HORIZON RAMDISK 256K EXPANSION PROJECT

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The HORIZON RAMDISK is available in 90K SSSD (360 SECTOR) and 180K DSSD (720 SECTOR) sizes. This project expands the size to 256K (976 SECTORS) for an increase in storage capacity of 64K (256 SECTORS) or 35.5%.

This increase is accomplished by adding one 74LS154 (4 to 16 DECODER), one 74LS02 (NOR GATE), and eight 8K 6264LP-15 STATIC RAM chips, removing one 74LS138 (3 to 8 DECODER) chip, and modifying the DSR CODE to recognize the existance of the added memory. The original HORIZON RAMDISK CIRCUIT does not fully decode one of the five memory address lines from U9 limiting it to 180K. By fully decoding this line we pick up eight more CHIP SELECT SIGNALS bringing us up to 256K (976 SECTORS). This utilizes the original design to its fullest potential with only a few SIMPLE MODIFICATIONS.

The HORIZON SOURCE CODE VER_03 was used in this project but modifications to other versions should be very similar. (Note: VER_04 arrived as this was going to press. All modifications were identical, except MEMTEST. Use the modified MEMTEST from VER_03 to check the memory added by this EXPANSION PROJECT.

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**CAUTION: THIS MODIFICATION IS UNDERTAKEN AT YOUR OWN RISK
AND MAY VOID YOUR HORIZON WARRANTY.**

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**CAUTION: REMOVE THE NICAD BATTERIES FROM THE RAMDISK BEFORE STARTING.
USE CARE WHEN HANDLING THE RAM CHIPS TO AVOID DAMAGE FROM STATIC.**

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1. Remove U1, the original 3 TO 8 DECODER CHIP, from its socket and DISCARD.

2. Remove the EIGHT PIGGYBACKED PAIRS of 8K RAM CHIPS from their sockets U3-U6 and U12-U16.

3. Remove U2, the original 4 TO 16 DECODER, from its socket.

4. Remove U10, the original NOR GATE, from its socket.

5. Install a THIRD ADDITIONAL 8K RAM CHIP PIGGYBACKED on top of EACH of the removed PIGGYBACKED PAIRS of 8K RAM CHIPS connecting EACH PIN to its CORRESPONDING PIN below with the EXCEPTION of PIN 20 (CHIP SELECT). BEND PIN 20 outward like PIN 20 on the CHIP below it. Reinstall these EIGHT PIGGYBACKED TRIOS into their sockets (U3-U6 and U12-Y13) and RECONNECT the ORIGINAL lines from PIN 20 of the CENTER CHIPS to their ORIGINAL POINTS on the EXPANSION JACK next to U3.

6. Install the ADDITIONAL 4 TO 16 DECODER CHIP (74LS154) PIGGYBACKED on top of the ORIGINAL 4 TO 16 DECODER CHIP, U2. Connect PIN 12 and PINS 20 THRU 24 to their corresponding PINS below. Bend PINS 1 THRU 11 and PINS 13 THRU 19 OUTWARD. Reinstall the PIGGYBACKED PAIR of 4 TO 16 DECODERS in its U2 socket. Connect lines from the UPPER CHIP PINS 1 THRU 8 as follows.

   PIN 1 to U1 SOCKET PIN 15.   PIN 2 to U1 SOCKET PIN 14.
   PIN 3 to U1 SOCKET PIN 13.   PIN 4 to U1 SOCKET PIN 12.
   PIN 5 to U1 SOCKET PIN 11.   PIN 6 to U1 SOCKET PIN 10.
   PIN 7 to U1 SOCKET PIN 9.   PIN 8 to U1 SOCKET PIN 7.

These provide the CHIP SELECT SIGNALS to the ORIGINAL (CENTER LAYER) of 8K RAM CHIPS.

Connect lines from the UPPER CHIP PINS 9 THRU 11 and 13 THRU 17 as follows.

   PIN 9 to PIN 20 U3 TOP 8K CHIP.   PIN 10 to PIN 20 U4 TOP 8K CHIP.
   PIN 11 to PIN 20 U5 TOP 8K CHIP.   PIN 13 to PIN 20 U6 TOP 8K CHIP.
   PIN 14 to PIN 20 U12 TOP 8K CHIP.   PIN 15 to PIN 20 U13 TOP 8K CHIP.
   PIN 16 to PIN 20 U14 TOP 8K CHIP.   PIN 17 to PIN 20 U15 TOP 8K CHIP.

These provide the CHIP SELECT SIGNALS to the ADDITIONAL EIGHT 8K RAM CHIPS (TOP LAYER)
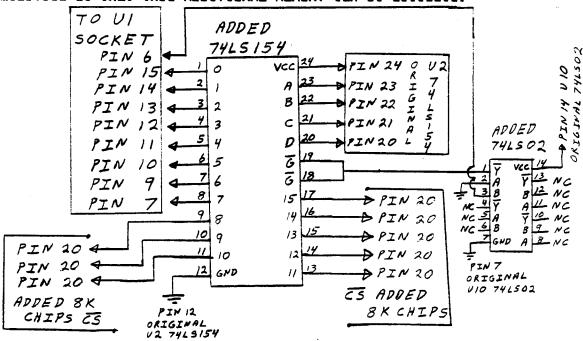
7. Install a new NOR GATE (74LS02) PIGGYBACKED on top of the ORIGINAL NOR GATE, U10. Connect PINS 2, 7, and 14 to the CORRESPONDING PINS below. BEND PINS 1, 3 THRU 6, and 8 THRU 13 outward. Reinstall the PIGGYBACKED PAIR of NOR GATES in its U10 socket. Connect LINES from the UPPER CHIP as follows.

   PIN 1 to PINS 18 and 19 U2 UPPER CHIP.
   PIN 3 to U1 SOCKET PIN 6.

These provide the CHIP SELECT SIGNAL for U2 UPPER 4 TO 16 DECODER CHIP thus fully decoding the available MEMORY ADDRESS LINES.

PINS 4 THRU 6 and PINS 8 THRU 13 of the UPPER NOR GATE U10 are not used and are left NOT connected. They may be used in future modifications.

This completes the HARDWARE modifications to the RAMDISK CARD. Next the DSR SOFTWARE must be modified so that this ADDITIONAL MEMORY can be accessed.

The original DSR CODE, CALL SUBPROGAMS, ETC. are located in RACKS 90-92 at the top of the RAMDISK MEMORY MAP. The MODIFIED RAMDISK MEMORY MAP now extends to RACK 124 and the DSR must be moved to the new top, in RACKS 122-124.

NOTE: IF THE CODE IS NOT MOVED IT WILL BE ERASED WHEN THE RAMDISK IS INITIALIZED TO MORE THAN 720 SECTORS.

The changes to the CODE, consist of changing ALL REFERENCES for the three upper 2K blocks of memory to a NEW LOCATION, changing the LOADER PROGRAMS to LOAD the NEW CODE at the NEW LOCATION, changing the MEMTEST PROGRAM to check THIRTY-TWO 8K CHIPS, changing the MAX SECTOR CALL, and modifying the FORMAT ROUTINE of the DSR.

Luckily, this is much EASIER than it might appear since the SOURCE CODE for the HORIZON RAMDISK was provided with the KIT and is very well Documented!

The following PROGRAMS will need to be modified and then REASSEMBLED with the EDITOR-ASSEMBLER. CALL/S, CHECK/S, CLEAR/S, CREATE/S, FILL/S, LOADER/S, PARTA, SVXB/S, XB/S, and VERSION/S.

The BASIC program MEMTEST must also be modified. The other ORIGINAL SOURCE programs do not require modifications and are used as is.

1. MEMTEST
    Delete LINES 110, 130 thru 170, 190, 200, 320 thru 340. Change LINE 180 from "LENGTH=24" to "LENGTH=32".

2. CALL/S.
    Change "CI R2,1441" to "CI R2,977" at LABEL MAX02.

3. CHECK/S.
    Change "CI R2,24" to "CI R2,32" (fourth LINE after LABEL CHK1).

4. CLEAR/S.
    Change "LI R2,90" to "LI R2,123" (fourth LINE after LABEL LOOP1).

5. CREATE/S.
    Change "DATA >BB00" to "DATA >FB00" at LABEL LINK1.
    Change "DATA >BD00" to "DATA >FD00" at LABEL LINK2.
    Change "DATA >BF00" to "DATA >FF00" at LABEL LINK3.
    Change "PARTA_03" to "PARTA256" in the TEXT LINE after LABEL PDATA.
    Change "PARTB_03" to "PARTB256" in the TEXT LINE after LABEL LDATA.

6. FILL/S.
    Change "LI R5,93" to "LI R5,125" (one LINE before LABEL FLOOP1).

7. LOADER/S.
    Change "DATA >BB00" to "DATA >FB00" at LABEL LINK.
    Change "BYTE >BB" to "BYTE >FB" at LABEL MXL1.
    Change "BYTE >BD" to "BYTE >FB" at LABEL MXL2.
    Change "BYTE >BF" to "BYTE >FF" at LABEL MXL3.

8. PARTA.
    Change "DATA 720" to "DATA 976" at LABEL MAXSEC.
    Change "DATA 720" to "DATA 976" at LABEL FORSEC.
    Change "DATA >BB00" to "DATA >FB00" at LABEL LINK1.
    Change "DATA >BD00" to "DATA >FD00" at LABEL LINK2.
    Change "DATA >BF00" to "DATA >FF00" at LABEL LINK3.
    Add the LINES "C R8,@MAXSEC" and "JEQ FFDONE" after the LINE "INC R8" (fourth
    LINE after LABEL FMTLP1.
    Add the LINE "FFDONE   MOV R8,R3" after the LINE "JNE FMTLP0" (sixth LINE after
    LABEL FMTLP1.

9. SVXB/S.
    Change "LI R1,>BF00" to "LI R1,>FF00" (fourth LINE after LABEL SVXB.

10. VERSION/S.
    Change "DATA >BB00" to "DATA >FB00" at LABEL LINK1.
    Change "DATA >BD00" to "DATA >FD00" at LABEL LINK2.
    Change "DATA >BF00" to "DATA >FF00" at LABEL LINK3.
    Change "PARTA_03" to "PARTA256" in the TEXT LINE after LABEL PDATA.
    Change "PARTB_03" to "PARTB256" in the TEXT LINE after LABEL LDATA.

11. XB/S.
    Change "CI R2,1441" to "CI R2,977" at LABEL MAX02.

REASSEMBLE these FILES to create the NEW OBJECT FILES.   Then   REASSEMBLE   the FILE
"TEST/S" which ASSEMBLES the DSR FILES PARTA thru PARTE. Call this FILE "DSR256".
ASSEMBLE the ORIGINAL FILES "CHAR/S" and "DOWNLD/S" from the HORIZON SOURCE DISK.

Next RUN the "LOADER" program assembled from "LOADER/S" to LOAD the following:
    "DSR256" into BLOCK 1.
    "CALL" from the assembled FILE "CALL/S" into BLOCK 2.
    "CHAR" from the assembled FILE "CHAR/S" into BLOCK 3.
    "DOWNLD" form the assembled FILE "DOWNLD/S" into BLOCK 3.

Now RUN this BASIC program.

```
100 CALL INIT
110 CALL LOAD("DSK1.XB")
120 CALL LOAD("DSK1.SVXB")
130 CALL LINK("SVXB")
140 END
```

NOTE: The RAMDISK MUST be set at CRU 1000 for the SVXB program to work as it does NOT
search for the HORIZON CARD CRU like the other programs do. If you have another CARD
at CRU 1000 (like the MYARC 128K or 512K CARD) you can change the sixth LINE of the
"SVXB/S" FILE from "LI R12,1000" to "LI R12,(CRU of your HORIZON CARD)".

The modified DSR CODE, CALL SUBPROGRAMS ETC. are now LOADED in their NEW locations in
RACKS 122 THRU 124. Next RUN the program "CREATE" from the assembled FILE "CREATE/S"
(PROGRAM NAME "IMAGE").   This will create the FILES "PARTA256" and "PARTB256" on DSK1
for use with the VER256 LOADER from the assembled FILE "VERSION/S"

The SOURCE CODE for the program "UTIL1" (the multiple RAMDISK LOADER) was not provided on the HORIZON SOURCE CODE DISK. It can be modified by DISSASSEMBLING it with "MILLERS GRAPHICS DISkASSEMBLER", finding the four words >02D0, >BB00, >BD00, and >BF00, changing them to >03D0, >FB00, >FD00, >FF00, changing "PARTA_03" and "PARTB_03" to "PARTA256" and "PARTB256", REASSEMBLING the program, and then RUNning the SAVE UTILITY from the EDITOR/ASSEMBLER to change it back to PROGRAM IMAGE FORMAT.

This completes the DSR modifications. All functions of the HORIZON RAMDISK will function as they did originally, but now being able to UTILIZE 976 SECTORS (256K).

When formatting the 976 SECTOR RAMDISK select DSDD format. The DISKMANAGER will show "974 SECTORS FREE" and "466 SECTORS USED". This is because the DISKMANAGER is trying to format 1440 SECTORS and reads 466 USED during SECTOR VERIFICATION. This does not affect RAMDISK OPERATION in any way but it can be corrected to show "974 SECTORS FREE" and "2 SECTORS USED" by changing BYTES 10 and 11 of SECTOR 0 from >05A0 to >03D0. The following program is used to correct the SECTORS FORMATTED number.

```
        DEF   START
SECTOR  DATA  >03D0
START   LI    R12,>1200 CRU OF YOUR CARD
        LI    R1,7
        SWPB  R1
        LDCR  R1,8
        MOV   SECTOR,@>580A
        SBZ   0
        RT
        END   START
```

This completes the HORIZON RAMDISK 256K EXPANSION PROJECT.

Questions concerning this EXPANSION PROJECT should be sent to:
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