



## The Memotech MTX Series



- [Computers Overview](#)
- [Commodore PET](#)
- [Sinclair ZX80](#)
- [Sinclair ZX81](#)
- [BBC Micro](#)
- [Sinclair Spectrum](#)
- [Memotech MTX](#)
- [About](#)
- [Library](#)
- [Manuals](#)
- [Options](#)
- [Photos](#)
- [Projects](#)
- [Repairs](#)
- [FDX Power](#)
- [FDX Systems](#)
- [MTX Power](#)
- [MTX Capacitors](#)
- [MTX Keyboard](#)
- [MTX RAM](#)
- [MTX ROM](#)
- [MTX Speculator](#)
- [MTX VRAM](#)
- [MTX VRAM - 2](#)
- [Spare Parts](#)
- [Video Wall DDFS](#)
- [Software](#)
- [Tools](#)
- [User Groups](#)
- [Video Wall](#)
- [Memotech CP/M](#)
- [Atari ST](#)
- [PDAs](#)
- [DEC 3000 AXP](#)
- [OpenVMS](#)
- [Raspberry Pi](#)

## Memotech MTX Speculator



This page provides details of fault finding, and hopefully fixing, my Memotech Speculator.



I had hoped to be able to add a [Speculator](#) to my collection for a long time, but had been disappointed, until Martin Allcorn did me a very good "deal" on his Speculator. Martin had not tested it, but given that the hardware is very simple, consisting of a RAM chip, two PALs, two 74LS chips, a couple of resistors and a couple of capacitors, hopes were high that it would work "out of the box". Even if it were faulty, I expected that it should have been relatively easy to repair- particularly as the original designer (Tony Brewer) had helped me to develop a schematic for the board and provided the logic equations for the PAL chips.




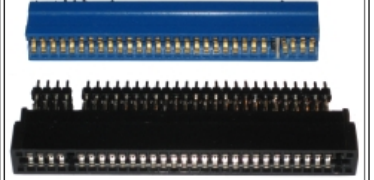

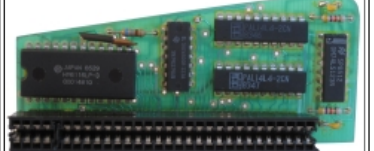
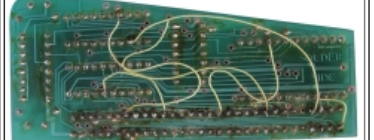

Unfortunately, when I tried out the Speculator by attaching it to my MTX and attempting the load the original tape program, it did not appear to work - the tape was recognised by the MTX with the name "SPECPROGS1" and appeared to load. However, when it got to the end of the tape, the computer just displayed the "Ready" prompt and nothing appeared to have been loaded into memory.

[ I subsequently found out from Tony Brewer that this is the expected behaviour. On loading the tape, the MTX tests for the presence of a Speculator by attempting to write to the device and then read back the values written. If this test fails, the MTX returns to the BASIC ROM. ]

So, some work required . . . . .

MTX Speculator	
The Speculator consists of a small PCB mounted in a ROMPAK case which attaches to the expansion port on the left hand side of the computer.	
As you can see by the join above the edge connector, the case is in two halves that are "snap-to-fit", and the label on the front side is applied over the join. The label needs to be removed before the case can be split and the board revealed.  Unfortunately, despite trying very carefully to peel back the label using the very sharp blade of a trimming knife, the label did not survive the process.	
With the case split and the PCB removed, you can see the "snap-clips" at either end of the bottom half that holds the case together.	
Vertical view of the two halves - showing the locating slots that the PCB sits in.  (There is a point to these uninteresting photos, as will become clear . . . .)	

											
<p>With the case removed, you can see how few components are fitted.</p> <p>The large chip is a 2K memory chip, an Hitachi HM6116P-4 200ns <a href="#">SRAM</a>, a 74LS123 (dual monostable multivibrator), a 74LS74 (dual flip-flop), two <a href="#">PALs</a> with custom programming and a few resistors and capacitors.</p>											
<p>View of the solder side of the board.</p>											
<p>When it became obvious that the Speculator had a fault, I wondered whether there were any tests that I could do to establish whether the MTX was even communicating with Speculator.</p> <p>Tony Brewer was very helpful and able to provide some details on the self testing routine that he had written into the code. It should have been possible to write data to some output ports and read it back through corresponding input ports.</p>	<table border="1"> <thead> <tr> <th colspan="2">Loopback Port Tests</th> </tr> <tr> <th>Output Port</th> <th>Input Port</th> </tr> </thead> <tbody> <tr> <td>31</td> <td>31</td> </tr> <tr> <td>126</td> <td>254</td> </tr> <tr> <td>254</td> <td>126</td> </tr> </tbody> </table>	Loopback Port Tests		Output Port	Input Port	31	31	126	254	254	126
Loopback Port Tests											
Output Port	Input Port										
31	31										
126	254										
254	126										
<p>I wrote a small BASIC program which wrote values from 0 to 255 to each of the output ports shown and read back the data from the corresponding loop-back port.</p> <p>In all cases, when values from 0 to 127 were written, the same value was read back, but for values 128-255, the values read were also 0 to 127, i.e., the output value - 128. These results were repeatable over a number of power cycles of the MTX and indicated a problem with bit 7 of the data bus, either a fault on the card or the memory chip. (The same MTX was working correctly with <a href="#">MAGROM</a> which seemed to confirm that the MTX edge connector and data bus were OK.)</p>											
<p>At this point, things got slightly more complicated as the MTX also developed a fault. Even with nothing attached to the expansion bus, the MTX would only run for a very short time before "crashing". This had a number of symptoms, including, the BASIC "<i>Ready</i>" screen freezing, the system dropping into PANEL and freezing and the screen clearing to a pale green colour and freezing.</p> <p>After investigation, I found that the problem was a faulty CPU, after changing out the Z80A processor, the "crashes" stopped. Although it is possible that either Speculator or <a href="#">MAGROM</a> had damaged the CPU, I think this was just an unfortunate coincidence, particularly as the failure has not reoccurred with either device attached since.</p>											
<p>After I had replaced the CPU, I repeated the loop back test described above, and found the results were markedly different to the previous ones. The values read back from the input ports bore no relation to the values written to the output ports and in fact were the same as when Speculator was not connected.</p> <p>I found that putting gentle pressure on the edge connector caused the returned values to change, it was not possible to isolate a particular area of the connector as being the source of the problem, but some of the connections appeared to be intermittent.</p>											
<p>This was not altogether surprising as the edge connector did appear to be somewhat "distressed".</p> <p>For example, the insulated separator between contacts 2 &amp; 3 and 3 &amp; 4 are missing and the locator key in position 5 is rather bent, though probably not enough to prevent it doing it's job or to cause a short circuit (it is metal). The contacts themselves were also very tarnished.</p>											
<p>Although there was continuity between the individual contacts and the corresponding PCB terminals, many of the contacts had a noticeable lack of "spring".</p> <p>I tried to reshape some of the contacts to put more pressure on the edge connector, but even if this had been beneficial, I was not confident of the long term reliability of the connector and decided that it needed to be replaced.</p>											
<p>The PCB sat in its slot in the lower half of the case, the edge connector is unusual, the bottom of the edge connector stands about 7.5mm off the surface of the PCB, this is necessary to allow the connector to protrude through the case far enough to mate with the MTX cartridge port.</p>											
<p>A typical, flush mounted edge connector would barely have cleared the case and would not have allowed Speculator to mate with the cartridge port. I</p>											

<p>initially thought that if I replaced the edge connector I would not be able to reinstall the Speculator in its case afterwards - this would have been disappointing, but likely to have been the only way to revive it.</p>	
<p>While I was trying to think of a way of extending a flush mounted connector, Martin made me this "special", it will lift the connector off the PCB by ~9mm, meaning that I can refit the case - thanks very much Martin !</p>	
<p>The tracks on the Speculator PCB are very fine and easily damaged, to try to limit the chances of damaging the PCB when removing the old edge connector, I snipped the contacts close to the connector before trying to remove it.</p>	
<p>The MTX expansion connector has 2 x 30 slots, including the keyway at position 5. The replacement connector was made using a 2 x 31 way connector. I removed the contacts from position 31 and used a junior hacksaw to trim the connector to fit the Speculator case.</p> <p>I appears that Memotech had difficulty in sourcing 30 way connectors too as the original had also be cut to the required size.</p>	
<p>As I mentioned above, the traces and vias on the PCB are very fragile and despite my best efforts, some of the pads separated from the barrel of the vias when the old connector legs were removed and I also damaged a couple of the connected tracks. Rather than try to repair the board, I decided to repair any faults after installing the replacement connector.</p>	
<p>The replacement connector fitted to the PCB.</p> <p>From this side - it looks pretty good, however . . . . .</p>	
<p>It is not quite so neat on the solder side!</p> <p>Using my Speculator schematic, I checked all of the connections on the PCB and added Memotech style yellow wires to remake the connections that I had broken when I replaced the edge connector.</p>	
<p>With the Speculator re-attached, the connection between it and the MTX connector was much more secure and did not suffer from the bad connection problems seen previously.</p> <p>On testing it, I found that the board was back to the same state that it was previously, i.e., it did not respond to the Speculator program tape, it was possible to write and read data from the output ports, but, as shown in this screen shot, data bit 7 still appeared to be stuck low, indicating a SRAM or bus problem.</p> <p>So, despite my bodging, Speculator seems to be no worse for the experience!</p>	
<p>To be continued . . . . .</p>	
<p>Next step is to try to isolate the problem using my Logic Analyser</p>	
<p>Potentially replace the SRAM chip</p>	