

PDP-11/70

DIAGNOSTIC/BOOTSTRAP
MD-11-DEKBH-A
(M9301-YC) PATTERN

EP-DEKBH-A-DL
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MAY 1978
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MADE IN USA



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IDENTIFICATION

PRODUCT CODE:	MAINDEC-11-DEKBH-A-D
PRODUCT NAME:	PDP-11/70 DIAGNOSTIC/BOOTSTRAP (M9381-YC) PATTERN
DATE CREATED:	21-JULY-75
MAINTAINER:	DIAGNOSTIC ENGINEERING
AUTHOR:	DALE A. ROEDGER

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1) ABSTRACT

THIS PROGRAM IS THE ROM DIAGNOSTIC/BOOTSTRAP FOR THE M9301-YC
IT IS MEANT TO BE FOR THE PDP-11/70 ONLY, AND WILL FAIL ON ALL
OTHER PDP-11 PROCESSORS.

THE DIAGNOSTIC PORTION OF THE PROGRAM WILL TEST THE BASIC CPU,
INCLUDING: THE BRANCHES, THE REGISTERS, ALL ADDRESSING MODES,
AND MOST OF THE INSTRUCTIONS IN THE PDP-11 REPERTOIRE. IT WILL
THEN SET THE STACK POINTER TO KERNEL D-SPACE P.A.R, 7, CHECK
AND TURN ON, IF REQUESTED, MEMORY MANAGEMENT AND THE UNIBUS MAP,
AND CHECK MEMORY FROM VIRTUAL ADDRESS 1000 TO 157776. AFTER
MAIN MEMORY HAS BEEN VERIFIED, WITH THE CACHE OFF, THE CACHE
MEMORY WILL BE TESTED TO VERIFY THAT "HITS" OCCUR PROPERLY.
THEN MAIN MEMORY WILL BE SCANNED AGAIN TO INSURE THAT THE CACHE
IS WORKING PROPERLY THROUGHOUT THE 28K OF MEMORY TO BE USED IN
THE "BOOT" OPERATION.

IF ONE OF THE CACHE MEMORY TESTS FAILS, THE OPERATOR CAN ATTEMPT
TO "BOOT" THE SYSTEM ANYWAY BY PRESSING "CONTINUE", THIS WILL
CAUSE THE PROGRAM TO FORCE "MISSES" IN BOTH GROUPS OF THE CACHE
BEFORE GOING TO THE BOOTSTRAP SECTION OF THE PROGRAM.

THE BOOTSTRAP PORTION OF THE PROGRAM LOOKS AT THE LOWER BYTE OF
THE SWITCH REGISTER TO DETERMINE WHICH ONE OF 9 DEVICES AND WHICH
DRIVE NUMBER TO ATTEMPT THE "BOOT" FROM. SWITCHES <02 ! 00>
SELECT THE DRIVE NUMBER (0 - 7), AND SWITCHES <06 ! 03> SELECT
THE DEVICE CODE (1 - 11). IF THE LOWER BYTE OF THE SWITCH REGIS-
TER IS ZERO, THE PROGRAM WILL READ THE SET OF SWITCHES ON THE
M9301-YC TO DETERMINE THE DEVICE AND DRIVE NUMBER. THESE SWITCHES
CAN BE SET BY FIELD SERVICE TO SELECT A "DEFAULT BOOT" DEVICE.

IF THE BOOTSTRAP OPERATION FAILS AS A RESULT OF A HARDWARE ERROR
IN THE PERIPHERAL DEVICE THE PROGRAM WILL DO A "RESET" INSTRU-
CTION AND JUMP BACK TO THE TEST THAT SETS UP AND TURNS ON MEMORY
MANAGEMENT AND TESTS MEMORY, THEN THE PROGRAM WILL ATTEMPT TO
"BOOT" AGAIN.

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2) STARTING PROCEDURE

2.1 SWITCH SETTINGS

THE LOWER BYTE OF THE SWITCH REGISTER SHOULD BE SET TO HAVE THE DRIVE NUMBER (0 - 7) IN SWITCHES <02 ! 00>, AND THE DEVICE CODE (1 - 11) IN SWITCHES <06 ! 03>.

THE UPPER BYTE OF THE SWITCH REGISTER SHOULD BE SET TO HAVE THE BANK NUMBER OF THE 32K BLOCK OF MEMORY TO BE USED FOR THE BOOTSTRAP OPERATION (0 - 17) IN SWITCHES <15 ! 12>.

THE DEVICE CODES ARE AS FOLLOWS:

- 1) TM11/TU10 MAGNETIC TAPE, TM11
- 2) TC11/TU50 DECTAPE, TC11-0
- 3) RK11/RK05 DECPACK DIS CARTRIDGE, RK11-0
- 4) RP11/RP03 DISK PACK, RP11-C
- 5) RESERVED FOR FUTURE DEVICE
- 6) RH70/TU16 MAGNETIC TAPE SYSTEM, THU16
- 7) RH70/RP04 DISK PACK, RHP04
- 10) RH70/RS04 FIXED HEAD DISK, RWS04 (OR RWS03)
- 11) RX11/RX01 DISKETTE

THE MEMORY BLOCKS ARE AS FOLLOWS:

- 0) PHYSICAL MEMORY 0 - 28K
- 1) PHYSICAL MEMORY 32K - 60K
- 2) PHYSICAL MEMORY 64K - 92K
- 3) PHYSICAL MEMORY 96K - 124K
- 4) PHYSICAL MEMORY 128K - 156K
- .
- 13) PHYSICAL MEMORY 256K - 284K
- .
- 14) PHYSICAL MEMORY 384K - 412K
- 15) PHYSICAL MEMORY 416K - 444K
- 16) PHYSICAL MEMORY 448K - 476K
- 17) PHYSICAL MEMORY 480K - 508K

.REM \

2.2 STARTING ADDRESSES

THE NORMAL STARTING ADDRESS FOR THIS PROGRAM IS 177765000.

IF THE DIAGNOSTIC PORTION OF THIS PROGRAM FAILS AND THE OPERATOR WANTS TO ATTEMPT TO "BOOT" ANYWAY, HE MUST FOLLOW THESE STEPS:

- 1) SET UP MEMORY MANAGEMENT IF "BOOTING" INTO OTHER THAN THE LOWER 20K OF MEMORY.
- 2A) IF DEVICE IS ON MASSBUS;
SET STACK POINTER TO A VALID ADDRESS AND LOAD THAT ADDRESS WITH THE MEMORY BANK NUMBER HE WOULD PUT INTO SWITCHES <15112>.
- 2B) IF DEVICE IS ON UNIBUS;
SET UP UNIBUS MAP REGISTERS 0 THRU 6 TO MAP TO SAME MEMORY AS MEMORY MANAGEMENT.
- 3) DEPOSIT ADDRESS 173000 INTO THE PC.
- 4) SET THE DEVICE CODE AND DRIVE NUMBER IN THE LOWER BYTE OF THE SWITCH REGISTER.
- 5) PRESS CONTINUE.

EXAMPLES:

- A) RP04 -- SET STACK POINTER TO 40000
LOAD 000000 INTO ADDRESS 40000
LOAD 173000 INTO THE PC (17777707)
SET 000070 INTO SWITCHES (RP04 DRIVE 0)
PRESS "CONTINUE"
- B) RK05 -- LOAD 173000 INTO THE PC (17777707)
SET 000030 INTO SWITCHES (RK05 DRIVE 0)
PRESS "CONTINUE"

2.3 OPERATOR ACTION

IF THE DIAGNOSTIC PORTION OF THE ROM FAILS RECORD THE PC OF THE "HALT" INSTRUCTION AND REFER TO THE LISTING TO FIND OUT WHAT PORTION OF THE MACHINE FAILED.

.REM \
3) ERRORS

3.1 LIST OF ERROR HALTS INDEXED BY THE ADDRESS DISPLAYED

ADDRESS DISPLAYED	TEST NUMBER AND SUBSYSTEM UNDER TEST
17765004	TEST 1 BRANCH TEST
17765020	TEST 2 BRANCH TEST
17765036	TEST 3 BRANCH TEST
17765052	TEST 4 BRANCH TEST
17765068	TEST 5 BRANCH TEST
17765076	TEST 6 BRANCH TEST
17765134	TEST 7 REGISTER DATA PATH TEST
17765146	TEST 10 BRANCH TEST
17765166	TEST 11 CPU INSTRUCTION TEST
17765204	TEST 12 CPU INSTRUCTION TEST
17765214	TEST 13 CPU INSTRUCTION TEST
17765222	TEST 14 "COM" INSTRUCTION TEST
17765236	TEST 14 CPU INSTRUCTION TEST
17765260	TEST 15 CPU INSTRUCTION TEST
17765270	TEST 16 BRANCH TEST
17765312	TEST 16 CPU INSTRUCTION TEST
17765346	TEST 17 CPU INSTRUCTION TEST
17765360	TEST 20 CPU INSTRUCTION TEST
17765374	TEST 20 CPU INSTRUCTION TEST
17765450	TEST 21 KERNEL P.A.R. TEST
17765474	TEST 22 KERNEL P.D.R. TEST
17765510	TEST 23 "JSR" TEST
17765520	TEST 23 "JSR" TEST
17765530	TEST 23 "RTS" TEST
17765542	TEST 23 "RTI" TEST
17765550	TEST 23 "JMP" TEST
17765760	TEST 25 MAIN MEMORY DATA COMPARE ERROR
17766000	TEST 25 MAIN MEMORY PARITY ERROR NO RECOVERY POSSIBLE FROM THIS ERROR
17773644	TEST 26 CACHE MEMORY DATA COMPARE ERROR
17773654	TEST 26 CACHE MEMORY NO "HIT" PRESSING "CONTINUE" HERE WILL CAUSE "BOOT" ATTEMPT FORCING "MISSES"
17773736	TEST 27 CACHE MEMORY DATA COMPARE ERROR
17773746	TEST 27 CACHE MEMORY NO "HIT" PRESSING "CONTINUE" HERE WILL CAUSE "BOOT" ATTEMPT FORCING "MISSES"
17773764	TEST 25 OR 26 CACHE MEMORY PARITY ERROR PRESSING "CONTINUE" HERE WILL CAUSE "BOOT" ATTEMPT FORCING "MISSES"

3.2 ERROR RECOVERY

MOST OF THE ABOVE ERROR HALTS ARE "HARD" FAILURES, WHICH MEANS
THAT THERE IS NO RECOVERY FROM THEM, ESPECIALLY THE TWO (2) MAIN

MEMORY HALTS ARE NOT RECOVERABLE, YOUR BEST BET IS TO TRY TO
"BOOT" INTO ANOTHER 32K BANK OF MEMORY IF IT APPEARS TO
BE A MAIN MEMORY FAILURE.

IF THE PROCESSOR HALTS IN ONE OF THE TWO CACHE TESTS THE ERROR
CAN BE RECOVERED FROM. BY PRESSING "CONTINUE" THE PROGRAM WILL
EITHER ATTEMPT TO FINISH THE TEST (IF AT EITHER: 17773644 OR
17773736) OR FORCE "MISSES" IN BOTH GROUPS OF THE CACHE AND
ATTEMPT TO "BOOT" THE SYSTEM MONITOR WITH THE CACHE FULLY
DISABLED (IF AT EITHER: 17773654, 17773740, OR 17773704).

4) EXECUTION TIME

THE RUN TIME FOR THIS PROGRAM IS APPROXIMATELY 3 SECONDS.

.END

ERRORS DETECTED: 0

*.DEKBHA/NL:SEQ/NL:LOC/NL:BIN/NL:SYM=DEKBHA.MAN
RUN-TIME: 0 1 0 SECONDS
CORE USED: 4K

118	TEST1	THIS TEST VERIFIES THE UNCONDITIONAL BRANCH
130	TEST2	TEST "SUB", MODE "0", AND "BHI", "BVS", "BHI", "BLOS"
147	TEST3	TEST "DEC", MODE "0", AND "BPL", "BEQ", "BGE", "BGT", "BLE"
169	TEST4	TEST "ROR", MODE "0", AND "BVC", "BHS", "BHI", "BNE"
190	TEST5	TEST "BHI", "BLT", AND "BLOS"
210	TEST6	TEST "BLE" AND "BGT"
228	TEST7	TEST REGISTER DATA PATH AND MODES "2", "3", "6"
257	TEST10	TEST "ROL", "BCC", "BLT", AND MODE "6"
277	TEST11	TEST "ADD", "INC", "COM", AND "BCS", "BLE"
301	TEST12	TEST "ROR", "BIS", "ADD", AND "BLO", "BGE"
324	TEST13	TEST "DEC" AND "BLOS", "BLT"
343	TEST14	TEST "COM", "BIC", AND "BGT", "BGE", "BLE"
368	TEST15	TEST "ADC", "CMP", "BIT", AND "BNE", "BGT", "BEQ"
394	TEST16	TEST "MOVB", "SOB", "CLR", "TST" AND "BPL", "BNE"
421	TEST17	TEST "ASR", "ASL"
452	TEST20	TEST ASH, AND SWAB
480	TEST21	TEST 16 KERNEL P.A.R.'S
517	TEST22	TEST AND LOAD KIPDR'S
545	TEST23	TEST "JSR", "RTS", "RTI", & "JMP"
576	TEST24	LOAD AND TURN ON MEMORY MANAGEMENT AND THE UNIBUS MAP
630	TEST25	TEST MAIN MEMORY FROM VIRTUAL 1000 TO 20K
682		BOOTSTRAP ENTRY POINT IS AT 17773000
707		CODE TO WAIT FOR TU10 TO COME ON LINE
714		THIS IS THE CODE TO READ THE SWITCH REGISTER AND DECODE IT
736		THIS IS THE START OF THE TM11/TU10 BOOT STRAP (MAGNETIC TAPE, TM11)
754		THIS IS THE START OF THE TC11/TU56 BOOT STRAP (DECTAPE, TC11-G)
767		THIS IS THE START OF THE RK11/RK05 BOOT STRAP (DECPACK DISK CARTRIDGE, RK11-D)
775		THIS IS THE START OF THE RP11/RP03 BOOT STRAP (DISK PACK, RP11-C)
780		THIS IS THE START OF THE COMMON READ CODE
800		THIS IS THE START OF THE RH70/TU16 BOOT STRAP (MAGNETIC TAPE SYSTEM, THU16)
822		THIS IS THE START OF THE RH70/RP04 BOOT STRAP (DISK PACK, RMP04)
832		THIS IS THE START OF THE RH70/RS04 BOOT STRAP (FIXED HEAD DISK, RWS04)
839		THIS IS THE START OF THE COMMON RH-70 CODE
845		THIS IS THE START OF THE RX11/RX01 BOOT STRAP (FLOPPY DISK)
872		THIS IS THE START RESERVED FOR A FUTURE DEVICE
887		FUNCTION CODES FOR THE ALL OF THE DEVICES
912		COMMAND AND STATUS REGISTER ADDRESS TABLE
924		FUNCTION POINTER TABLE
936		STARTING ADDRESS TABLE
949		CACHE MEMORY DIAGNOSTIC TESTS
967	TEST26	TEST CACHE DATA MEMORY
1009	TEST27	TEST VIRTUAL 20K WITH CACHE ON

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; MAYNARD, MASS. 01754
;
; PROGRAMMER DALE A. ROEDGER
;


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129      ;|.....
130      .SBTTL TEST2  TEST "SUB", MODE "0", AND "BHI","BVS","BHI","BLOS"
131      ;|
132      ;| THE REGISTERS AND CONDITION CODES ARE ALL UNDEFINED WHEN
133      ;| THIS TEST IS ENTERED.  UPON COMPLETION OF THIS TEST THE "SP"
134      ;| (R6) SHOULD BE ZERO AND ONLY THE "Z" FLIP-FLOP WILL BE SET.
135      ;|
136      ;|.....
137      165004  TST2:
138
139      165004  005006      CLR      SP      ;N=0,Z=1;V=0,C=0,SP=000000
140      165006  100403      BHI     15      ; V 324 BRANCH IF N=1
141      165010  102402      BVS     15      ; V 324 BRANCH IF V=1
142      165012  101001      BHI     15      ; V 321 BRANCH IF B AND C ARE BOTH 0
143      165014  101401      BLOS   TST3    ;  325 BRANCH IF (Z XOR C)=1
144      165016  000000      15:     HALT
145
146      ;|.....
147      .SBTTL TEST3  TEST "DEC", MODE "0", AND "BPL","BEQ","BGE","BGT","BLE"
148      ;|
149      ;| UPON ENTERING THIS TEST THE CONDITION CODES ARE:
150      ;| N = 0, Z = 1, V = 0, AND C = 0.
151      ;| THE REGISTERS ARE: R0 = ?, R1 = ? R2 = ?
152      ;| R3 = ? R4 = ? R5 = ? SP = 000000
153      ;| UPON COMPLETION OF THIS TEST THE CONDITION CODES WILL BE:
154      ;| N = 1, Z = 0, V = 0, AND C = 0
155      ;| THE REGISTERS AFFECTED BY THE TEST ARE:
156      ;| SP = 177777
157      ;|
158      ;|.....
159      165020  TST3:
160      165020  005306      DEC     SP      ;N=1,Z=0;V=0,C=0,SP=177777
161      165022  100204      BPL     15      ; V 321 BRANCH IF N=0
162      165024  001403      BEQ     15      ; V 324 BRANCH IF Z=1
163      165026  002002      BGE     15      ; V 322 BRANCH IF (N XOR V)=0
164      165030  003001      BGT     15      ; V 322 BRANCH IF Z AND (N XOR V) ARE BOTH 0
165      165032  003401      BLE    TST4    ;  326 BRANCH IF [Z OR (N XOR V)]=1
166      165034  000000      15:     HALT
167
168      ;|.....
169      .SBTTL TEST4  TEST "ROR", MODE "0", AND "BVC","BHS","BHI","BNE"
170      ;|
171      ;| UPON ENTERING THIS TEST THE CONDITION CODES ARE:
172      ;| N = 1, Z = 0, V = 0, AND C = 0.
173      ;| THE REGISTERS ARE: R0 = ?, R1 = ? R2 = ?
174      ;| R3 = ? R4 = ? R5 = ? SP = 177777
175      ;| UPON COMPLETION OF THIS TEST THE CONDITION CODES WILL BE:
176      ;| N = 0, Z = 0, V = 1, AND C = 1
177      ;| THE REGISTERS AFFECTED BY THE TEST ARE:
178      ;| SP = 077777
179      ;|
180      ;|.....
181      165036  TST4:
182      165036  006006      ROR     SP      ;N=0,Z=0;V=1,C=1,SP=077777
    
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183 165040 102003
 184 165042 103002
 185 165044 101001
 186 165046 001001
 187 165050 000000

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BVC      15          ; V 321 BRANCH IF V=0
BHIS     15          ; V 321 BRANCH IF C=0
BHI      15          ; V 321 BRANCH IF C AND Z ARE BOTH 0
BNE      TST5       ; 320 BRANCH IF Z=0
187:     HALT
    
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;|.....
;| .SBTTL TEST5 TEST "BHI", "BLT", AND "BLOS"
;|
;| UPON ENTERING THIS TEST THE CONDITION CODES ARE:
;| N = 0, Z = 0, V = 1, AND C = 1.
;| THE REGISTERS ARE: R0 = ?, R1 = ? R2 = ?
;| R3 = ? R4 = ? R5 = ? SP = 077777
;| UPON COMPLETION OF THIS TEST THE CONDITION CODES WILL BE:
;| N = 1, Z = 1, V = 1, AND C = 1
;| THE REGISTERS ARE ALL UNAFFECTED BY THE TEST.
;|
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201 165052
 202 165052 000204
 203 165054 101003
 204 165056 000270
 205 165060 002401
 206 165062 101401
 207 165064 000000

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TST5:
      SEB          ; N=0,Z=1;V=1,C=1
      BHI      15  ; V 321 BRANCH IF Z AND C ARE BOTH 0
      SEN          ; N=1,Z=1;V=1,C=1
      BLT      15  ; V 324 BRANCH IF (N XOR V)=1
      BLOS     TST6 ; 325 BRANCH IF (Z OR C)=1
187:     HALT      ; STOP HERE IF A BRANCH FAILED
    
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;|.....
;| .SBTTL TEST6 TEST "BLE" AND "BGT"
;|
;| UPON ENTERING THIS TEST THE CONDITION CODES ARE:
;| N = 1, Z = 1, V = 1, AND C = 1.
;| THE REGISTERS ARE: R0 = ?, R1 = ? R2 = ?
;| R3 = ? R4 = ? R5 = ? SP = 077777
;| UPON COMPLETION OF THIS TEST THE CONDITION CODES WILL BE:
;| N = 1, Z = 0, V = 1, AND C = 1
;| THE REGISTERS ARE ALL UNAFFECTED BY THE TEST.
;|
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221 165066
 222 165066 000244
 223 165070 003401
 224 165072 003001
 225 165074 000000

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TST6:
      CLB          ; N=1,Z=0;V=1,C=1
      BLE      15  ; V 324 BRANCH IF [Z OR (N XOR V)]=1
      BGT      TST7 ; 320 BRANCH IF Z AND (N XOR V) ARE BOTH 0
187:     HALT      ; STOP HERE IF A BRANCH FAILED
    
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226
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;|.....
;| .SBTTL TEST7 TEST REGISTER DATA PATH AND MODES "2", "3", "6"
;|
;| WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
;| N = 1, Z = 0, V = 1, AND C = 1.
;| THE REGISTERS ARE: R0 = ?, R1 = ?, R2 = ?
;| R3 = ?, R4 = ?, R5 = ?, SP = 077777.
;| UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
;| N = 0, Z = 1, V = 0, AND C = 0.
;| THE REGISTERS ARE LEFT AS FOLLOWS:
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;|.....
    
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237 ;o R0 = 125252, R1 = 000000, R2 = 125252, R3 = 125252
238 ;o R4 = 125252, R5 = 125252, SP = 125252, AND MAPL00 = 125252
239 ;o
240 ;|.....
241 165076 ;o TST7:
242 165076 012706 125252 ;o MOV 0125252,SP ;N=1,Z=0;V=0,C=1,SP=125252
243 165102 010600 ;o MOV SP,R0 ;N=1,Z=0;V=0,C=1,R0=125252
244 165104 010001 ;o MOV R0,R1 ;N=1,Z=0;V=0,C=1,R1=125252
245 165106 010102 ;o MOV R1,R2 ;N=1,Z=0;V=0,C=1,R2=125252
246 165110 010203 ;o MOV R2,R3 ;N=1,Z=0;V=0,C=1,R3=125252
247 165112 010304 ;o MOV R3,R4 ;N=1,Z=0;V=0,C=1,R4=125252
248 165114 010405 ;o MOV R4,R5 ;N=1,Z=0;V=0,C=1,R5=125252
249 165116 010537 ;o MOV R5,0(PC)+ ;N=1,Z=0;V=0,C=1
250 165120 170200 ;o INDMAP: ,WORD MAPL0 ;MAPL0=125252
251 165122 167701 177772 ;o SUB 0INDMAP,R1 ;N=0,Z=1,V=0,C=0, AND R1=000000
252 165126 002401 ;o BLT 18 ; V 324 BRANCH IF (N XOR V)=1
253 165130 001401 ;o BEQ TST10 ; o 326 BRANCH IF Z=1
254 165132 000000 ;o 18: HALT
255 ;|.....
256 ;o .SBTTL TEST10 TEST "ROL", "BCC", "BLT", AND MODE "6"
257 ;o
258 ;o WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
259 ;o N = 0, Z = 1, V = 0, AND C = 0,
260 ;o THE REGISTERS ARE: R0 = 125252, R1 = 000000, R2 = 125252
261 ;o R3 = 125252, R4 = 125252, R5 = 125252, SP = 125252.
262 ;o MAPL00 = 125252
263 ;o UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
264 ;o N = 0, Z = 0, V = 1, AND C = 1.
265 ;o THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
266 ;o MAPL00 WHICH SHOULD NOW EQUAL 052524.
267 ;o
268 ;|.....
269 ;o TST10:
270 165134 ;o ROL MAPL0 ;N=0,Z=0;V=1,C=1, AND MAPL00 = 052524
271 165134 006167 003040 ;o BCC 18 ; V 321 BRANCH IF C=0
272 165140 103001 ;o BLT TST11 ; o 326 BRANCH IF (N XOR V)=1
273 165142 002401 ;o 18: HALT
274 165144 000000 ;|.....
275 ;o .SBTTL TEST11 TEST "ADD", "INC", "COM", AND "BCS", "BLE"
276 ;o
277 ;o WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
278 ;o N = 0, Z = 0, V = 1, AND C = 1.
279 ;o THE REGISTERS ARE: R0 = 125252, R1 = 000000, R2 = 125252
280 ;o R3 = 125252, R4 = 125252, R5 = 125252, SP = 125252.
281 ;o MAPL00 = 052524.
282 ;o UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
283 ;o N = 0, Z = 1, V = 0, AND C = 0.
284 ;o THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
285 ;o R3 WHICH NOW EQUALS 000000, AND R1 WHICH IS ALSO 000000
286 ;o
287 ;|.....
288 ;o TST11:
289 165146
290

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291                                     ;(MAPL00 = 052524) + (R3 = 125252)
292 165146 066703 003020             ADD     MAPL0,R3             ;N=1,Z=0,V=0,C=0, AND R3=177776
293 165152 025203                   INC     R3                 ;N=1,Z=0,V=0,C=0, AND R3=177777
294 165154 005103                   COM     R3                 ;N=0,Z=1,V=0,C=1, AND R3 = 000000
295 165156 060301                   ADD     R3,R1             ;N=0,Z=1,V=0,C=0, AND R1 = 000000
296 165160 103401                   BCS     15                ; V 324 BRANCH IF C=1
297 165162 003401                   BLE     TST12            ; * 326 BRANCH IF [Z OR (N XOR V)]=1
298 165164 020000             15:   HALT
    
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300                                     ;:.....
301                                     .SBTTL TEST12 TEST "ROR", "BIS", "ADD", AND "BLO", "BGE"
302                                     ;*
303                                     ;* WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
304                                     ;* N = 0, Z = 1, V = 0, AND C = 0.
305                                     ;* THE REGISTERS ARE: R0 = 125252, R1 = 000000, R2 = 125252
306                                     ;* R3 = 000000, R4 = 125252, R5 = 125252, SP = 125252.
307                                     ;* UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
308                                     ;* N = 0, Z = 1, V = 0, AND C = 0.
309                                     ;* THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
310                                     ;* R3 WHICH SHOULD BE MODIFIED BACK TO 000000, AND
311                                     ;* R4 WHICH SHOULD NOW EQUAL 052525
312                                     ;*
    
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313                                     ;:.....
314 165166                                     TST12:
315 165166 006004             ROR     R4                 ;N=0,Z=0,V=1,C=0, AND R4 = 052525
316 165170 050403             BIS     R4,R3            ;N=0,Z=0,V=0,C=0, AND R3 = 052525
317 165172 060503             ADD     R5,R3            ;N=1,Z=0,V=0,C=0, AND R3 = 177777
318 165174 005203             INC     R3                 ;N=0,Z=1,V=0,C=0, AND R3 = 000000
319 165176 103401             BLO     15                ; V 324 BRANCH IF C=1
320 165200 002001             BGE     TST13            ; * 328 BRANCH IF (N XOR V)=0
321 165202 000000             15:   HALT
    
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323                                     ;:.....
324                                     .SBTTL TEST13 TEST "DEC" AND "BLOS", "BLT"
325                                     ;*
326                                     ;* WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
327                                     ;* N = 0, Z = 1, V = 0, AND C = 0.
328                                     ;* THE REGISTERS ARE: R0 = 125252, R1 = 000000, R2 = 125252
329                                     ;* R3 = 000000, R4 = 052525, R5 = 125252, SP = 125252.
330                                     ;* UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
331                                     ;* N = 1, Z = 0, V = 0, AND C = 0.
332                                     ;* THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
333                                     ;* R1 WHICH SHOULD NOW EQUAL 177777
334                                     ;*
    
```

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335                                     ;:.....
336 165204                                     TST13:
337 165204 005301             DEC     R1                 ;N=1,Z=0,V=0,C=0,R1=177777
338 165206 101401             BLOS   15                ; V 324 BRANCH IF [Z OR C]=1
339 165210 002401             BLT    TST14            ; * 326 BRANCH IF (N XOR V)=1
340 165212 000000             15:   HALT
    
```

```

342                                     ;:.....
343                                     .SBTTL TEST14 TEST "COM", "BIC", AND "BGT", "BGE", "BLE"
344                                     ;*
    
```

```

345 ;0 WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
346 ;0 N = 1, Z = 0, V = 0, AND C = 0,
347 ;0 THE REGISTERS ARE: R0 = 125252, R1 = 177777, R2 = 125252
348 ;0 R3 = 000000, R4 = 052525, R5 = 125252, SP = 125252.
349 ;0 UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
350 ;0 N = 0, Z = 0, V = 1, AND C = 1,
351 ;0 THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
352 ;0 R0 WHICH SHOULD NOW EQUAL 052525, AND
353 ;0 R1 WHICH SHOULD NOW EQUAL 052524
354 ;0
355 ;0

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356 165214 ;0.....
357 165214 005100 TST14:
358 165216 101401 COM R0 ;N=0,Z=0,V=0,C=1, AND R0 = 052525
359 165220 000000 BLOS 25 ; = 325 BRANCH IF (Z OR C)=1
360 165222 040001 HALT ;STOP HERE IF BRANCH FAILED
361 165224 060101 25: BIC R0,R1 ;N=1,Z=0,V=0,C=1, AND R1 = 125252
362 165226 033002 ADD R1,R1 ;N=0,Z=0,V=1,C=1, AND R1 = 052524
363 165230 002001 BGT 15 ; V 322 BRANCH IF Z AND (N XOR V) ARE BOTH 0
364 165232 003401 BGE 15 ; V 322 BRANCH IF (N XOR V)=0
365 165234 000000 BLE TST15 ; = 326 BRANCH IF [Z OR (N XOR V)]=1
366 ;0
367 ;0

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```

368 ;0.....
369 ;0 .SBTTL TEST14 TEST "ADC", "CMP", "BIT", AND "BNE", "BGT", "BEQ"
370 ;0
371 ;0 WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
372 ;0 N = 0, Z = 0, V = 1, AND C = 1,
373 ;0 THE REGISTERS ARE: R0 = 052525, R1 = 052524, R2 = 125252
374 ;0 R3 = 000000, R4 = 052525, R5 = 125252, SP = 125252.
375 ;0 UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
376 ;0 N = 0, Z = 1, V = 0, AND C = 0,
377 ;0 THE REGISTERS ARE NOW:
378 ;0 R0 = 052525, R1 = 000000, R2 = 125252, R3 = 000000
379 ;0 R4 = 052525, R5 = 052525, SP = 125252.
380 ;0
381 ;0.....

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381 165236 ;0.....
382 165236 005501 TST15:
383 165240 020401 ADC R1 ;N=0,Z=0,V=0,C=0, AND R1 = 052525
384 165242 001005 CMP R4,R1 ;N=0,Z=1;V=0,C=0
385 ;0 BNE 15 ; V 322 BRANCH IF Z=0
386 165244 030105 BIT R1,R5 ;R1 = 052525 R5 = 125252
387 165246 003003 BGT 15 ;N=0,Z=1;V=0,C=0
388 165250 005105 COM R5 ; V 322 BRANCH IF Z AND (N XOR V) ARE BOTH 0
389 165252 160501 SUB R5,R1 ;N=0,Z=0,V=0,C=1, AND R5 = 052525
390 165254 001401 BEQ TST16 ;N=0,Z=1;V=0,C=0, AND R1 = 000000
391 165256 000000 ; = 326 BRANCH IF Z=1
392 ;0
393 ;0

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394 ;0.....
395 ;0 .SBTTL TEST10 TEST "MOVB", "SOB", "CLR", "TST" AND "BPL", "BNE"
396 ;0
397 ;0 WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
398 ;0 N = 0, Z = 1, V = 0, AND C = 0,
399 ;0 THE REGISTERS ARE: R0 = 052525, R1 = 000000, R2 = 125252

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B1

B


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406 165260
407 165260 112700 177401
408 165264 100001
409 165266 000000
410 165270 077002
411 165272 005001
412 165274 005201
413 165276 077002
414 165300 005700
415 165302 001002
416 165304 005701
417 165306 001401
418 165310 000000
419
420
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434
435 165312
436 165312 012700 100000
437 165316 005201
438 165320 012702 000020
439 165324 006200
440 165326 005500
441 165330 006301
442 165332 005501
443 165334 077205
444
445
446 165336 060001
447 165340 003401
448 165342 003001
449 165344 000000
450
451
452
    
```

```

;0 R3 = 000000, R4 = 052525, R5 = 052525, SP = 125252.
;0 UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
;0 N = 0, Z = 1, V = 0, AND C = 0.
;0 R0 IS DECREMENTED BY A SOB INSTRUCTION TO 000000
;0 R1 IS CLEARED AND THEN INCREMENTED AROUND TO 000000
;0
;|.....
TST16:
MOV 0177401,R0 ;N=0,Z=0,V=0,C=0, AND R0 = 000001
BPL 25 ; * 320 BRANCH IF N=0
;0 STOP IF "BPL" FAILED
15: HALT ;DO NOT LOOP SINCE (R0 - 1) = 0
25: SOB R0,15 ;N=0,Z=1,V=0,C=0, AND R1 = 000000
CLR R1 ;INCREMENT 64K TIMES (2 * 16)
35: INC R1 ;LOOP BACK TO "INC" 64K TIMES
SOB R0,35 ;N=0,Z=1,V=0,C=0, AND R0 = 000000
TST R0 ; V 322 BRANCH IF Z=0
BNE 45 ;N=0,Z=1,V=0,C=0, AND R1 = 000000
TST R1 ; * 326 BRANCH IF Z=1
BEG TST17
45: HALT
;|.....
.SBTTL TEST17 TEST "ASR", "ASL"
;0
;0 WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
;0 N = 0, Z = 1, V = 0, AND C = 0.
;0 THE REGISTERS ARE: R0 = 125252, R1 = 000000, R2 = 125252
;0 R3 = 000000, R4 = 052525, R5 = 052525, SP = 125252.
;0 UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
;0 N = 0, Z = 0, V = 0, AND C = 0.
;0 THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
;0 R0 WHICH IS NOW EQUAL TO 000000,
;0 R1 WHICH IS NOW 000001, AND
;0 R2 WHICH IS NOW 000000.
;0
;|.....
TST17:
MOV 0100000,R0 ;R0=100000
INC R1 ;R1=000001
MOV 01016,R2 ;SET COUNTER TO 16 DECIMAL
15: ASR R0 ;RIGHT SHIFT R0, SIGN EXTEND (16 TIMES)
ADC R0 ;ADD CARRY (0 UNTIL LAST TIME)
ASL R1 ;LEFT SHIFT R1 (16 TIMES)
ADC R1 ;ADD CARRY (0 UNTIL LAST TIME)
SOB R2,15 ;LOOP BACK 16 DECIMAL TIMES
;0 AT THE END OF THE LOOP
;0 R0 = 000000 AND R1 = 000001
ADD R0,R1 ;N=0,Z=0,V=0,C=0 R1=000001, R0=000000
BLE 25 ; V 324 BRANCH IF [Z OR (N XOR V)]=1
BGT TST20 ; * 320 BRANCH IF Z AND (N XOR V) ARE BOTH 0
25: HALT
;|.....
.SBTTL TEST20 TEST ASH, AND SHAB
    
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C1

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453 ;
454 ;
455 ; WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
456 ; N = 0, Z = 0, V = 0, AND C = 0.
457 ; THE REGISTERS ARE: R0 = 000000, R1 = 000001, R2 = 000000
458 ; R3 = 000000, R4 = 052525, R5 = 052525, SP = 125252.
459 ; UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
460 ; N = 0, Z = 1, V = 0, AND C = 1.
461 ; THE REGISTERS ARE LEFT UNCHANGED EXCEPT FOR
462 ; R1 WHICH SHOULD NOW EQUAL 000000
463 ;
464 ;-----
464 165346 TST20:
465 165346 072127 000007 ASH #7,R1 ;LEFT SHIFT BITS INTO BIT7
466 ;N=0,Z=0;V=0,C=0, AND R1 = 000200
467 165352 105701 TSTB R1 ;LOWER BYTE SHOULD BE NEGATIVE
468 ;N=1,Z=0,V=0,C=0
469 165354 100401 BHI 15 ; * 325 BRANCH IF N=1
470 165356 000000 HALT ;"ASH" MUST HAVE FAILED
471 165360 000301 15: SWAB R1 ;SWITCH BYTES OF R1, R1 = 100000
472 ;N=1,Z=0,V=0,C=0
473 165362 072127 177761 ASH #=015,R1 ;RIGHT SHIFT R1 15 PLACES SIGN EXTEND
474 ;N=1,Z=0;V=0,C=0, R1 = 177777
475 165366 005201 INC R1 ;N=0,Z=1;V=0,C=1, R1 = 000000
476 165370 001401 BEQ TST21 ; * 326 BRANCH IF Z=1
477 165372 000000 HALT ;EITHER "SWAB" OR "ASH" FAILED
478 ;
479 ;-----
480 .SBTTL TEST21 TEST 16 KERNEL P.A.R.'S
481 ;
482 ; WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
483 ; N = 0, Z = 1, V = 0, AND C = 1.
484 ; THE REGISTERS ARE: R0 = 000000, R1 = 000000, R2 = 000000
485 ; R3 = 000000, R4 = 052525, R5 = 052525, SP = 125252.
486 ; UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
487 ; N = 0, Z = 1, V = 0, AND C = 0.
488 ; THE REGISTERS NOW EQUAL:
489 ; R0 = 172400, R1 = 000000, R2 = 000000, R3 = 000000
490 ; R4 = 052525, R5 = 125252, SP = 125252.
491 ; ALL KERNEL P.A.R.'S = 125252.
492 ;
493 ;-----
494 TST21:
495 165374 012700 172340 MOV #KIPAR0,R0 ;FIRST "PAR" TO BE CHECKED
496 165400 012701 000020 MOV #016,R1 ;DO KIPAR0 THRU KOPAR7
497 165404 005105 COM R5 ;R5=125252
498 165406 010420 15: MOV R4,(R0)+ ;PAR=052525
499 165410 020460 177776 CMP R4,-2(R0) ;DID IT LOAD PROPERLY?
500 165414 001014 BNE 25 ; V BRANCH IF NO R0 = PAR + 2
501 165416 105140 COMB =(R0) ;COMPLEMENT HIGH BYTE PAR=125125
502 165420 120510 CMPB R5,(R0) ;CHECK THE HIGH BYTE
503 165422 001011 BNE 25 ; V BRANCH IF BAD R0 = PAR + 1
504 165424 120440 CMPB R4,-(R0) ;CHECK THE LOW BYTE DIDN'T CHANGE
505 165426 001007 BNE 25 ; V BRANCH IF IT CHANGED R0 = PAR
506 165430 105110 COMB (R0) ;COMPLEMENT THE LOW BYTE PAR=125252
    
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507 165432 120520      CMPB   R5,(R0)+      ;CHECK THE LOW BYTE
508 165434 001004      BNE    25             ; V BRANCH IF BAD R0 = PAR + 1
509 165436 120520      CMPB   R5,(R0)+      ;CHECK THE HIGH BYTE
510 165440 001002      BNE    25             ; V BRANCH IF IT FAILED R0 = PAR + 2
511 165442 077117      SOB    R1,15         ;LOOP UNTIL KDPAR7 HAS BEEN TESTED
512 165444 000401      BR     TST22         ; * BRANCH TO NEXT TEST
513 165446 000000      25:   HALT          ;A P.A.R. FAILED TO HOLD THE RIGHT DATA
514                                     ;CHECK R0 FOR THE ADDRESS
515
516 ;|.....
517   .SBTTL TEST22 TEST AND LOAD KIPDR'S
518 ;|
519 ;| WHEN THIS TEST IS ENTERED THE CONDITION CODES ARE:
520 ;| N = 0, Z = 1, V = 0, AND C = 0.
521 ;| THE REGISTERS ARE: R0 = 172400, R1 = 000000, R2 = 000000
522 ;| R3 = 000000, R4 = 052525, R5 = 125258, SP = 125252.
523 ;| UPON COMPLETION OF THIS TEST THE CONDITION CODES ARE:
524 ;| N = 0, Z = 1, V = 0, AND C = 0.
525 ;| THE REGISTERS THAT ARE MODIFIED ARE:
526 ;| R0 = 172300, R1 = 000000, R2 = 077406
527 ;| ALL KERNEL 1-SPACE P.D.R.'S (172300 = 172316) = 077406
528 ;|
529 ;|.....
530 TST22:
531 165450 012700 172320      MOV    #KIPDR7+2,R0  ;START WITH LAST "PDR"
532 165454 012701 000010      MOV    #0,R1         ;DO KIPDR7 THRU KIPDR0
533 165460 012702 077406      MOV    #077406,R2    ;PATTERN TO TEST "PDR'S"
534 165464 010240 35:   MOV    R2,-(R0)       ;LOAD "PDR" UNDER TEST
535 165466 021002      CMP    (R0),R2       ;SEE IF THE DATA LOADED IS CORRECT
536 165470 001401      BEQ    25            ;BRANCH IF THE DATA MATCHES
537 165472 000000      HALT                ;A "PDR" HAS FAILED
538                                     ;R0 HAS THE ADDRESS OF THE BAD "PDR"
539                                     ;R2 HAS THE EXPECTED DATA
540 165474 077105      25:   SOB    R1,15         ;LOOP UNTIL ALL EIGHT "PDR'S" HAVE BEEN
541                                     ;TESTED
542
543 ;|.....
544   .SBTTL TEST23 TEST "JSR", "RTS", "RTI", & "JMP"
545 ;|
546 ;| THIS TEST FIRST SETS THE STACK POINTER TO "KDPAR7" (172376),
547 ;| AND THEN VERIFIES THAT "JSR", "RTS", "RTI", AND "JMP"
548 ;| ALL WORK PROPERLY.
549 ;|
550 ;| ON ENTRY TO THIS TEST THE STACK POINTER "SP" IS INITIALIZED
551 ;| TO 172376 AND IS LEFT THAT WAY ON EXIT.
552 ;|
553 ;|.....
554 TST23:
555 165476
556
557 165476 012706 172376      MOV    #KDPAR7,SP    ;SET UP THE STACK POINTER
558 165502 004767 000002      JSR    PC,15         ;TRY TO JSR TO 15
559 165506 000000      105:  HALT                ;THE "JSR" MUST HAVE FAILED
560 165510 022716 165506      15:   CMP    #105,(SP)    ;WAS THE CORRECT ADDRESS PUSHED?
    
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561 165514 001401 BEQ 25 ;BRANCH IF YES
562 165516 000000 HALT ;WRONG THING PUSHED ON STACK
563 165520 012716 165530 2S: MOV #3S,(SP) ;CHANGE THE ADDRESS ON THE STACK
564 165524 000207 RTS PC ;TRY TO RETURN TO 3S
565 165526 000000 HALT ;DID NOT RETURN PROPERLY
566 165530 005046 3S: CLR -(SP) ;PUSH A ZERO ON THE STACK
567 165532 012746 165542 MOV #4S,-(SP) ;PUSH THE RETURN ADDRESS ON STACK
568 165536 000002 RTI ;SEE IF AN "RTI" WORKS
569 165540 000000 HALT ;THE "RTI" FAILED
570 165542 000137 165550 4S: JMP 005S ;TRY TO "JMP"
571 165546 000000 HALT ;THE "JMP" FAILED
572 165550 5S: ;ADDRESS TO "JMP" TO

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;|.....
;| .SBTTL TEST24 LOAD AND TURN ON MEMORY MANAGEMENT AND THE UNIBUS MAP
;|
;| THIS TEST IS ONLY EXECUTED IF THE UPPER 4 BITS <15:12> OF
;| THE SWITCH REGISTER ARE NON-ZERO, THE TEST WILL LOAD MEMORY
;| MANAGEMENT TO RELOCATE TO THE 32K BLOCK NUMBER SPECIFIED,
;| IT WILL ALSO SET UP THE UNIBUS MAP REGISTERS 0 THRU 6 TO
;| RELOCATE THE UNIBUS ADDRESSES CORRECTLY. (IE. IF BITS <15:12>
;| SPECIFY BLOCK NUMBER 3, THEN YOU WANT TO BOOT INTO
;| MEMORY FROM 90K TO 120K, THE KIPAR'S WILL BE LOADED AS FOLLOWS:
;| KIPAR0 = 000000, KIPAR1 = 006200, KIPAR2 = 000400, KIPAR3 = 000600
;| KIPAR4 = 007000, KIPAR5 = 007200, KIPAR6 = 007400.)
;| KIPAR7 WILL ALWAYS EQUAL 177600,
;| THE UNIBUS MAP REGISTERS WILL THEN BE SET AS FOLLOWS:
;| MAPL0 = 000000, MAPH0 = 03, MAPL1 = 020000, MAPH1 = 03,
;| MAPL2 = 040000, MAPH2 = 03, MAPL3 = 060000, MAPH3 = 03,
;| MAPL4 = 100000, MAPH4 = 03, MAPL5 = 120000, MAPH5 = 03,
;| MAPL6 = 140000, MAPH6 = 03.
;|
;|.....

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595 165550
596 165550 013702 177570
597 165554 001002
598 165556 013702 173024
599 165562 072227 177776
600 165566 042702 141777
601 165572 001433
602
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605
606 165574 012700 172340
607 165600 012701 000007
608 165604 010220
609 165606 062702 000200
610 165612 077104
611 165614 012710 177600
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;|.....
;| TST24:
;| MOV #0SHR,R2 ;READ THE SWITCH REGISTER
;| BNE 10S ;SKIP THE NEXT INSTRUCTION IF NOT ZERO
;| MOV #0173024,R2 ;READ THE SWITCHES ON THE M9301
10S: ;ASH #2,R2 ;RIGHT SHIFT BITS <15:12> 2 PLACES
;| BIC #0C030000,R2 ;LEAVE ONLY BITS <13:10> IN R2
;| BEQ TST25 ;GO TO NEXT TEST IF R2 IS ZERO NOW
;|
;| THIS NEXT PORTION OF CODE WILL BE RUN ONLY IF YOU ARE
;| BOOTING INTO MEMORY OTHER THAN PHYSICAL 0 TO 20K.
;|
;| MOV #KIPAR0,R0 ;ADDRESS OF FIRST "PAR" TO LOAD
;| MOV #D7,R1 ;LOAD KIPAR0 THRU KIPAR6
;| MOV R2,(R0)+ ;LOAD THE KERNEL I-SPACE P.A.R.'S
1S: ;ADD #200,R2 ;MAKE R2 POINT TO NEXT 4K BLOCK
;| SOB R1,1S ;LOOP UNTIL KIPAR6 HAS BEEN LOADED
;| MOV #177600,(R0) ;MAP KIPAR7 TO I/O PAGE
;|
;| NOW LOAD THE UNIBUS MAP TO REFERENCE THE SAME MEMORY
;| AS MEMORY MANAGEMENT DOES.
;|

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615
616 165620 072227 177760          ASH      0=+D10,R2      ;RIGHT SHIFT R2 10 PLACES
617 165624 005003                    CLR      R3           ;START WITH R3 = 000000
618 165626 012700 170200          MOV      #MAPL0,R0    ;ADDRESS OF FIRST MAP REGISTER
619 165632 012701 030007          MOV      #D7,R1       ;PREPARE TO LOAD SEVEN MAP REGISTERS
620 165636 010320          2S:    MOV      R3,(R0)+     ;LOAD LOWER 16 BITS OF THE MAP REGISTER
621 165640 010220          MOV      R2,(R0)+     ;LOAD UPPER 6 BITS OF THE MAP REGISTER
622 165642 062703 020000          ADD      #20000,R3    ;POINT TO THE NEXT 4K BLOCK
623 165646 077105          SOB      R1,2S        ;LOOP UNTIL SEVEN MAP REGS ARE LOADED
624
625 165650 012737 000060 172516    MOV      #60,#MMR3    ;ENABLE 22-BIT MAPPING AND UNIBUS MAP
626 165656 009237 177972          INC      #MMR0        ;TURN ON FULL RELOCATION
627
628
629          ;|.....
630          .SBTTL TEST29 TEST MAIN MEMORY FROM VIRTUAL 1000 TO 20K
631          ;|
632          ;| THIS TEST WILL TEST MAIN MEMORY WITH THE CACHE DISABLED, FROM
633          ;| VIRTUAL ADDRESSES 001000 TO 197776, IF THE DATA DOES NOT COMPARE
634          ;| PROPERLY THE TEST WILL HALT AT EITHER 165740 OR 165796, IF A
635          ;| PARITY ERROR OCCURS THE TEST WILL HALT AT ADDRESS 165776, WITH
636          ;| THE PC + 2 ON THE STACK WHICH IS IN THE KERNEL D-SPACE P.A.R.'S.
637          ;|
638          ;| IN THIS TEST THE REGISTERS ARE INITIALIZED AS FOLLOWS:
639          ;| R0 = 001000, R1 = DATA READ, R2 = 067400, R3 = 001000
640          ;| R4 = 067400, R5 = 177746 (CONTROL REG.) SP = 172376
641          ;|
642          ;|.....
643 165662
644 165662 010216          TST25: MOV      R2,(SP)      ;SAVE R2 FOR THE UPPER SIX BITS
645          ;| OF THE MASS BUS DEVICE'S BUS ADDRESS
646          ;| IN ADDRESS 17772376 (KOPAR7)
647
648 165664 012737 165776 000114    MOV      #PAEHLT,#114 ;SET UP PARITY VECTOR
649 165672 005037 000116          CLR      #0116       ;SET PROCESSOR STATUS WORD TO ZERO
650 165676 012705 177746          MOV      #177746,R5   ;CACHE CONTROL REGISTER ADDRESS
651 165702 012715 000014          MOV      #MISS,(R5)   ;FORCE MISS BOTH GROUPS
652 165706 012702 067400          MOV      #67400,R2    ;COUNT STORAGE
653 165712 012703 001000          MOV      #1000,R3     ;FIRST ADDRESS STORAGE
654 165716 010204          MOV      R2,R4        ;SETUP COUNTER
655 165720 010300          MOV      R3,R0        ;SETUP FIRST ADDRESS
656 165722 010020          1S:    MOV      R0,(R0)+    ;LOAD EACH ADDRESS WITH ITS
657          ;| OWN ADDRESS
658 165724 077402          SOB      R4,1S        ;LOOP UNTIL DONE
659 165726 010204          MOV      R2,R4        ;SETUP COUNTER AND FIRST ADDRESS
660 165730 010300          MOV      R3,R0        ;SET STARTING ADDRESS IN R0
661 165732 011001          2S:    MOV      (R0),R1     ;GET THE DATA
662 165734 020001          CMP      R0,R1        ;IS IT CORRECT?
663 165736 001401          BEQ      3S           ;BRANCH IF YES
664 165740 000000          HALT
665 165742 005120          3S:    COM      (R0)+     ;COMPLEMENT DATA AND INCREMENT ADDRESS
666 165744 077406          SOB      R4,2S        ;LOOP UNTIL DONE
667 165746 014001          4S:    MOV      -(R0),R1   ;READ THE DATA (IT SHOULD NOW BE THE
668          ;| COMPLEMENT OF THE ADDRESS)

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669	165750	005101			COM	R1		;COMPLEMENT BEFORE CHECKING
670	165752	020001			CMP	R0,R1		;IS THE DATA CORRECT?
671	165754	001401			BEQ	SS		;BRANCH IF YES
672	165756	000000			HALT			;R0=ADDRESS R1=-DATA
673	165760	077206			SQB	R2,4S		;LOOP UNTIL DONE
674	165762	012737	173762	000114	MOV	#CONT,#114		;SET PARITY VECTOR TO CODE THAT
675								;WILL TRY TO CONTINUE AND BOOT
676								;IF THE CACHE FAILS,
677	165770	005046			CLR	-(SP)		;SET THE CYCLE FLAG TO ZERO
678	165772	000137	173600		JMP	00TST26		;JUMP TO SECOND HALF OF THE ROM
679	165776	000000			PAEHLT: HALT			;HALTING HERE MEANS A PARITY ERROR
680								


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735
736          .SBTTL THIS IS THE START OF THE TM11/TU10 BOOT STRAP (MAGNETIC TAPE, TM11)
737          ;COMMAND REGISTER ADDRESS IS 172922
738
739 173070 010211 TU10: MOV R2,(R1) ;LOAD UNIT NUMBER INTO C.S.R.
740 173072 000743 BR WAIT ;GO WAIT FOR SELECTED DRIVE TO COME ONLINE
741 173074 052311 TU102: BIS (R3)+,(M1) ;'ON' REWIND COMMAND INTO C.S.R.
742 ;THIS COMMAND ALSO SETS 000 BPI 9 CHAN.
743 173076 105711 1S: TSTB (R1) ;SEE IF THE REWIND IS COMPLETE
744 173100 100376 BPL 15 ;WAIT FOR BIT 07 OF C.S.R. TO BE SET
745 173102 012761 177777 000002 MOV #=1,2(R1) ;SET RECORD COUNTER TO SKIP ONE RECORD
746 173110 112311 MOVB (R3)+,(M1) ;LOAD SPACE FORWARD COMMAND INTO C.S.R.
747 173112 105711 2S: TSTB (R1) ;SEE IF THE SPACE IS COMPLETE
748 173114 100376 BPL 25 ;WAIT FOR BIT 07 OF C.S.R. TO BE SET
749 173116 005711 TST (R1) ;CHECK THE ERROR FLAG FOR THE TM11/TU10
750 173120 100563 BMI AGAIN ;RE-TRY BOOT IF THERE WAS AN ERROR
751 173122 000417 BR CMNSGO ;BRANCH TO COMMON READ CODE IF NO ERRORS
752
753
754          .SBTTL THIS IS THE START OF THE TC11/TU96 BOOT STRAP (DECTAPE, TC11-G)
755          ;COMMAND REGISTER ADDRESS IS 177342
756
757 173124 010211 TU96: MOV R2,(R1) ;LOAD UNIT NUMBER INTO C.S.R.
758 173126 052311 BIS (R3)+,(M1) ;'ON' REWIND COMMAND INTO C.S.R.
759 173130 005711 1S: TST (R1) ;SEE IF ERROR BIT IS SET
760 173132 100376 BPL 15 ;WAIT UNTIL BIT 15 OF C.S.R. IS SET
761 173134 005761 177770 TST #=2(R1) ;IS THE ERROR 'END ZONE'
762 173140 100153 BPL AGAIN ;BRANCH IF NOT 'END ZONE'
763 173142 010211 MOV R2,(R1) ;RE-LOAD DRIVE NUMBER AND CLEAR REVERSE BIT
764 173144 000406 BR CMNSGO ;BRANCH TO COMMON READ CODE
765
766
767          .SBTTL THIS IS THE START OF THE RK11/RK05 BOOT STRAP (DECPACK DISK CARTRIDGE, RK11-D)
768          ;COMMAND REGISTER ADDRESS IS 177404
769
770 173146 072227 000005 RK05: ASH #5,R2 ;LEFT SHIFT UNIT NUMBER 5 PLACES
771 173152 010261 000000 MOV R2,6(M1) ;LOAD UNIT NUMBER INTO DEVICE
772 173156 000401 BR CMNSGO ;BRANCH TO COMMON READ CODE
773
774
775          .SBTTL THIS IS THE START OF THE RP11/RP03 BOOT STRAP (DISK PACK, RP11-C)
776          ;COMMAND REGISTER ADDRESS IS 176714
777
778 173160 010211 RP03: MOV R2,(R1) ;LOAD THE UNIT NUMBER INTO THE COMMAND REG.
779
780          .SBTTL THIS IS THE START OF THE COMMON READ CODE
781
782 173162 012761 177000 000002 CMNSGO: MOV #=512,,2(R1) ;LOAD WORD COUNT OF 512 WORDS
783 173170 111311 MOVB (R3),(R1) ;LOAD READ FUNCTION INTO C.S.R.
784 173172 105711 1S: TSTB (R1) ;SEE IF FUNCTION IS COMPLETE
785 173174 100376 BPL 15 ;WAIT UNTIL BIT 07 OF C.S.R. IS SET
786 173176 005711 TST (R1) ;WERE THERE ANY ERRORS ON THE TRANSFER
787 173200 100007 BPL 25 ;IF NO ERRORS BRANCH TO SEC. BOOT
788 173202 022704 000012 CMP #12,R4 ;IS THIS THE RH70/TU10?
    
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789 173206 001130      BNE    AGAIN          ;BRANCH IF NOT TO TRY AGAIN
790 173210 022701 001000 000014    CMP    #FCE,14(R1)    ;WAS ERROR A FRAME COUNT ERROR?
791 173216 001124      BNE    AGAIN          ;BRANCH IF NOT TO TRY AGAIN
792 173220 005011      2S:   CLR    (R1)      ;CLEAR COMMAND REGISTER THIS WILL STOP
793                                     ;THE DECTAPE MOTION IF DEVICE WAS TU56
794 173222 005007      CLR    PC            ;START SECONDARY BOOT AT VIRTUAL ZERO
795
796 173224 165000      .WORD 165000         ;VECTOR TO THE START OF M9301 BOOTSTRAP
797 173226 000340      .WORD 000340         ;PROCESSOR STATUS TO ASSUME AT BOOT TIME
798
799

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800                                     .SBTTL THIS IS THE START OF THE RM70/TU16 BOOT STRAP (MAGNETIC TAPE SYSTEM, TU16)
801                                     ;COMMAND REGISTER ADDRESS IS 172440
802

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803 173230 010002      TU16: MOV    R0,R2          ;COPY UNIT NUMBER INTO R2
804 173232 052702 001300      BIS    #001300,R2    ;OR' 000 BP1 & FORMAT, WITH SLAVE NUMBER
805 173236 010261 000032      MOV    R2,32(R1)     ;LOAD UNIT NUMBER
806 173242 032761 010000 000012 1S:   BIT    #MOL,12(R1)   ;IS THE MEDIUM ON LINE
807 173250 001774      BEQ    1S            ;WAIT FOR BIT 12 OF DRIVE STATUS REG
808 173252 112311      MOVB   (R3)+,(R1)    ;ISSUE REWIND COMMAND
809 173254 105761 000012 2S:   TSTB   12(R1)       ;IS DRIVE READY BIT SET YET?
810 173260 100375      BPL    2S            ;WAIT FOR DRIVE READY BIT
811 173262 112311      MOVB   (R3)+,(R1)    ;ISSUE DRIVE CLEAR COMMAND
812 173264 105761 000012 3S:   TSTB   12(R1)       ;IS DRIVE READY BIT SET?
813 173270 100375      BPL    3S            ;WAIT UNTIL BIT 07 IS SET
814 173272 012761 177777 000006      MOV    #01,6(R1)     ;SET SKIP COUNT TO 1 RECORD
815 173300 112311      MOVB   (R3)+,(R1)    ;ISSUE SPACE FORWARD COMMAND
816 173302 105761 000012 4S:   TSTB   12(R1)       ;HAS THE DRIVE FINISHED THE SPACE?
817 173306 100375      BPL    4S            ;WAIT UNTIL BIT 07 IS SET
818 173310 011661 000034      MOV    (#P),34(R1)   ;LOAD UPPER 6 BITS OF BUS ADDRESS
819 173314 000415      BR     CMNSRH        ;GO JOIN COMMON RM70 CODE
820
821

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822                                     .SBTTL THIS IS THE START OF THE RM70/RP04 BOOT STRAP (DISK PACK, RMP04)
823                                     ;COMMAND REGISTER ADDRESS IS 176700
824

```

```

825 173316 110061 000010      RP04: MOVB   R0,10(R1)   ;SELECT UNIT NUMBER TO BOOT FROM
826 173322 112311      MOVB   (R3)+,(R1)    ;ISSUE READ-IN PRESET COMMAND
827 173324 012761 014000 000032      MOV    #14000,32(R1) ;SET FMT22 & ECC INHIBIT BITS
828 173332 011661 000050      MOV    (#P),50(R1)   ;LOAD UPPER 6 BITS OF BUS ADDRESS
829 173336 000404      BR     CMNSRH        ;GO JOIN THE COMMON RM70 CODE
830
831

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832                                     .SBTTL THIS IS THE START OF THE RM70/R004 BOOT STRAP (FIXED HEAD DISK, RNS04)
833                                     ;COMMAND REGISTER ADDRESS IS 172040
834

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835 173340 110061 000010      R004: MOVB   R0,10(R1)   ;LOAD THE DRIVE NUMBER TO BOOT FROM
836 173344 011661 000030      MOV    (#P),30(R1)   ;LOAD UPPER 6 BITS OF BUS ADDRESS
837
838

```

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839                                     .SBTTL THIS IS THE START OF THE COMMON RM-70 CODE
840

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841 173350 016161 000010 000016  CMNSRH: MOV    10(R1),10(R1) ;TURN OFF ANY ACTIVE ATTENTION FLAGS
842 173356 000701      BR     CMNSGO        ;BRANCH TO COMMON READ CODE

```

THIS IS THE START OF THE COMMON RH-70 CODE

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843
844
845          .SBTTL THIS IS THE START OF THE RX11/RX21 BOOT STRAP (FLOPPY DISK)
846          ;COMMAND REGISTER ADDRESS IS 177170
847
848 173360 042700 000000 RX01: BIC      #0,R0          ;MAKE SURE UNIT NUMBER IS ZERO OR ONE
849 173364 001401          BEQ      10          ;SKIP NEXT INST IF UNIT NUMBER IS ZERO
850 173366 005203          INC      R3          ;POINT TO UNIT ONE'S READ COMMAND
851 173370 132711 000040 1S:  BITB   #40,(R1)        ;IS THE "DONE" BIT SET?
852 173374 001775          BEQ      10          ;WAIT UNTIL THE DONE BIT IS SET
853 173376 111311          MOVB   (R3),(R1)        ;LOAD THE READ COMMAND
854 173400 012702 000002          MOV    #2,R2          ;LOAD LOOP COUNT INTO R2
855 173404 105711          2S:  TSTB   (R1)          ;IS THE "TR" BIT SET?
856 173406 100376          BPL    20          ;WAIT UNTIL BIT 07 OF RXCS IS SET
857 173410 112761 000001 000002          MOVB  #001,2(R1)      ;LOAD SECTOR NUMBER OR TRACK ADDRESS
858 173416 077206          SOB    R2,2S          ;LOOP BACK TO LOAD SECTOR NUMBER
859 173420 032711 100040 3S:  BIT    #100040,(R1)    ;CHECK FOR "ERROR" OR "DONE"
860 173424 001775          BEQ      30          ;WAIT UNTIL BIT 15 OR BIT 05 OF RXCS IS SET
861 173426 100420          BHI    AGAIN          ;BRANCH TO TRY AGAIN IF ERROR
862 173430 112711 000003          MOVB  #003,(R1)      ;LOAD "EMPTY BUFFER" COMMAND INTO RXCS
863 173434 105711          4S:  TSTB   (R1)          ;IS 'TR' BIT SET?
864 173436 100376          BPL    40          ;WAIT UNTIL BIT 07 OF RXCS IS SET
865 173440 116122 000002          MOVB  2(R1),(R2)+    ;STORE DATA (R2 STARTS AT 0 & GOES TO 177)
866 173444 105702          TSTB   R2          ;IS BIT 07 OF MEMORY ADDRESS SET?
867 173446 100372          BPL    45          ;BRANCH IF NOT 120 BYTES YET
868 173450 005007          CLR    PC          ;START SECONDARY BOOT AT VIRTUAL ZERO
869
870
871
872          .SBTTL THIS IS THE START RESERVED FOR A FUTURE DEVICE
873
874 173452 000000          FUTDEV: HALT          ;THERE IS NO BOOT YET
875 173454 000000          ,WORD  000000      ;RESERVED FOR FUTURE BOOT EXPANSION
876 173456 000000          ,WORD  000000      ;RESERVED FOR FUTURE BOOT EXPANSION
877 173460 000000          ,WORD  000000      ;RESERVED FOR FUTURE BOOT EXPANSION
878 173462 000000          ,WORD  000000      ;RESERVED FOR FUTURE BOOT EXPANSION
879 173464 000000          ,WORD  000000      ;RESERVED FOR FUTURE BOOT EXPANSION
880 173466 000000          ,WORD  000000      ;RESERVED FOR FUTURE BOOT EXPANSION
881
882
883 173470 000005          AGAIN: RESET        ;CLEAR THE WORLD AFTER ERROR
884 173472 000137 165550          JMP    #0TST24      ;GO SETUP MEMORY MANAGEMENT AND TEST
885                                     ;MAIN MEMORY AND THE CACHE AGAIN,
    
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086
087
088          .SBTTL  FUNCTION CODES FOR THE ALL OF THE DEVICES
089 173476 060017  TU10S: .WORD 060017 ;REWIND SELECTED DRIVE AND SET 000 MPI
090 173500      011      .BYTE 011 ;SPACE FORWARD COMMAND FOR TU10
091 173501      003      .BYTE 003 ;READ COMMAND FOR TU10
092
093 173502 004003  TU56S: .WORD 004003 ;SEARCH FOR BLOCK 0, REVERSE DIRECTION
094 173504      005      RK05S: .BYTE 005
095 173504      005      RP03S: .BYTE 005 ;READ COMMAND FOR TU56, RK05, RP03
096
097 173505      007      TU16S: .BYTE 007 ;REWIND SELECTED DRIVE
098 173506      011      .BYTE 011 ;DRIVE CLEAR COMMAND
099 173507      031      .BYTE 031 ;SPACE FORWARD
900 173510      071      .BYTE 071 ;READ FORWARD
901
902 173511      021      RP04S: .BYTE 021 ;READ-IN PRESET
903 173512      071      RS04S: .BYTE 071 ;READ COMMAND FOR RP04 & RS04
904
905 173513      007      RX01S: .BYTE 007 ;READ SECTOR COMMAND FOR DRIVE ZERO
906 173514      027      .BYTE 027 ;READ SECTOR COMMAND FOR DRIVE ONE
907
908 173515      000      FUTDES: .BYTE 0 ;SPACE FOR FUTURE DEVICE COMMAND
909 173516 000000      .WORD 0 ;SPACE FOR MORE COMMANDS
910
```

M

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911
912          .SBTTL  COMMAND AND STATUS REGISTER ADDRESS TABLE
913
914 173520 172522  CSRPTR: .WORD 172522 ;THIS IS THE C.S.R, ADDRESS FOR TU10
915 173522 177342          .WORD 177342 ;THIS IS THE C.S.R, ADDRESS FOR THE TU56
916 173524 177404          .WORD 177404 ;THIS IS THE C.S.R, ADDRESS FOR THE RK05
917 173526 176714          .WORD 176714 ;THIS IS THE C.S.R, ADDRESS FOR THE RP03
918 173530 020000          .WORD 0 ;THIS IS THE C.S.R, ADDRESS OF A FUTURE DEVICE
919 173532 172440          .WORD 172440 ;THIS IS THE C.S.R, ADDRESS FOR THE RH70/TU16
920 173534 176700          .WORD 176700 ;THIS IS THE C.S.R, ADDRESS FOR THE RH70/RP04
921 173536 172040          .WORD 172040 ;THIS IS THE C.S.R, ADDRESS FOR THE RH70/RS04
922 173540 177170          .WORD 177170 ;THIS IS THE C.S.R, ADDRESS FOR RX11/RX01
923
924          .SBTTL  FUNCTION POINTER TABLE
925
926 173542 173476  CMDPTR: .WORD TU10S ;POINTER TO FUNCTION TABLE FOR THE TU10
927 173544 173502          .WORD TU56S ;POINTER TO FUNCTION TABLE FOR THE TU56
928 173546 173504          .WORD RK05S ;POINTER TO FUNCTION TABLE FOR THE RK05
929 173550 173504          .WORD RP03S ;POINTER TO FUNCTION TABLE FOR THE RP03
930 173552 173515          .WORD FUTDES ;POINTER TO FUNCTION TABLE FOR A FUTURE DEVICE
931 173554 173505          .WORD TU16S ;POINTER TO FUNCTION TABLE FOR THE RH70/TU16
932 173556 173511          .WORD RP04S ;POINTER TO FUNCTION TABLE FOR THE RH70/RP04
933 173560 173512          .WORD RS04S ;POINTER TO FUNCTION TABLE FOR THE RH70/RS04
934 173562 173513          .WORD RX01S ;POINTER TO FUNCTION TABLE FOR THE RX01
935
936          .SBTTL  STARTING ADDRESS TABLE
937
938 173564 173070  ADDR:  .WORD TU10 ;STARTING ADDRESS FOR THE TM11/TU10
939 173566 173124          .WORD TU56 ;STARTING ADDRESS FOR THE TC11/TU56
940 173570 173146          .WORD RK05 ;STARTING ADDRESS FOR THE RK11/RK05
941 173572 173160          .WORD RP03 ;STARTING ADDRESS FOR THE RP11/RP03
942 173574 173452          .WORD FUTDEV ;STARTING ADDRESS FOR A FUTURE DEVICE
943 173576 173230          .WORD TU16 ;STARTING ADDRESS FOR THE RH70/TU16
944 173600 173316          .WORD RP04 ;STARTING ADDRESS FOR THE RH70/RP04
945 173602 173340          .WORD RS04 ;STARTING ADDRESS FOR THE RH70/RS04
946 173604 173362          .WORD RX01 ;STARTING ADDRESS FOR THE RX11/RX01
947

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1002 173660 005720          TST      (R0)+      ;MOVE TO NEXT ADDRESS
1003 173662 077221          SOB      R2,25      ;BRANCH IF NOT DONE
1004 173664 012715 000044  MOV      @GRP1,(R5)  ;FORCE REPLACE GROUP 1 AND FORCE MISS GROUP 0
1005 173670 005116          COM      (SP)       ;COMPLEMENT THE CYCLE FLAG
1006 173672 001351          BNE     15          ;LOOP IF NOT DONE
1007
1008
1009
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1021
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1026
1027
1028 173674
1029 173674 012702 067400      TST27:  MOV      @07400,R2    ;COUNT STORAGE (20K - 1000 BYTES)
1030 173700 010300          MOV      R3,R0      ;FIRST ADDRESS IS 1000 OCTAL
1031 173702 010204          MOV      R2,R4      ;SETUP COUNTER
1032 173704 010020          15:     MOV      R0,(R0)+  ;FILL MEMORY WITH ADDRESSES
1033 173706 077402          SOB      R4,15      ;LOOP UNTIL DONE
1034 173710 012716 000030  MOV      @GRP0,(SP) ;LOAD CODE TO FORCE GROUP 0 ONTO STACK
1035 173714 012701 000003  MOV      @3,R1       ;SET PASS COUNT TO THREE
1036 173720 010300          25:     MOV      R3,R0      ;FIRST ADDRESS
1037 173722 010204          MOV      R2,R4      ;COUNTER
1038 173724 005110          35:     COM      (R0)     ;DOUBLE COMPLEMENT DATA AND
1039 173726 005110          COM      (R0)     ;MAKE SURE IT IS IN THE CACHE,
1040 173730 020020          CMP      R0,(R0)+  ;COMPARE DATA, AND SET BIT 0 IN HIT/MISS REG
1041
1042 173732 001401          BEQ     55          ;ALSO POINT TO NEXT ADDRESS
1043 173734 000000          ;BRANCH IF DATA MATCHES
1044 173736 006037 177752  55:     ROR      @0177752  ;DATA DIDN'T MATCH R0 = ADDRESS + 2
1045 173742 103402          BCS     45          ;WAS THE LAST MEMORY REFERENCE A HIT?
1046 173744 000000          ;BRANCH IF YES
1047 173746 000407          HALT    ;HIT FAILED TO OCCUR R0 = ADDRESS + 2
1048 173750 077413          BR      BOOTHISS   ;ABORT REST OF TEST IF "CONTINUE" PRESSED
1049 173752 011615          45:     SOB      R4,35      ;LOOP UNTIL DONE
1050
1051 173754 005016          MOV     (SP),(R5)   ;FORCE MISS GRP1 ON PASS 2, FULLY
1052 173756 077120          CLR     (SP)       ;ENABLE CACHE ON PASS THREE,
1053 173760 000404          SOB     R1,25      ;GET READY TO FULLY ENABLE CACHE ON PASS 3
1054
1055
1055

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ca

c

1056	173762	000000		CONT:	HALT				
1057	173764	022020			CMR	(SP)+,(SP)+			;STOP HERE IF THERE IS A CACHE ERROR
1058	173766			BOOTMISS:					;ADJUST STACK POINTER AFTER ABORT
1059	173766	012715	000014		MOV	@MISS,(R5)			;FORCE MISSES IN BOTH GROUPS OF CACHE
1060	173772	005720		JUMP:	TST	(SP)+			;POINT TO UPPER SIX BITS OF BUS ADDRESS
1061									;THAT DATA IS IN ADDRESS 1772376 (KOPAR7)
1062	173774	000137	173000		JMP	@BOOT			;GO TO BOOT STRAP ENTRY POINT
1063									
1064									
1065		000001		.END					

TU56S	173502	893#	927												
WAIT	173002	709#	710	740											
STN	= 000030	1#	117	126#	129	138#	143	146	168#	165	168	182#	186	189	
		202#	206	209	222#	224	227	242#	253	256	271#	273	276	291#	
		297	300	315#	320	323	337#	339	342	357#	364	367	382#	398	
		393	407#	417	420	436#	448	451	469#	476	479	495#	512	516	
		531#	544	556#	575	596#	601	629	644#	966	985#	1008	1029#		
.	= 174000	116#	704#	964#											

COMMEN	10	77	100	083	951										
ENDCOM	10	96	112	700	961										
MSG1	1170	119													
MSG10	2560	258													
MSG11	2760	278													
MSG12	3000	302													
MSG13	3230	325													
MSG14	3420	344													
MSG15	3670	369													
MSG16	3930	395													
MSG17	4200	422													
MSG2	1290	131													
MSG20	4510	453													
MSG21	4790	481													
MSG22	5160	518													
MSG23	5440	546													
MSG24	5750	577													
MSG25	6290	631													
MSG26	9660	968													
MSG27	10080	1010													
MSG3	1460	148													
MSG4	1680	170													
MSG5	1890	191													
MSG6	2090	211													
MSG7	2270	229													
NXTTST	10	117	129	146	168	189	209	227	256	276	300	323	342	367	393
	420	451	479	516	544	575	629	966	1008						
SKIP	10	126	143	165	186	206	224	253	273	297	320	339	364	390	417
	448	476	512	601											
STARS	10	117	124	129	136	146	158	168	189	189	200	209	220	227	240
	256	269	276	289	300	313	323	335	342	355	367	380	393	405	420
	434	451	463	479	493	516	529	544	554	575	594	629	642	966	983
	1008	1027													
\$\$\$NXT	10	117	129	146	168	189	209	227	256	276	300	323	342	367	393
	420	451	479	516	544	575	629	966	1008						
\$\$\$SKIP	10	126	143	165	186	206	224	253	273	297	320	339	364	390	417
	448	476	512	601											

ADC	382	440	442												
ADD	292	295	317	361	446	609	622								
ASH	465	473	599	616	726	770									
ASL	441														
ASR	439	723													
BCC	272														
BCS	296	998	1045												
BEQ	162	253	390	417	476	536	561	601	603	671	710	807	849	852	860
	995	1042													
BGE	163	320	363												
BGT	164	224	302	307	448										
BHI	142	185	203												
BHIS	184														
BIC	360	600	725	720	848										
BIS	316	741	758	804											
BIT	306	709	806	859											
BITB	851														
BLE	165	223	297	364	447										
BLO	319														
BLOS	143	206	338	358											
BLT	205	252	273	339											
BMI	140	469	750	861											
BNE	186	384	415	500	583	585	588	510	597	717	789	791	1006		
BPL	161	408	744	748	760	762	785	787	810	813	817	856	864	867	
BR	126	512	705	711	740	751	764	772	819	829	842	1000	1047	1053	
BVC	183														
BVS	141														
CLR	139	411	566	617	649	677	792	794	808	1051					
CLZ	222														
CMP	383	499	535	500	662	670	700	790	994	1048	1057				
CMPB	502	504	507	509											
COM	294	357	388	497	665	669	990	992	993	1005	1030	1039			
COMB	501	506													
DEC	160	337													
HALT	127	144	166	187	207	225	254	274	298	321	340	359	365	391	409
	418	449	470	477	513	537	559	562	565	569	571	664	672	679	674
	996	999	1043	1046	1056										
INC	293	318	412	437	475	626	850								
JMP	570	678	733	804	1062										
JSR	558														
MOV	242	243	244	245	246	247	248	249	436	438	495	496	498	531	532
	533	534	557	563	567	596	598	606	607	608	611	610	619	620	621
	625	644	648	650	651	652	653	654	655	656	659	660	661	667	674
	719	724	729	731	732	739	745	757	763	771	778	782	803	805	814
	818	827	828	836	841	854	985	986	987	988	989	991	1004	1029	1030
	1031	1032	1034	1035	1036	1037	1049	1059							
MOVB	407	716	746	783	808	811	815	825	826	835	853	857	862	865	
RESET	883														
ROL	271														
ROR	182	315	997	1044											
RTI	568														
RTS	564														
SEN	204														
SEZ	202														

I2

SUB	410	413	443	511	540	610	623	658	666	673	658	1001	1003	1033	1040
1052															
SUB	251	309													
SWAB	471	730													
TST	414	416	727	749	759	761	786	1002	1000						
TSTB	467	743	747	784	809	812	816	855	863	866					
.BYTE	890	891	895	897	898	899	900	902	903	905	906	908			
.DSABL	1														
.ENABL	1														
.END	1065														
.ENDC	118	129	127	130	137	144	147	159	166	169	181	187	190	201	207
	210	221	225	228	241	254	257	270	274	277	290	298	301	314	321
	324	336	340	343	356	365	368	381	391	394	406	418	421	439	449
	452	464	477	480	494	513	517	530	545	555	576	595	602	630	643
	967	984	1009	1020											
.EQUIV	1														
.IF	117	124	126	129	136	143	146	158	165	168	180	186	189	200	206
	209	220	224	227	240	253	256	269	273	276	289	297	300	313	320
	323	335	339	342	355	364	367	380	390	393	405	417	420	434	440
	451	463	476	479	493	512	516	529	544	554	575	594	601	629	642
	966	983	1008	1027											
.IFF	117	124	126	129	136	143	146	158	165	168	180	186	189	200	206
	209	220	224	227	240	253	256	269	273	276	289	297	300	313	320
	323	335	339	342	355	364	367	380	390	393	405	417	420	434	440
	451	463	476	479	493	512	516	529	544	554	575	594	601	629	642
	966	983	1008	1027											
.IIF	117	118	119	124	129	130	131	136	146	147	148	158	168	189	178
	180	189	190	191	200	209	210	211	220	227	228	229	240	256	257
	258	269	276	277	278	289	300	301	302	313	323	324	325	335	342
	343	344	355	367	368	369	380	393	394	395	405	420	421	422	434
	451	452	453	463	479	480	481	493	516	517	518	529	544	545	546
	554	575	576	577	594	629	630	631	642	966	967	968	983	1000	1009
	1010	1027													
.LIST	1	77	96	100	112	117	126	129	130	146	160	160	182	189	202
	209	222	227	242	256	271	276	291	300	319	323	337	342	357	367
	382	393	407	420	436	451	465	479	495	516	531	544	556	575	596
	629	644	683	700	951	961	966	985	1000	1029					
.MACRO	1	117	129	146	168	189	209	227	296	276	300	323	342	367	393
	420	451	479	516	544	575	629	966	1000						
.NLIST	1	77	96	100	112	117	126	129	130	146	160	160	182	189	202
	209	222	227	242	256	271	276	291	300	319	323	337	342	357	367
	382	393	407	420	436	451	465	479	495	516	531	544	556	575	596
	629	644	683	700	951	961	966	985	1000	1029					
.PAGE	1	21	75	881	886	911	948								
.REPT	77	96	100	112	683	700	879	951	961						
.SBTTL	118	130	147	169	190	210	220	257	277	301	324	343	368	394	421
	452	480	517	545	576	630	682	707	714	736	754	767	775	780	800
	822	832	839	845	872	887	912	924	936	949	967	1009			
.TITLE	13														
.WORD	250	722	796	797	875	876	877	878	879	880	889	893	909	914	915
	916	917	918	919	920	921	922	926	927	928	929	938	931	932	933
	934	938	939	940	941	942	943	944	945	946					

ERRORS DETECTED: 0

*DEKBHA,DEKBHA,LIS/SOL/CRF=DEKBHA.P11
RUN-TIME: 10 15 2 SECONDS
CORE USED: 9K