINTER.
4912 013352 104400 013672          TYPE   ,DH.2         ;TYPE MESSAGE
4913 013356 104400 013754          TYPE   ,DH.2B        ;TYPE THE HEADER
4914 013362 012767 000007 165632  1$:  MOV    #7,TEMP5      ;SET COUNTER
4915 013370 011001          MOV    (RO),R1       ;READ THE ROM
4916 013372 010067 165626          MOV    RO,TEMP3      ;STORE RO
4917 013376 010167 165624          MOV    R1,TEMP4      ;STORE R1
4918 013402 022767 010000 176724  CMP    #MAP.Y.,TABLE ;IF BM873.Y* SELECTED; FILL TABLE
4919 013410 001001          BNE    22$          ;BR IF NOT BM873.Y*
4920 013412 011023          MOV    (RO),(R3)+    ;FILL THE TABLE..
4921 013414 005720          22$:  TST    (RO)+         ;POP THE POINTER
4922 013416 104400 016414          TYPE   ,MCRLF
4923
4924 013422 016746 165576          MOV    TEMP3,-(SP)
4925 013426 104402          TYPOC
4926 013430 104400 016405          TYPE   ,MSPACE     ;TYPE THREE SPACES.
4927
4928
4929 013434 016746 165566          MOV    TEMP4,-(SP)
4930 013440 104402          TYPOC
4931 013442 011001          7$:  MOV    (RO),R1       ;STORE ROM DATA
4932 013444 010067 165554          MOV    RO,TEMP3      ;STORE ROM ADDRESS
4933 013450 010167 165552          MOV    R1,TEMP4      ;PREPARE DATA FOR TYPE OUT
4934 013454 022767 010000 176652  CMP    #MAP.Y.,TABLE ;IS BM873.Y* SELECTED?
4935 013462 001001          BNE    23$          ;BR IF NO.
4936 013464 011023          MOV    (RO),(R3)+    ;FILL THE DATA TABLE
4937 013466 005720          23$:  TST    (RO)+         ;POP THE POINTER
4938
4939 013470 104400 016405          TYPE   ,MSPACE
4940
4941 013474 016746 165526          MOV    TEMP4,-(SP)
4942 013500 104402          TYPOC
4943
4944 013502 026700 177450          CMP    LAST,RO ;HAS THE HIGHEST LIMIT BEEN HIT?
4945 013506 001404          BEQ    2$          ;BR IF ALL DONE.
4946 013510 005367 165506          DEC    TEMPS         ;DECREASE COUNTER
4947 013514 001352          BNE    7$          ;BR IF NOT 0; KEEP GOING
4948 013516 000721          BR     1$          ;GO TYPE ADDRESS NOW
4949
4950 013520 032767 000001 164042  2$:  BIT    #BIT0,SWR     ;IS THE EXTENDED 128. WORDS TO BE CHECKED??
4951 013526 001455          BEQ    3$          ;BR IF NO.
4952 013530 012700 173400          MOV    #173400,RO    ;RESET POINTER OF ROM
4953 013534 016703 176600          MOV    EXTMAP,R3     ;SET SOFTWARE MAP POINTER

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4954	013540	104400	014066			TYPE	,DH.2A		;TYPE NEW HEADER
4955	013544	104400	013754			TYPE	,DH.2B		;TYPE ADDRESS AND +XX
4956	013550	012767	000007	165444	6\$:	MOV	#7,TEMP5		;SET TYPE OUT COUNTER
4957	013556	011001				MOV	(R0),R1		;READ THE ROM
4958	013560	010067	165440			MOV	R0,TEMP3		;STORE R0
4959	013564	010167	165436			MOV	R1,TEMP4		;STORE R1
4960	013570	012023				MOV	(R0)+,(R3)+		;STORE THE DATA IN SOFTWARE MAP
4961	013572	104400	016414			TYPE	MCRLF		
4962	013576	016746	165422			MOV	TEMP3,-(SP)		
4963	013602	104402				TYPOC			
4964									
4965	013604	104400	016405			TYPE	MSPACE		
4966	013610	016746	165412			MOV	TEMP4,-(SP)		
4967	013614	104402				TYPOC			
4968									
4969	013616	011001			8\$:	MOV	(R0),R1		;SAVE THE ROM DATA
4970	013620	010067	165400			MOV	R0,TEMP3		;SAVE THE ROM ADDRESS
4971	013624	010167	165376			MOV	R1,TEMP4		;SET DATA FOR TYPE OUT
4972									
4973	013630	104400	016405			TYPE	,MSPACE		
4974									
4975	013634	016746	165366			MOV	TEMP4,-(SP)		
4976	013640	104402				TYPOC			
4977									
4978	013642	012023				MOV	(R0)+,(R3)+		;STORE THE DATA IN SOFTWARE TABLE
4979	013644	022700	174000			CMP	#174000,R0		;HAS THE HIGHEST LIMIT BEEN HIT?
4980	013650	001404				BEQ	3\$;BR IF ALL DONE.
4981	013652	005367	165344			DEC	TEMP5		;DEC TABLE COUNTER
4982	013656	001357				BNE	8\$;BR TO JUST TYPE DATA
4983	013660	000733				BR	6\$;BR TO TYPE ADDRESS
4984	013662	005000			3\$:	CLR	R0		;CLEAR DATA LIGHTS
4985	013664	000000				HALT			;HIT CONTINUE TO PROCEED.
4986	013666	000167	177420			JMP	PRG2		;GOTO PRG 2
4987	013672	006414	005012	016412	DH.2:	.ASCII	<14><15><12><12><12><35><37><177><177><177>/BLIND READ OF ROM/		
	013725	015	006412	077577		.ASCIZ	<15><12><15><177><177>/NOTE: NO CHECKING/		
	013754	005015	040412	042104	DH.2B:	.ASCII	<15><12><12>/ADDRESS ADD+00 ADD+02 ADD+04/		
	014015	040	040440	042104		.ASCIZ	/ ADD+06 ADD+10 ADD+12 ADD+14 ADD+16/		
	014066	005015	042412	052130	DH.2A:	.ASCII	<15><12><12>/EXTENDED 128. WORD ROM DUMP./		
	014125	015	041412	047117		.ASCII	<15><12>/CONTENTS DUMPED IS PLACED IN THE SOFTWARE/		
	014200	005015	040515	027120		.ASCII	<15><12>/MAP. DATA SHOULD BE VISUALLY INSPECTED!/		
		014252			.EVEN				

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4991
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4996
4997
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5000
5001
5002
5003 014252 012767 014252 002250 PRG3:  MOV    #PRG3,PRG.NO    ;SET FOR POWER FAIL
5004 014260 016701 176050          MOV    TABLE,R1      ;DEFAULT STARTING ADDRESS TO MAP
5005 014264 010167 000764          MOV    R1,ADDRESS    ;SAVE THE SOFTWARE ADDRESS
5006 014270 104400 016307          XHOLD: TYPE    ,MASTER ;TYPE AN "*"
5007 014274 104412          RDLIN
5008 014276 012602          MOV    (SP)+,R2
5009 014300 011202          MOV    (R2),R2
5010 014302 022702 000114          CMP    #114,R2      ;WAS AN "L" (LIST) HIT?
5011 014306 001464          BEQ    SRV.L
5012
5013 014310 022702 000104          1$:   CMP    #104,R2    ;WAS A "D" (DATA) HIT?
5014 014314 001413          BEQ    SRV.D
5015 014316 022702 000122          CMP    #122,R2      ;WAS AN "R" (RUN) HIT?
5016 014322 001002          BNE    10$
5017 014324 000167 000342          JMP    SRV.R
5018 014330 022702 000101          10$:  CMP    #101,R2      ;WAS AN "A" (ADDRESS) HIT?
5019 014334 001444          BEQ    SRV.A
5020 014336 104400 016400          TYPE    ,M.QM      ;TYPE A "?"
5021 014342 000752          BR     XHOLD        ;NEITHER A "L","P","D","R","A",OR CR WAS HIT.
5022
5023 014344 016767 000704 164654  SRV.D:  MOV    ADDRESS,TEMP4 ;RESET ADDRESS POINTER.
5024 014352 104400 016414          TYPE    MCRLF
5025 014356 016746 164644          MOV    TEMP4,-(SP)
5026 014362 016701 164640          MOV    TEMP4,R1
5027 014366 104402          TYPOC
5028
5029 014370 104400 016405          TYPE    ,MSPACE
5030
5031 014374 104414          RDOCT
5032 014376 012611          MOV    (SP)+,(R1)   ;STORE DATA
5033
5034 014400 005721          TST    (R1)+        ;UPDATE THE SOFTWARE ADDRESS
5035 014402 026701 175734          CMP    EXTEND,R1    ;IS THE LIMIT EXCEEDED
5036 014406 103413          BLO    7$           ;INPUT LIMIT EXCEEDED!! ERROR.
5037 014410 010167 164612          MOV    R1,TEMP4     ;SAVE THE ADDRESS.
5038 014414 104400 016414          TYPE    MCRLF
5039 014420 016746 164602          MOV    TEMP4,-(SP)
5040 014424 104402          TYPOC
5041
;PROGRAM 3
;PROGRAM 3 IS THE SAME AS PROGRAM 1 ONLY YOU THE
;USER HAS THE CHANCE TO ALTER THE MAP WHICH IS
;COMPARED TO THE DATA IN THE ROM ADDRESSES
;NOTE THE FOLLOWING COMMANDS:
;
;*D    DATA    INSERT DATA; HIT LINE FEED TO ESCAPE.
;*R    RUN      RUN THE PROGRAM
;*L    LIST     LIST THE SOFTWARE TABLE ON TTY.
;*A    ADDRESS  INPUT THE ADDRESS OF THE DATA YOU WANT TO ALTER.
;CR    CARRAGE  RETURN- WHEN IN THE DATA INPUT MODE A CARRAGE RETURN
;        WAITS FOR NEW DATA.

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5042 014426 010167 000622          MOV    R1,ADDRESS      ;SAVE THE ADDRESS FOR GOOD
5043 014432 000167 177632          JMP    XHOLD
5044 014436 104400 016400      7$:   TYPE    ,M.QM      ;TYPE A "?"
5045 014442 000167 177622          JMP    XHOLD
5046
5047          ;YOU ARE HERE BECAUSE YOU HIT AN "A"
5048          ;YOU TOLD ME YOU WERE GOING TO INPUT AN ADDRESS.
5049          ;SO INPUT THE ADDRESS AND TERMINATE WITH A CARRAGE RETURN.
5050          ;OK??
5051
5052 014446 104414          SRV.A: RDOCT          ;READ THE ADDRESS HE WANTS TO MODIFY.
5053 014450 012667 000600          MOV    (SP)+,ADDRESS
5054 014454 000167 177610      4$:   JMP    XHOLD
5055
5056          ;YOU ENTERED HERE BECAUSE YOU HIT "L"
5057          ;YOU TOLD ME YOU WANTED A LISTING OF THE SOFTWARE MAP
5058          ;SO HERE IT IS.
5059
5060
5061 014460          SRV.L:
5062 014460 016700 175650          MOV    TABLE,RO      ;GET SOFTWARE MAP
5063 014464 016767 175646      000176  MOV    ALLEND,DEAD    ;SET DEAD END POINTER
5064 014472 104400 016226          TYPE    ,MSG4        ;TYPE HEADER
5065 014476 104400 013754          TYPE    ,DH.2B      ;TYPE ADDRESS ADD+XX
5066 014502 012767 000007      164512  1$:   MOV    #7,TEMP5      ;SET COUNTER FOR ACCROSS PAGE
5067 014510 011067 164512          MOV    (RO),TEMP4    ;GET DATA
5068 014514 010067 164504          MOV    RO,TEMP3      ;GET ADDRESS
5069 014520 005720          TST    (RO)+         ;UPDATE ADDRESS POINTER
5070 014522 104400 016414          TYPE    ,MCRLF
5071
5072 014526 016746 164472          MOV    TEMP3,-(SP)
5073 014532 104402          TYPOC
5074
5075 014534 104400 016405          TYPE    ,MSPACE
5076
5077 014540 016746 164462          MOV    TEMP4,-(SP)
5078 014544 104402          TYPOC
5079
5080 014546 104400 016405          TYPE    ,MSPACE
5081
5082 014552 011067 164450      2$:   MOV    (RO),TEMP4    ;GET DATA
5083 014556 010067 164442          MOV    RO,TEMP3      ;GET ADDRESS
5084 014562 005720          TST    (RO)+         ;UPDATE POINTER
5085
5086 014564 016746 164436          MOV    TEMP4,-(SP)
5087 014570 104402          TYPOC
5088 014572 104400 016405          TYPE    ,MSPACE
5089
5090 014576 016703 000066      3$:   MOV    DEAD,R3
5091 014602 005723          TST    (R3)+         ;UPDATE POINTER
5092 014604 020003          CMP    RO,R3         ;LIMIT DONE ??
5093 014606 001404          BEQ    5$           ;BR IF YES
5094 014610 005367 164406      4$:   DEC    TEMPS        ;DEC DATA COUNTER
5095 014614 001356          BNE    2$           ;BR IF MORE DATA TO GO

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5096 014616 000731          BR      1$          ;TYPE THE ADDRESS$
5097 014620          5$:          BIT      #BIT0,SWR      ;EXTENDED SOFTWARE DUMP?
5098 014620 032767 000001 162742  BEQ      6$          ;BR IF NO DUMP
5099 014626 001416          TST      -(R3)       ;PUSH POINTER
5100 014630 005743          CMP      EXTEND,R3
5101 014632 026703 175504  BEQ      6$          ;BR IF ALL DONE
5102 014636 001412          TYPE     ,MSG5       ;TYPE EXTENDED MAP:
5103 014640 104400 016254  TYPE     DH.2B
5104 014644 104400 013754  MOV      EXTMAP,RO   ;SET POINTER
5105 014650 016700 175464  MOV      EXTEND,DEAD ;SET DEAD END POINTER
5106 014654 016767 175462 000006 BR      1$          ;DO IT AGAIN SAM.
5107 014662 000707          JMP      XHOLD
5108 014664 000167 177400 6$:          DEAD: 0
5109 014670 000000
5110
5111          ;NOW YOU ARE HERE BECAUSE YOU WANT TO RUN THE PROGRAM
5112          ;REMEMBER NOW, YOU SET UP THE MAP.
5113          ;ARE YOU SURE YOU TYPED IN THE CORRECT DATA.??
5114          ;HERE WE GO
5115
5116 014672          SRV.R:
5117 014672 012737 016532 000004 RUN3:  MOV      #NO.TRAP,2#4 ;GET READY FOR UNEXPECTED TRAP
5118 014700 012767 000500 164312  MOV      #500,ICOUNT ;DO TEST 500(8) TIMES
5119 014706 012700 173000          RUN.3: MOV      #173000,RO ;SET BEGGING ADDRESS
5120 014712 012767 014736 164166  MOV      #2$,SLPADR ;IF SW14=1; GOTO 2$ WHEN I HIT "SCOPE"
5121 014720 016704 175410          MOV      TABLE,R4 ;SET SOFTWARE RESUTS
5122 014724 016767 175416 176224  MOV      LASTA,LAST ;SET LAST ADDRESS
5123 014732 012703 000005          1$:  MOV      #5,R3 ;DO EACH ADDRESS 5 TIMES.
5124 014736 022700 173024          2$:  CMP      #173024,RO ;DON'T DO THE VECTOR ADD.
5125 014742 001001          BNE     30$ ;BR IF NOT THE VECTOR ADD.
5126 014744 022024          CMP      (RO)+,(R4)+ ;UPDATE TO NEXT ADDRESS
5127 014746 022700 173224          30$: CMP      #173224,RO ;IS THIS THE SECOND TRAP VECTOR??
5128 014752 001001          BNE     10$ ;BR IF NOT VECTOR
5129 014754 022024          CMP      (RO)+,(R4)+ ;UPDATE THE POINTERS !!
5130 014756 010467 164142          10$: MOV      R4,$GODAT
5131 014762 010067 164140          MOV      RO,$BODAT
5132 014766 011067 164234          MOV      (RO),TEMP4 ;READ THE ADDRESS
5133 014772 011467 164226          MOV      (R4),TEMP3 ;READ THE SOFTWARE ADDRESS
5134 014776 026767 164222 164222  CMP      TEMP3,TEMP4
5135 015004 001401          BEQ     11$ ;BRANCH IF OK
5136 015006 104001          ERROR  1 ;INCORRECT COMPARISON.
5137 015010 032767 004000 162552 11$: BIT      #BIT11,SWR ;QUICK PASS.
5138 015016 001002          BNE     12$ ;BR IF YES
5139 015020 005303          DEC     R3 ;HAS THAT ADD BEEN READ 10 TIMES?
5140 015022 001345          BNE     2$ ;BR IF NOT 10 TIMES
5141 015024 026700 176126          12$: CMP      LAST,RO ;WAS LAST ADDRESS CHECKED?
5142 015030 001403          BEQ     15$ ;BR IF YES
5143 015032 000004          SCOPE ;LOCK ON THIS ADDRESS?
5144 015034 022024          CMP      (RO)+,(R4)+ ;UPDATE THE POINTERS.
5145 015036 000735          BR      1$ ;CONTINUE THE TEST.
5146 015040 032767 000001 162522 15$: BIT      #BIT0,SWR ;EXTENDED WORD TO BE CHECKED?
5147 015046 001413          BEQ     3$ ;BR IF NO CHECKING.
5148 015050 022767 173776 1,6100  CMP      #173776,LAST ;IS ALL THE TEST DONE?
5149 015056 001407          BEQ     3$ ;BR IF YES.

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5150	015060	012767	173776	176070	MOV	#173776, LAST	;SET LAST ADDRESS.
5151	015066	016704	175246		MOV	EXTMAP, R4	;SET EXTENDED MAP.
5152	015072	005720			TST	(R0)+	;POP POINTER
5153	015074	000716			BR	1\$;GO DO THE TEST.

E11

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5154                                     ;TEST THAT WRITING ROM RESULTS IN A TIME OUT
5155                                     ;TRAP.
5156
5157 015076 012700 173000 3$:      MOV      #173000,RO      ;SET BASE ADDRESS
5158 015102 012767 015122 163776  MOV      #5$, $LPADR    ;IF SW14=1: GOTO 5$ AT SCOPE
5159 015110 012737 015156 000004  MOV      #6$, 2#4      ;TIME OUT TRAP: GOTO 6$
5160 015116 012703 000012 4$:      MOV      #10., R3     ;DO EACH ADD 10 TIMES
5161 015122 022700 173024 5$:      CMP      #173024,RO    ;IS THIS AT THE TRAP VECTOR
5162 015126 001001 20$:      BNE      20$          ;BR IF NO
5163 015130 005720 20$:      TST      (RO)+        ;UPDATE POINTER
5164 015132 022700 173224 20$:      CMP      #173224,RO    ;IS THIS AT THE SECOND TRAP VECTOR
5165 015136 001001 21$:      BNE      21$          ;BR IF NO
5166 015140 005720 21$:      TST      (RO)+        ;UPDATE THE POINTER
5167 015142 012710 177777 21$:      MOV      #-1, (RO)    ;WRITE ROM WITH A -1
5168 015146 000240 21$:      NOP                     ;WAIT ONE INSTR. TIME
5169 015150 010067 164052 21$:      MOV      RO, TEMP4
5170 015154 104002 21$:      ERROR      2                ;WRITING ROM DIDN'T TIME OUT.
5171 015156 012706 001100 6$:      MOV      #STACK, SP    ;RESTORE STACK
5172 015162 032767 004000 162400  BIT      #BIT11, SWR   ;QUICK PASS?
5173 015170 001002 22$:      BNE      22$          ;BR IF YES
5174 015172 005303 22$:      DEC      R3             ;DO EACH ADD 10 TIMES
5175 015174 001352 22$:      BNE      5$             ;NOT DONE WITH THIS ONE YET.
5176 015176 032767 000001 162364 22$:  BIT      #BIT0, SWR   ;IS THE EXTENDED 128. WORDS TO BE TESTED??
5177 015204 001404 23$:      BEQ      23$          ;BR IF NO
5178 015206 022700 173776 23$:      CMP      #173776,RO    ;IS THE EXTENDED LIMIT BEEN TESTED?
5179 015212 001407 23$:      BEQ      7$             ;IF YES; GOTO 7$
5180 015214 000403 23$:      BR       24$          ;IF NO: KEEP GOING.
5181 015216 026700 175124 23$:      CMP      LASTA, RO    ;ALL DONE??
5182 015222 001403 23$:      BEQ      7$             ;IF YES: GOTO 7$
5183 015224 000004 24$:      SCOPE     ;GO CHECK SW14: (FREEZE !!)
5184 015226 005720 24$:      TST      (RO)+        ;UPDATE TO NEXT ADDRESS
5185 015230 000732 24$:      BR       4$             ;GO DO IT AGAIN
5186 015232 005367 163762 7$:      DEC      ICOUNT     ;CHECK ITERATION COUNT
5187 015236 001004 7$:      BNE      8$             ;MORE TO GO
5188 015240 004767 001326 7$:      JSR      PC, EOP     ;GO TO END OF PASS ROUTINE
5189 015244 000167 177422 7$:      JMP      RUN3        ;GO DO TEST AGAIN
5190 015250 000167 177432 8$:      JMP      RUN.3
5191
5192 015254 000000 ADDRESS: 0

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5193 ;PROGRAM 4
5194 ;PROGRAM 4 CHECKS THE TRAP VECTOR ADDRESS.
5195 ;THE PROGRAM SIMULATES ACTIVATING THE BUTTON
5196 ;FOR EACH CHANNEL AND THEN READS
5197 ;THE CONTENTS OF THE ADDRESS.
5198 ;ON THE FIRST PASS THE CONTENTS WILL
5199 ;BE TYPED OUT FOR YOU THE
5200 ;USER TO VERIFY. AFTER THIS THE PROGRAM
5201 ;DOES A COMPARE TO THE PREVIOUSLY FOUND DATA
5202 ;AND REPORTS AN ERROR IF DIFFERENT THAN
5203 ;WHAT WAS FOUND BEFORE.
5204
5205 015256 012767 015256 001244 PRG4:  MOV  #PRG4,PRG.NO  ;SET FOR POWER FAIL
5206 015264 005067 163726          CLR  LSTERR      ;PREPARE ERROR CONDITIONS
5207 015270 012706 001100          MOV  #STACK,SP  ;SET THE STACK POINTER
5208 015274 012767 020000 163716  MOV  #20000,ICOUNT ;SET ITERATION COUNT TO 20000(8)
5209 015302 005767 000544          TST  FLAG4      ;HAVE I BEEN HERE BEFOR??
5210 015306 001106          BNE  TAG.A      ;BR IF NOT FIRST TIME HERE.
5211 015310 005167 000536          COM  FLAG4      ;SET THE FLAG
5212 015314 012705 000002          MOV  #2,R5      ;SET R5 FOR SWITCH 1
5213 015320 012704 016042          MOV  #LOC1,R4   ;SET STORAGE LOCATION
5214 015324 012737 016532 000004  MOV  #NO.TRAP,#4 ;SET FOR TIME OUT TRAP
5215 015332 012767 000001 163664  MOV  #1,TEMP3   ;SET FOR MESSAGE ON CHANNEL NO.
5216 015340 104400 016054          1$:  TYPE ,MCHAN   ;TYPE MESSAGE ABOUT CHANNEL
5217 015344 104400 016405          TYPE ,MSPACE
5218
5219 015350 016746 163650          MOV  TEMP3,-(SP)
5220 015354 104402          TYPOC
5221 015356 104400 016405          TYPE ,MSPACE
5222
5223
5224 015362 104400 016070          2$:  TYPE ,MACTV   ;TYPE REST OF MESSAGE
5225 015366 104400 016103          TYPE ,MADD1    ;TYPE ADDRESS MESSAGE
5226 015372 012700 173024          MOV  #173024,RO
5227 015376 005037 173024          CLR  @#173024
5228 015402 010537 173024          MOV  R5,@#173024 ;WRITE ROM WITH SWITCH
5229 015406 000240          NOP           ;WAIT ONE INSTR. TIME
5230 015410 012706 001100          3$:  MOV  #STACK,SP  ;SET THE STACK POINTER
5231 015414 012700 173024          MOV  #173024,RO ;SET FOR ERROR MESSAGE
5232 015420 012737 016532 000004  MOV  #NO.TRAP,#4 ;SET FOR NO MORE TRAPS
5233 015426 013767 173024 163572  MOV  @#173024,TEMP4 ;READ THE ADDRESS
5234
5235 015434 104400 016405          TYPE ,MSPACE
5236 015440 016746 163562          MOV  TEMP4,-(SP)
5237 015444 104402          TYPOC
5238 015446 013724 173024          MOV  @#173024,(R4)+ ;STORE THE INFORMATION FOUND
5239 015452 104400 016137          TYPE ,MADD2    ;TYPE THE SECOND ADDRESS MSG
5240 015456 012700 173224          MOV  #173224,RO  ;SET FOR ERROR CONDITION.
5241 015462 013767 173224 163536  MOV  @#173224,TEMP4 ;STORE ROM DATA
5242 015470 104400 016405          TYPE ,MSPACE
5243
5244 015474 016746 163526          MOV  TEMP4,-(SP)
5245 015500 104402          TYPOC
5246

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5301	016010	012767	173224	163110	MOV	#173224,\$BDDAT	
5302	016016	013767	173224	163202	MOV	3#173224,TEMP4	
5303							
5304	016024	020105			CMP	R1,R5	;IS LINE 1 DEFAULT LINE
5305	016026	001401			BEQ	33\$;BR IF OK
5306	016030	104001			ERROR	1	;ERROR LINE 1 NOT DEFAULT LINE.
5307	016032	004767	000534		JSR	PC,EOP	;TYPE END MESSAGE.
5308	016036	000167	177214		JMP	PRG4	;GOTO PROGRAM 4 AGAIN
5309							
5310	016042	000000			LOC1:	0	
5311	016044	000000			LOC2:	0	
5312	016046	000000			LOC3:	0	
5313	016050	000000			LOC4:	0	
5314	016052	000000			FLAG4:	0	

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5315	016054	005015	041412	040510	MCHAN:	.ASCIZ <15><12><12>/CHANNEL /
	016070	041501	044524	040526	MACTV:	.ASCIZ/ACTIVATED./
	016103	015	040412	042104	MADD1:	.ASCIZ <15><12>/ADDRESS 773024 CONTAINS: /
	016137	015	040412	042104	MADD2:	.ASCIZ <15><12>/ADDRESS 773224 CONTAINS: /
		016174			.EVEN	
5316						
5317	016174	005015	051120	043517	MSG3:	.ASCIZ <15><12>/PROGRAM NO. (1,2,3,4) /
	016226	006414	016412	077437	MSG4:	.ASCIZ <14><15><12><35><37><177><177><177>/SOFTWARE MAP: /
	016254	005015	020012	054105	MSG5:	.ASCIZ <15><12><12>/ EXTENDED SOFTWARE MAP: /
	016307	015	025012	000	MASTER:	.ASCIZ <15><12>*/
	016313	007	006407	042412	M.END:	.ASCIZ <7><7><15><12>/END PASS BM873-Y/
	016340				MFAIL:	
	016340	005015	053520	020122		.ASCII <15><12>/PWR UP AFTER/
	016356	005015	042522	046101		.ASCIZ <15><12>/REAL PWR FAIL/
	016376	000044			M.DOL:	.ASCIZ /\$/
	016400	005015	037477	000	M.QM:	.ASCIZ <15><12>??/
	016405	040	000040		MSPACE:	.ASCIZ / /
	016410	020040	000040		SPACE3:	.ASCIZ / /
	016414	005015	000		MCRLF:	.ASCIZ <15><12>
	016417	012	000		MLF:	.ASCIZ <12>
		016422			.EVEN	

5318

5319	016422	005067	162570		.PFAIL: CLR	LSTERR	
5320	016426	013746	000004		MOV	@#4, -(SP)	
5321	016432	012737	016462	000004	MOV	#1\$, @#4	
5322	016440	005737	173000		TST	@#173000	; IS THIS PF REAL?
5323	016444	000240			NOP		; TRAP IS CAUSED BY LOADER
5324	016446	012737	016472	000024	MOV	#PWR.UP, @#24	; ITS REAL. PREPARE FOR PWR UP
5325	016454	012637	000004		MOV	(SP)+, @#4	
5326	016460	000000			HALT		
5327	016462	005726			1\$: TST	(SP)+	; POP THE STACK.
5328	016464	012637	000004		MOV	(SP)+, @#4	
5329	016470	000000			HALT		; HARDWARE ERROR. BOOT DIDN'T FORCE
5330							; HIGH ADDR LINES AND LOAD BUTTON WAS ACTIVATED
5331	016472	012737	016422	000024	PWR.UP: MOV	#.PFAIL, @#24	
5332	016500	012706	001100		MOV	#STACK, SP	
5333	016504	005000			CLR	RO	; SET DELAY
5334	016506	062700	000001		1\$: ADD	#1, RO	; WAIT FOR TTY
5335	016512	001375			BNE	1\$	
5336	016514	104400	016340		TYPE	MFAIL	; TYPE FAILED.
5337	016520	005067	161252		CLR	PS	; SET STATUS TO ZERO
5338	016524	000177	000000		JMP	@PRG.NO	
5339	016530	000000			PRG.NO: 0		
5340	016532				NO.TRAP:		
5341	016532	011667	000032		MOV	(SP) XSTORE	
5342	016536	032716	100000		BIT	#BIT15, (SP)	
5343	016542	001410			BEQ	1\$	
5344	016544	011600			MOV	(SP), RO	
5345	016546	104004			ERROR	4	
5346	016550	012706	001100		MOV	#STACK, SP	
5347	016554	005067	161216		CLR	PS	
5348	016560	000177	177744		JMP	@PRG.NO	
5349	016564	104003			1\$: ERROR	3	
5350	016566	000002			RTI		
5351	016570	000000			XSTORE: 0		
5352							
5353	016572	005067	162420		EOP: CLR	LSTERR	
5354	016576	104400	016313		TYPE	, M.END	
5355	016602	104400	016652		TYPE	, VERNON	
5356	016606	013701	000042		MOV	@#42, R1	
5357	016612	001416			BEQ	X1	
5358	016614	022767	012566	177706	CMP	#PRG1, PRG.NO	
5359	016622	001002			BNE	. +6	
5360	016624	000167	176426		JMP	PRG4	
5361	016630	013701	000042		MOV	@#42, R1	
5362	016634	001405			BEQ	X1	
5363	016636	000005			RESET		
5364	016640				SENDAD:		
5365	016640	004711			LOGIC: JSP	PC, (R1)	
5366	016642	000240			NOP		
5367	016644	000240			NOP		
5368	016646	000240			NOP		
5369	016650	000207			X1: RTS	PC	
5370	016652	000101			VERNON: 101		; SEVEN BIT ASCII FOR DEFAULT "A"

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5371 016654 005015 041520 020072 MERRPC: .ASCIZ <15><12>/PC: /
5372 016662 000
5373 016664 .EVEN
5374 .MCALL .SEOP, .STYPE, .STYPOCT, .SPOWER, .SREAD
5375 ;:*****
5376
5377 .SBTTL TYPE ROUTINE
5378
5379 ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
5380 ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
5381 ;*NOTE1: $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
5382 ;*NOTE2: $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
5383 ;*NOTE3: $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
5384 ;*
5385 ;*CALL:
5386 ;*1) USING A TRAP INSTRUCTION
5387 ;* TYPE ,MESADR ;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
5388 ;*OR
5389 ;* TYPE
5390 ;* MESADR
5391 ;*
5392 ;*2) USING A JSR INSTRUCTION
5393 ;* MOV PS,-(SP) ;PUSH PROCESSOR STATUS WORD ON THE STACK
5394 ;* JSR PC,$TYPE ;CALL TYPE ROUTINE
5395 ;* MESADDR ;FIRST ADDRESS OF MESSAGE
5396
5397 016664 105767 162261 $TYPE: TSTB $TFPLG ; IS THERE A TERMINAL?
5398 016670 100002 BPL 1$ ; BR IF YES
5399 016672 000000 HALT ; HALT HERE IF NO TERMINAL
5400 016674 000407 BR 3$ ; LEAVE
5401 016676 010046 1$: MOV RO,-(SP) ; SAVE RO
5402 016700 017600 000002 MOV @2(SP),RO ; GET ADDRESS OF ASCIZ STRING
5403 016704 112046 2$: MOVB (RO)+,-(SP) ; PUSH CHARACTER TO BE TYPED ONTO STACK
5404 016706 001005 BNE 4$ ; BR IF IT ISN'T THE TERMINATOR
5405 016710 005726 TST (SP)+ ; IF TERMINATOR POP IT OFF THE STACK
5406 016712 012600 MOV (SP)+,RO ; RESTORE RO
5407 016714 062716 000002 3$: ADD #2,(SP) ; ADJUST RETURN PC
5408 016720 000002 RTI ; RETURN
5409 016722 004767 000026 4$: JSR PC,7$ ; GO TYPE THIS CHARACTER
5410 016726 126726 162216 5$: CMPB $FILLC,(SP)+ ; IS IT TIME FOR FILLER CHARS.?
5411 016732 001364 BNE 2$ ; IF NO GO GET NEXT CHAR.
5412 016734 016746 162206 MOV $NULL,-(SP) ; GET # OF FILLER CHARS. NEEDED
5413 ; AND THE NULL CHAR.
5414 016740 105366 000001 6$: DECB 1(SP) ; DOES A NULL NEED TO BE TYPED?
5415 016744 002770 BLT 5$ ; BR IF NO--GO POP THE NULL OFF OF STACK
5416 016746 004767 000002 JSR PC,7$ ; GO TYPE A NULL
5417 016752 000772 BR 6$ ; LOOP
5418 016754 105777 162162 7$: TSTB @STPS ; WAIT UNTIL PRINTER IS READY
5419 016760 100375 BPL 7$
5420 016762 116677 000002 162154 MOVB 2(SP),@STPB ; LOAD CHAR TO BE TYPED INTO DATA REG.
5421 016770 000207 RTS PC
5422 ;:*****
5423
5424 .SBTTL TTY INPUT ROUTINE

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5425
5426      ;*INPUT A SINGLE CHARACTER FROM THE TTY
5427      ;*CALL:
5428      ;*      RDCHR                      ;INPUT A SINGLE CHARACTER FROM THE TTY
5429      ;*      RETURN HERE                ;CHARACTER IS ON THE STACK
5430
5431
5432      016772 011646      $RDCHR: MOV      (SP), -(SP)      ;PUSH DOWN THE PC
5433      016774 016666 000004 000002      MCV      4(SP), 2(SP)      ;SAVE THE PS
5434      017002 105777 162130      1$:      TSTB      @STKS      ;WAIT FOR
5435      017006 100375      BPL      1$              ;A CHARACTER
5436      017010 117766 162124 000004      MOVB      @STKB, 4(SP)      ;READ THE TTY
5437      017016 042766 177600 000004      BIC      #1C(177), 4(SP)   ;GET RID OF JUNK IF ANY
5438      017024 000002      RTI                          ;GO BACK TO USER
5439      ;*****
5440      ;*INPUT A STRING FROM THE TTY
5441      ;*CALL:
5442      ;*      RDLIN                      ;INPUT A STRING FROM THE TTY
5443      ;*      RETURN HERE                ;ADDRESS OF FIRST CHARACTER WILL BE ON THE STACK
5444      ;*                                  ;TERMINATOR WILL BE A BYTE OF ALL 0'S
5445
5446      017026 010346      $RDLIN: MOV      R3, -(SP)      ;SAVE R3
5447      017030 012703 017134      1$:      MOV      #STTYIN, R3      ;GET ADDRESS
5448      017034 022703 017144      2$:      CMP      #STTYIN+8., R3      ;BUFFER FULL?
5449      017040 101405      BLOS      4$              ;BR IF YES
5450      017042 104410      RDCHR      ;GO READ ONE CHARACTER FROM THE TTY
5451      017044 112613      MOVB      (SP)+, (R3)      ;GET CHARACTER
5452      017046 122713 000177      CMPB      #177, (R3)      ;IS IT A RUBOUT
5453      017052 001003      BNE      3$              ;SKIP IF NOT
5454      017054 104400 001152      4$:      TYPE      $QUES      ;TYPE A '?'
5455      017060 000763      BR      1$              ;CLEAR THE BUFFER AND LOOP
5456      017062 111367 000044      3$:      MOVB      (R3), 8$      ;ECHO THE CHARACTER
5457      017066 104400 017132      TYPE      8$
5458      017072 122723 000015      CMPB      #15, (R3)+      ;CHECK FOR RETURN
5459      017076 001356      BNE      2$              ;LOOP IF NOT RETURN
5460      017100 105063 177777      CLRB      -1(R3)          ;CLEAR RETURN (THE 15)
5461      017104 104400 001154      TYPE      $LF            ;TYPE A LINE FEED
5462      017110 012603      MOV      (SP)+, R3        ;RESTORE R3
5463      017112 011646      MOV      (SP), -(SP)      ;ADJUST THE STACK AND PUT ADDRESS OF THE
5464      017114 016666 000004 000002      MOV      4(SP), 2(SP)      ;FIRST ASCII CHARACTER ON IT
5465      017122 012766 017134 000004      MOV      #STTYIN, 4(SP)
5466      017130 000002      RTI                          ;RETURN
5467      017132      000      8$:      .BYTE      0              ;STORAGE FOR ASCII CHAR. TO TYPE
5468      017133      000      .BYTE      0              ;TERMINATOR
5469      017134 000010      $TTYIN: .BLKB      8.      ;RESERVE 8 BYTES FOR TTY INPUT
5470      ;*****
5471
5472      .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE
5473
5474      ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
5475      ;*CALL:
5476      ;*      MOV      NUM, -(SP)          ;NUMBER TO BE TYPED
5477      ;*      TYPOS      ;CALL FOR TYPEOUT
5478      ;*      .BYTE      N              ;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE

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M11

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BINARY TO OCTAL (ASCII) AND TYPE

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5479      ;*      .BYTE      M      ;M=1 OR 0
5480      ;*      ;1=TYPE LEADING ZEROS
5481      ;*      ;0=SUPPRESS LEADING ZEROS
5482      ;*
5483      ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
5484      ;*$TYPOS OR $TYPOC
5485      ;*CALL:
5486      ;*      MOV      NUM,-(SP)      ;NUMBER TO BE TYPED
5487      ;*      TYPON      ;CALL FOR TYPEOUT
5488      ;*
5489      ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
5490      ;*CALL:
5491      ;*      MOV      NUM,-(SP)      ;NUMBER TO BE TYPED
5492      ;*      TYPOC      ;CALL FOR TYPEOUT
5493      ;*
5494      017144 017646 000000      $TYPOS: MOV      2(SP),-(SP)      ;PICKUP THE MODE
5495      017150 116667 000001 000211      MOV      1(SP),$OFILL      ;LOAD ZERO FILL SWITCH
5496      017156 112667 000207      MOV      (SP)+,$SOMODE+1      ;NUMBER OF DIGITS TO TYPE
5497      017162 062716 000002      ADD      #2,(SP)      ;ADJUST RETURN ADDRESS
5498      017166 000406      BR      $TYPON
5499      017170 112767 000001 000171      $TYPOC: MOV      #1,$OFILL      ;SET THE ZERO FILL SWITCH
5500      017176 112767 000006 000165      MOV      #6,$SOMODE+1      ;SET FOR SIX(6) DIGITS
5501      017204 112767 000005 000154      $TYPON: MOV      #5,$OCNT      ;SET THE ITERATION COUNT
5502      017212 010346      MOV      R3,-(SP)      ;SAVE R3
5503      017214 010446      MOV      R4,-(SP)      ;SAVE R4
5504      017216 010546      MOV      R5,-(SP)      ;SAVE R5
5505      017220 116704 000145      MOV      $SOMODE+1,R4      ;GET THE NUMBER OF DIGITS TO TYPE
5506      017224 005404      NEG      R4
5507      017226 062704 000006      ADD      #6,R4      ;SUBTRACT IT FOR MAX. ALLOWED
5508      017232 110467 000132      MOV      R4,$SOMODE      ;SAVE IT FOR USE
5509      017236 116704 000125      MOV      $OFILL,R4      ;GET THE ZERO FILL SWITCH
5510      017242 016605 000012      MOV      12(SP),R5      ;PICKUP THE INPUT NUMBER
5511      017246 005003      CLR      R3      ;CLEAR THE OUTPUT WORD
5512      017250 006105      1$:      ROL      R5      ;ROTATE MSB INTO "C"
5513      017252 000404      BR      3$      ;GO DO MSB
5514      017254 006105      2$:      ROL      R5      ;FORM THIS DIGIT
5515      017256 006105      ROL      R5
5516      017260 006105      ROL      R5
5517      017262 010503      MOV      R5,R3
5518      017264 006103      3$:      ROL      R3      ;GET LSB OF THIS DIGIT
5519      017266 105367 000076      DECB      $SOMODE      ;TYPE THIS DIGIT?
5520      017272 100016      BPL      7$      ;BR IF NO
5521      017274 042703 177770      BIC      #177770,R3      ;GET RID OF JUNK
5522      017300 001002      BNE      4$      ;TEST FOR 0
5523      017302 005704      TST      R4      ;SUPPRESS THIS 0?
5524      017304 001403      BEQ      5$      ;BR IF YES
5525      017306 005204      4$:      INC      R4      ;DON'T SUPPRESS ANYMORE 0'S
5526      017310 052703 000060      BIS      #'0,R3      ;MAKE THIS DIGIT ASCII
5527      017314 052703 000040      5$:      BIS      #' ,R3      ;MAKE ASCII IF NOT ALREADY
5528      017320 110367 000040      MOV      R3,8$      ;SAVE FOR TYPING
5529      017324 104400 017364      TYPE      8$      ;GO TYPE THIS DIGIT
5530      017330 105367 000032      7$:      DECB      $OCNT      ;COUNT BY 1
5531      017334 003347      BGT      2$      ;BR IF MORE TO DO
5532      017336 002402      BLT      6$      ;BR IF DONE

```

```

5533 017340 005204          INC      R4          ;INSURE LAST DIGIT ISN'T A BLANK
5534 017342 000744          BR       2$          ;GO DO THE LAST DIGIT
5535 017344 012605      6$:    MOV      (SP)+,R5      ;RESTORE R5
5536 017346 012604          MOV      (SP)+,R4      ;RESTORE R4
5537 017350 012603          MOV      (SP)+,R3      ;RESTORE R3
5538 017352 016666 000002 000004  MOV      2(SP),4(SP)    ;SET THE STACK FOR RETURNING
5539 017360 012616          MOV      (SP)+,(SP)
5540 017362 000002          RTI
5541 017364 000          8$:    .BYTE   0          ;RETURN
5542 017365 000          .BYTE   0          ;STORAGE FOR ASCII DIGIT
5543 017366 000          $OCNT:  .BYTE   0          ;TERMINATOR FOR TYPE ROUTINE
5544 017367 000          $OFILL: .BYTE   0          ;OCTAL DIGIT COUNTER
5545 017370 000000          $OMODE: 0          ;ZERO FILL SWITCH
5546          ;;*****
5547          ;;*****
5548          .SBTTL SCOPE HANDLER ROUTINE
5549
5550          ;*SW14=1      LOOP ON TEST
5551          ;*THE TEST NUMBER ($TSTNM) IS INCREMENTED AND DISPLAYED IN DISPLAY<7:0>
5552          ;*AND THE ERROR FLAG ($ERFLG) IS DISPLAYED IN DISPLAY<15:08>
5553
5554          $SCOPE:
5555 017372 006137 177570          ROL      @#SWR          ;LOOP ON PRESENT TEST?
5556 017376 100425          BMI     $OVER          ;YES IF SW14=1
5557          ;*****START OF CODE FOR THE XOR TESTER*****
5558 017400 000416      $XTSTR: BR       6$          ;IF RUNNING ON THE "XOR" TESTER CHANGE
5559          ;THIS INSTRUCTION TO A "NOP" (NOP=240)
5560 017402 013746 000004          MOV      @#ERRVEC, -(SP) ;SAVE THE CONTENTS OF THE ERROR VECTOR
5561 017406 012737 017426 000004  MOV      #55, @#ERRVEC   ;SET FOR TIMEOUT
5562 017414 005737 177060          TST     @#177060        ;TIME OUT ON XOR?
5563 017420 012637 000004          MOV      (SP)+, @#ERRVEC ;RESTORE THE ERROR VECTOR
5564 017424 000404          BR      $SVLAD          ;GO TO THE NEXT TEST
5565 017426 022626      5$:    CMP      (SP)+,(SP)+    ;CLEAR THE STACK AFTER A TIME OUT
5566 017430 012637 000004          MOV      (SP)+, @#ERRVEC ;RESTORE THE ERROR VECTOR
5567 017434 000406          BR      $OVER          ;LOOP ON THE PRESENT TEST
5568 017436          6$:    ;*****END OF CODE FOR THE XOR TESTER*****
5569 017436 105267 161440      $SVLAD: INCB    $TSTNM      ;COUNT TEST NUMBERS
5570 017442 011667 161440          MOV      (SP), $LPADR    ;SAVE SCOPE LOOP ADDRESS
5571 017446 105067 161431          CLRB   $ERFLG          ;ZERO THE ERROR FLAG
5572 017452 016737 161424 177570  $OVER:  MOV      $TSTNM, @#DISPLAY ;DISPLAY TEST NUMBER
5573 017460 016716 161422          MOV      $LPADR, (SP)   ;FUDGE RETURN ADDRESS
5574 017464 000002          RTI
5575          ;;*****
5576          ;;*****
5577          .SBTTL ERROR HANDLER ROUTINE
5578
5579          ;*SW15=1      HALT ON ERROR
5580          ;*SW13=1      INHIBIT ERROR TYPEOUTS
5581          ;*GO TO $ERRTYP ON ERROR
5582
5583          $ERROR:
5584 017466 105267 161411      7$:    INCB    $ERFLG          ;SET THE ERROR FLAG
5585 017472 001775          BEQ     7$            ;DON'T LET THE FLAG GO TO ZERO
5586 017474 016737 161402 177570  MOV      $TSTNM, @#DISPLAY ;DISPLAY TEST NUMBER AND ERROR FLAG

```


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ERROR MESSAGE TYPEOUT ROUTINE

```

5641 017676 005710          TST      (R0)          ;IS THERE ANOTHER NUMBER?
5642 017700 001770          BEQ      6$          ;BR IF NO
5643 017702 104400 017710  TYPE      8$          ;TYPE TWO(2) SPACES
5644 017706 000771          BR       7$          ;LOOP
5645 017710 020040 000      8$: .ASCIZ  / /          ;TWO(2) SPACES
5646 017714 017714          .EVEN
5647 ;:*****
5648 .SBTTL  READ AN OCTAL NUMBER FROM THE TTY
5649
5650
5651 ;*CALL:
5652 ;*      RDOCT          ;READ AN OCTAL NUMBER
5653 ;*      RETURN HERE   ;LOW ORDER BITS ARE ON TOP OF THE STACK
5654 ;*
5655
5656 017714 011646 000004 000002 $RDOCT: MOV      (SP),-(SP)      ;PROVIDE SPACE FOR THE
5657 017716 016666          MOV      4(SP),2(SP)      ;INPUT NUMBER
5658 017724 010046          MOV      R0,-(SP)        ;PUSH R0 ON STACK
5659 017726 010146          MOV      R1,-(SP)        ;PUSH R1 ON STACK
5660 017730 010246          MOV      R2,-(SP)        ;PUSH R2 ON STACK
5661 017732 104412          1$:  RDLIN          ;READ AN ASCIZ LINE
5662 017734 012600          MOV      (SP)+,R0        ;GET ADDRESS OF 1ST CHARACTER
5663 017736 005001          CLR      R1              ;CLEAR DATA WORD
5664 017740 005002          CLR      R2
5665 017742 112046          2$:  MOVB      (R0)+,-(SP)    ;PICKUP THIS CHARACTER
5666 017744 001412          BEQ      3$              ;IF ZERO GET OUT
5667 017746 006301          ASL      R1              ;*2
5668 017750 006102          ROL      R2
5669 017752 006301          ASL      R1              ;*4
5670 017754 006102          ROL      R2
5671 017756 006301          ASL      R1              ;*8
5672 017760 006102          ROL      R2
5673 017762 042716 177770  BIC      #1C7,(SP)        ;STRIP THE ASCII JUNK
5674 017766 062601          ADD      (SP)+,R1        ;ADD IN THIS DIGIT
5675 017770 000764          BR       2$              ;LOOP
5676 017772 005726          3$:  TST      (SP)+        ;CLEAN TERMINATOR FROM STACK
5677 017774 010166 000012  MOV      R1,12(SP)        ;SAVE THE RESULT
5678 020000 010267 000010  MOV      R2,$HIOCT
5679 020004 012602          MOV      (SP)+,R2        ;POP STACK INTO R2
5680 020006 012601          MOV      (SP)+,R1        ;POP STACK INTO R1
5681 020010 012600          MOV      (SP)+,R0        ;POP STACK INTO R0
5682 020012 000002          RTI
5683 020014 000000          $HIOCT: .WORD  0          ;RETURN
5684 ;:*****
5685
5686 .SBTTL  TRAP DECODER
5687
5688 ;*THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE "TRAP" INSTRUCTION
5689 ;*AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
5690 ;*OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL
5691 ;*GO TO THAT ROUTINE.
5692
5693 020016 010046 000002  $TRAP: MOV      R0,-(SP)      ;SAVE R0
5694 020020 016600          MOV      2(SP),R0        ;GET TRAP ADDRESS

```

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TRAP DECODER

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5695	020024	005740	
5696	020026	111000	
5697	020030	016000	020036
5698	020034	000200	
5699			
5700			
5701			
5702			
5703			
5704			
5705			
5706			
5707			
5708	020036		
5709	020036	016664	
5710	020040	017170	
5711	020042	017144	
5712	020044	017204	
5713	020046	016772	
5714	020050	017026	
5715	020052	017714	
5716	020054	005015	047522 020115
		005015	051127 052111
		005015	047125 054105
		005015	040506 040524
		005015	041520 020040
		015	040412 042104
		015	050012 004503
		015	040412 042104
		015	050012 020103
		015	052012 040522
		020452	
5717	020452	001116	001124 001126
5718	020460	001224	001226 000000
5719			
5720	020466	001116	001226 000000
5721	020474	001116	016570 000000
5722		020542	
5723	020542		
5724		000001	

```

TST      -(RO)
MOV      (RO),RO
MOV      $TRPAD(RO),RO
RTS      RO

```

```

;BACKUP BY 2
;GET RIGHT BYTE OF TRAP
;INDEX TO TABLE
;GO TO ROUTINE

```

.SBTTL TRAP TABLE

```

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

```

```

; ROUTINE
; -----

```

\$TRPAD:

```

$TYPE      :CALL=TYPE      TRAP+0(104400)  TTY TYPEOUT ROUTINE
$TYPOC     :CALL=TYPOC     TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING
$TYPOS     :CALL=TYPOS     TRAP+4(104404)  TYPE OCTAL NUMBER (NO LEADING ZE
$TYPON     :CALL=TYPON     TRAP+6(104406)  TYPE OCTAL NUMBER (AS PER LAST C
$RDCHR     :CALL=RDCHR     TRAP+10(104410) TTY TYPEIN CHARACTER ROUTINE
$RDLIN     :CALL=RDLIN     TRAP+12(104412) TTY TYPEIN STRING ROUTINE
$RDOCT     :CALL=RDOCT     TRAP+14(104414) READ AN OCTAL NUMBER FROM TTY

```

```

EM1: .ASCIZ <15><12>/ROM READ DATA COMPARISON ERROR./
EM2: .ASCIZ <15><12>/WRITING ROM FAILED TO TRAP./
EM3: .ASCIZ <15><12>/UNEXP TRAP WHILE READING ROM./
EM4: .ASCIZ <15><12>/FATAL TRAP. ROM PC ON STACK./
DH1: .ASCII <15><12>/PC      SOFT  ROM/
     .ASCIZ <15><12>/ADDRESS ADDRESS ADDRESS EXPECTED FOUND /
DH2: .ASCII <15><12>/PC      ROM/
     .ASCIZ <15><12>/ADDRESS ADDRESS/
DH3: .ASCII <15><12>/PC OF  PROGRAM /
     .ASCIZ <15><12>/TRAP  ADDRESS/

```

.EVEN

DT1: .WORD \$ERRPC, \$GDDAT, \$BDDAT, TEMP3, TEMP4, 0

DT2: .WORD \$ERRPC, TEMP4, 0

DT3: .WORD \$ERRPC, XSTORE, 0

.=. +40

CORMAX:

.END

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CROSS REFERENCE TABLE

PIRQVE=	000240	445#												
PRG.NO	016530	4633*	4819*	4906*	5003*	5205*	5338	5339#	5348	5358				
FRG.!	012602	4821#	4896											
PRG1	012566	4659	4667	4685	4693	4701	4709	4717	4787	4819#	4895	5358		
PRG2	013312	4790	4906#	4986										
PRG3	014252	4793	5003#											
PRG4	015256	4796	5205#	5252	5308	5360								
PS =	177776	358#	359	5337*	5347*									
PSW =	177776	359#												
PWRVEC=	000024	440#												
PWR.UP	016472	5324	5331#											
RDCHR =	104410	5450	5713#											
RDLIN =	104412	4725	4782	5007	5661	5714#								
RDOCT =	104414	5031	5052	5715#										
RESTRT	011000	350	4615#	4798										
RESVEC=	000010	435#												
RUN.3	014706	5119#	5190											
RUN3	014672	5117#	5189											
RO =	%000000	366#	4822*	4827	4829	4830	4832	4834	4835	4845	4848	4857	4863#	4866
		4868	4869	4871	4872*	4874	4884	4887	4890	4910*	4915	4916	4920	4921
		4931	4932	4936	4937	4944	4952*	4957	4958	4960	4969	4970	4978	4979
		4984*	5062*	5067	5068	5069	5082	5083	5084	5092	5105*	5119#	5124	5126
		5127	5129	5131	5132	5141	5144	5152	5157*	5161	5163	5164	5166	5167*
		5169	5178	5181	5184	5226*	5231*	5240*	5262*	5272*	5288*	5298*	5333*	5334*
		5344*	5401	5402*	5403	5406*	5609	5610*	5611*	5618*	5619*	5620*	5621*	5622*
		5623	5628	5633*	5635*	5639	5641	5658	5662*	5665	5681*	5693	5694*	5695
		5696*	5697*	5698*										
R1 =	%000001	367#	4915*	4917	4931*	4933	4957*	4959	4969*	4971	5004*	5005	5026*	5032*
		5034	5035	5037	5042	5263*	5269	5276	5289*	5293	5299*	5304	5356*	5361*
		5365	5659	5663*	5667*	5669*	5671*	5674*	5677	5680*				
R2 =	%000002	368#	4726*	4727*	4728	4734	4740	4746	4752	4758	4764	4770	4776	4783*
		4784	5008*	5009*	5010	5013	5015	5018	5660	5664*	5668*	5670*	5672*	5678
		5679*												
R3 =	%000003	369#	4784*	4785	4788	4791	4794	4826*	4842*	4865*	4879*	4911*	4920*	4936*
		4953*	4960*	4978*	5090*	5091	5092	5100	5101	5123*	5139*	5160*	5174*	5254*
		5258	5281*	5282	5446	5447*	5448	5451*	5452	5456	5458	5460*	5462*	5502
		5511*	5517*	5518*	5521*	5526*	5527*	5528	5537*					
R4 =	%000004	370#	4824*	4829	4832	4833	4836	4848	4856*	5121*	5126	5129	5130	5133
		5144	5151*	5213*	5238*	5255*	5263	5279	5503	5505*	5506*	5507*	5508	5509*
		5523	5525*	5533*	5536*									
R5 =	%000005	371#	5212*	5228	5249*	5250	5264*	5269	5273*	5276	5290*	5293	5300*	5304
		5504	5510*	5512*	5514*	5515*	5516*	5517	5535*					
R6 =	%000006	372#	374	4616*	4617*	4618								
R7 =	%000007	373#	375											
SAVRO	001230	538#												
SAVR1	001232	539#												
SAVR4	001234	540#												
SAVR5	001236	541#												
SP =	%000006	374#	4620*	4630*	4640*	4644	4647*	4651	4653	4654	4671*	4675	4677	4678
		4726	4783	4876*	4924*	4929*	4941*	4962*	4966*	4975*	5008	5025*	5032	5039*
		5053	5072*	5077*	5096*	5171*	5207*	5219*	5230*	5236*	5244*	5260*	5320*	5325
		5327	5328	5332*	5341	5342	5344	5346*	5401*	5402	5403*	5405	5406	5407*
		5410	5412*	5414*	5420	5432*	5433*	5436*	5437*	5446*	5451	5462	5463*	5464*
		5465*	5494*	5495	5496	5497*	5502*	5503*	5504*	5510	5535	5536	5537	5538*

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CROSS REFERENCE TABLE

	5539*	5560*	5563	5565	5566	5570	5573*	5588	5609*	5614*	5635	5639*	5656*
	5657*	5658*	5659*	5660*	5662	5665*	5673*	5674	5676	5677*	5679	5680	5681
	5693*	5694											
SPACE3	5317*												
SRV.A	5019	5052*											
SRV.D	5014	5023*											
SRV.L	5011	5061*											
SRV.R	5017	5116*											
STACK =	355*	4620	4630	4876	5171	5207	5230	5260	5332	5346			
START	4630*	4633											
STKLMT=	360*												
SWR =	362*	363	4840	4851	4877	4882	4950	5098	5137	5146	5172	5176	5555*
	5591	5595											
SW0 =	403*												
SW00 =	393*	403											
SW01 =	392*	402											
SW02 =	391*	401											
SW03 =	390*	400											
SW04 =	389*	399											
SW05 =	388*	398											
SW06 =	387*	397											
SW07 =	386*	396											
SW08 =	385*	395	5551	5569									
SW09 =	384*	394	485	4627	5551	5567	5569	5571	5575	5581	5598	5599	
SW1 =	402*												
SW10 =	383*	485	5581	5587	5599								
SW11 =	382*	485	4627	5551	5569	5571	5575						
SW12 =	381*												
SW13 =	380*	5580	5591										
SW14 =	379*	5550	5555										
SW15 =	378*	5579	5595										
SW2 =	401*												
SW3 =	400*												
SW4 =	399*												
SW5 =	398*												
SW6 =	397*												
SW7 =	396*												
SW8 =	395*												
SW9 =	394*												
TABLE	4629*	4655*	4663*	4681*	4689*	4697*	4705*	4713*	4730*	4736*	4742*	4748*	4754*
	4760*	4766*	4772*	4777	4799*	4824	4911	4918	4934	5004	5062	5121	
TAG.A	5210	5254*	5285										
TBITVE=	436*												
TEMP3	536*	4836*	4837	4916*	4924	4932*	4958*	4962	4970*	5068*	5072	5083*	5133*
	5134	5215*	5219	5247*	5267*	5717							
TEMP4	537*	4835*	4837	4874*	4917*	4929	4933*	4941	4959*	4966	4971*	4975	5023*
	5025	5026	5037*	5039	5067*	5077	5082*	5086	5132*	5134	5169*	5233*	5236
	5241*	5244	5268*	5275*	5292*	5302*	5717	5720					
TEMP5	535*	4914*	4946*	4956*	4981*	5066*	5094*						
TKVEC =	443*												
TPVEC =	444*												
TRAPVE=	442*	4625*	4626*										
TRTVEC=	437*												
TYPE =	4719	4724	4779	4781	4797	4805	4912	4913	4922	4926	4939	4954	4955

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CROSS REFERENCE TABLE

.\$SCOP	1#	338#	5546
.\$SIZE	1#		
.\$SUPR	1#		
.\$TRAP	1#	337#	5684
.\$TYPB	1#		
.\$TYPD	1#		
.\$TYPE	1#	5374#	5375
.\$TYPO	1#	5374#	5470

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CROSS REFERENCE TABLE

ADD	4909	5334	5407	5497	5507	5622	5674								
ASL	5619	5620	5621	5667	5669	5671									
BEQ	4838	4846	4852	4854	4883	4885	4888	4945	4951	4980	5011	5014	5019	5093	5099
	5102	5135	5142	5147	5149	5177	5179	5182	5270	5277	5294	5305	5343	5357	5362
	5524	5585	5624	5629	5642	5666									
BGT	5531														
BIC	5437	5521	5673												
BIS	5526	5527													
BISB	5611														
BIT	4840	4851	4877	4882	4950	5098	5137	5146	5172	5176	5342	5591			
BLO	5036														
BLOS	5449														
BLT	5415	5532													
BMI	5556														
BNE	4619	4638	4646	4662	4670	4674	4688	4696	4704	4712	4722	4729	4735	4741	4747
	4753	4759	4765	4771	4778	4786	4789	4792	4795	4828	4831	4841	4843	4867	4870
	4878	4880	4893	4919	4935	4947	4982	5016	5095	5125	5128	5139	5140	5162	5165
	5173	5175	5187	5210	5251	5283	5285	5335	5359	5404	5411	5453	5459	5522	5592
	5612	5634													
BPL	5398	5419	5435	5520	5596										
BR	4652	4676	4679	4780	4807	4849	4858	4886	4891	4948	4983	5021	5096	5107	5145
	5153	5180	5185	5400	5417	5455	5498	5513	5534	5558	5564	5567	5617	5644	5675
CLC	5248	5280													
CLR	4617	4628	4629	4631	4632	4635	4636	4984	5206	5227	5257	5287	5297	5319	5333
	5337	5347	5353	5511	5610	5663	5664								
CLRB	5460	5571													
CMP	4618	4645	4653	4661	4669	4673	4677	4687	4695	4703	4711	4728	4734	4740	4746
	4752	4758	4764	4770	4785	4788	4791	4794	4827	4829	4830	4832	4837	4845	4848
	4853	4866	4869	4884	4887	4918	4934	4944	4979	5010	5013	5015	5018	5035	5092
	5101	5124	5126	5127	5129	5134	5141	5144	5148	5161	5164	5178	5181	5250	5269
	5276	5282	5293	5304	5358	5448	5565								
	5410	5452	5458												
CMPB	5410	5452	5458												
COM	4723	5211													
DEC	4842	4879	4892	4946	4981	5094	5139	5174	5186	5284	5618				
DECB	5414	5519	5530												
EMT	356														
HALT	346	4720	4806	4985	5326	5329	5399	5597							
INC	5247	5525	5533	5587											
INCB	5569	5584													
IOT	357														
JMP	350	4639	4659	4667	4685	4693	4701	4709	4717	4787	4790	4793	4796	4798	4895
	4896	4986	5017	5043	5045	5054	5108	5189	5190	5252	5308	5338	5348	5360	
JSR	4894	5193	5307	5365	5409	5416	5593								
MOV	4616	4620	4621	4622	4623	4624	4625	4626	4627	4630	4633	4634	4640	4641	4644
	4647	4648	4651	4654	4655	4656	4657	4658	4663	4664	4665	4666	4671	4672	4675
	4678	4681	4682	4683	4684	4689	4690	4691	4692	4697	4698	4699	4700	4705	4706
	4707	4708	4713	4714	4715	4716	4726	4727	4730	4731	4732	4736	4737	4738	4742
	4743	4744	4748	4749	4750	4754	4755	4756	4760	4761	4762	4766	4767	4768	4772
	4773	4774	4776	4783	4784	4819	4820	4821	4822	4823	4824	4825	4826	4833	4834
	4835	4836	4855	4856	4862	4863	4864	4865	4872	4874	4876	4906	4907	4908	4910
	4911	4914	4915	4916	4917	4920	4924	4929	4931	4932	4933	4936	4941	4952	4953
	4956	4957	4958	4959	4960	4962	4966	4969	4970	4971	4975	4978	5003	5004	5005
	5008	5009	5023	5025	5026	5032	5037	5039	5042	5053	5062	5063	5066	5067	5068
	5072	5077	5082	5083	5086	5090	5105	5106	5117	5118	5119	5120	5121	5122	5123

.MCALL	337	338	446	5374											
.NLIST	1	337	346	446	485	555	4607	4616	4808	4899	4987	5315	5317	5439	5700
.PAGE	5709	5710	5711	5712	5713	5714	5715	5716	5724						
	446	488	742	1114	1585	1636	1683	1746	1791	1842	1912	1966	2019	2073	2120
	2172	2225	3264	3833	4611	4859	5154	5315							
.REM	4	2026	2076												
.REPT	346														
.SBTTL	337	340	347	352	448	490	555	5377	5424	5472	5548	5577	5601	5649	5686
	5701														
.TITLE	542														
.WORD	346	457	462	465	466	467	468	471	472	473	474	475	476	5626	5631
	5683	5717	5720	5721											

ERRORS DETECTED: 0

*, DZBMDH.SEQ/SOL/CRF/NL: TOC=DSKZ: DZBMDH.SML, DZBMDH.P11
 RUN-TIME: 12 18 1 SECONDS
 CORE USED: 20K

