

M E M O

To: P  
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 Subject: Speed of M1 CPU1 in 940 mode

The following timings were obtained by executing 64 sequential copies of the indicated instruction, in a loop that was performed 10000 times. For memory reference instructions, each of the 64 copies had a different address, to negate the effect of the fast memory.

<u>Instruction</u>	<u>Time (<math>\mu</math>s)</u>	<u>940 time</u>
LDA	6.0	3.5
LDA indexed	7.0	3.5
LDA indirect	10.1	5.25
LDA indirect, 2 levels	14.2	7.0
MUL	56.8	7.0
MIN	6.3	5.25
CLA, CLB	10.2	1.75
XAB, AXC	11.6	1.75
LCY 1, 8, 16	10.2	3.5, 5.25, 5.25
LCY 40	11.7	7.0
LSH 2, 8	11.2	3.5, 5.25
LSH 32	14.8	7.0
RCY 8	11.7	5.25
BRU *+1	3.9	1.75
BRR *	5.2	3.5
BRX *+1, successful	5.0	1.75
unsuccessful	6.3	3.5
SKG, successful	7.2	5.25
unsuccessful	6.1	3.5
DIV, (AB)=0, (Q)=1234567	50.1	17.5
177B5, (177B)=BRR 0	10.6	7.0

Most of the tests were run two or three times to check the consistency of the timings. The variation was no more than 2% in any case. Putting the same address in all copies of memory reference instructions speeded them up by about .4  $\mu$ s, presumably because their operand stayed in the fast memory.

These figures explain why 940 programs run so slowly on M1: with an average mix of RCH's, the M1 is only worth about 40% of a 940.