A MEMOTECH METAMORPHOSIS

Richard Sargent reports on a stunningly clever piece of software which turns a Memotech into a Spectrum. We do not lie!

Take one Memotech MTX512 computer, a wedge-shaped MTX ROM-Pack, and a Spectrum Games Cassette – *Jetpac* will do nicely. Load Spectrum tape into Memotech . . . observe Sinclair's flashing border on screen . . . and play Jetpac using the usual keys and at the usual speed . . .

Science Fiction, perhaps? Freelance software designer Tony Brewer didn't think so, and to prove it he has the MTX512 currently running 20 Spectrum machine-code games. Memotech is as you might expect, rather pleased.

How it's done is more fascinating than why it's done. Memotech, very sensibly, see this as one more facility available to users of their machines; underlining the claim that the MTX range of computers and peripherals constitute powerful and versatile tools. But the transfer was made to prove that software compatibility *can* be achieved if the hardware involved is flexible enough.

Why it works

The Spectrum has a screen resolution of 256 x 192 pixels, which is the same as that of the MTX. Both computers run using Z80 code and both can cope with Z80 non-maskable interrupt. The MTX runs slightly faster – 4MHz as opposed to 3.5MHz – and, if there had to be a speed difference, this way round is the easier to cope with. So far so good, but what of the machines' operating systems? There is not a block of code in the Spectrum ROM which is anything remotely like that in the MTX ROM, and it would break all the copyright rules under the sun to put Sinclair's ROM into the MTX. The solution to this problem is simply to ignore the Spectrum ROM: there are very few routines in it which are of use to the writers of fast arcade games, and most Spectrum machine-code games make just one or two calls to the ROM. To put it another way, the code on the cassette tape is virtually self-contained, and a small amount of supervision by a friendly CPU will cause it to run.

How it works

Without giving away too many of Tony Brewer's ideas, it is possible to give a reasonably detailed account of how the system works. First, you need an MTX with 64K of RAM, so it has to be an MTX512 or an expanded MTX500. Then you will need to purchase the small box-of-tricks (price to be announced) which plugs into the Memotech ROM slot, and with that you will also receive the first of a series of cassette tapes which allow you to play *selected* Spectrum games. Memotech says the cassette tapes will be priced at less than the average games-tape, and each will allow between 0 and 12 specific Spectrum games to be used on the MTX. The first one, which is now ready to be produced in quantity, is a generous offering and contains the supervisory code to enable the twenty games listed in **Table 1** to be played.

TABLE 1. Spectrum games available

ARCADIA	ASTRONUT
ATIC ATAC	DECATHLON
GRIDRUNNER	HUMPTY DUMPTY
HUNCHBACK	JETPAC
JETSET WILLY	JUMP CHALLENGE
LASERWARP	POITY PIGEON
PROJECT FUTURE	SPECTIPEDE
STARION	STOP THE EXPRESS
TORNADO	TRAXX
TWIN KINGDOM VALLEY	
WORSE THINGS HAPPEN	

Once the tape is loaded into the MTX, an auto-run is performed and the MTX proceeds to turn itself (partially) into a Spectrum. The first indication that this has happened is the appearance of the on-screen menu, listing the Spectrum games that can now be loaded into the MTX. Naturally, this menu is in the Spectrum character set and uses Spectrum colours.

Internally, a more important change has taken place. The banked-memory which the 512 possesses moves from its normal position (PAGE 1, 8000H-BFFFH) to PAGE 0, 0000H-3FFFH, giving PAGE 0 a complete range of RAM from 0 to 64K. The Spectrum character shape-table is created at 3D00H-3FFFH, while 4000H-5CBSH is put aside for the "Spectrum screen" and the "Spectrum system variables". This leaves 5CB6H-FFFFH free to accept the Spectrum-game's code.

The supervisory code lies somewhere in the Z000H-5CFFH area. One major, purpose-written routine is the "Load Spectrum-format tape" (and there is also a "Save Spectrum-format tape" to cater for games where you can save a partly played version), but the main effort of coding is the routine which takes the display from 4000H (Spectrum display file) and 5800H (Spectrum colour attributes) and passes it to the 16K of video RAM used by the MTX's Video Processing chip (the VDP). This is where the artistry comes in. The task is performed using interrupts, but even so it takes two passes to move the relatively small Spectrum video RAM (size 1B00H) to the larger VDP RAM (size 4000H); this does not reduce the speed of the game, but does cause the graphics to move less smoothly: a point which is noticeable only when large sprite graphics are involved. For all other games there is no visual difference between the Spectrum version and the Memotech version.

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No copied code

Apart from the legal implications of copying Spectrum code, the challenge of not doing so appealed to Tony Brewer. Thus when a games program uses a call to the Spectrum ROM, something has to be there at the "ROM address" to intercept the flow of the program. An example is the CLS routine, widely used by games-programmers as a quick way of cleaning out the area of RAM from 4000H-5B00H. It's at 0D6BH, so the MTX has screen-clearing code at 0D6BH too. Similar trapping has to be done for the often used Z80 RST addresses (print-to-screen at 0010H is often used), and for the interrupt RST at 0038H.

BEEPER (03B5H) is rather more difficult. Sound is not used on the Memotech version of Spectrum games, since the effect doesn't warrant the high cost of implementing it. Nevertheless, the call is intercepted and the games code thinks the beeper-port exists: this is necessary to avoid program crashes.

Fooling the code is the main task of the hardware, which, although in a ROM-pack case, doesn't contain a ROM. What it does contain is five chips, two of which are custom-blown PALs. The PAL (Phase Alternation by Line) is the cheap younger brother of the ULA, and is used extensively in decoding circuits, and (as a side benefit) to prevent inquisitive constructors working out how a circuit operates. The other three chips are standard devices. The other duty of the hardware is to pretend to be a Spectrum keyboard: with some help fro MTX code and MTX interupts, the key presses (on the Memotech keyboard) are translated into Spectrum-style keypresses and joystick movements.

It is doubtful whether the whole package (tentatively called the Spectrum Speculator) will sell in any quantity now that the games-market has died down, but full marks to Memotech (and Tony Brewer) for doing it anyway.