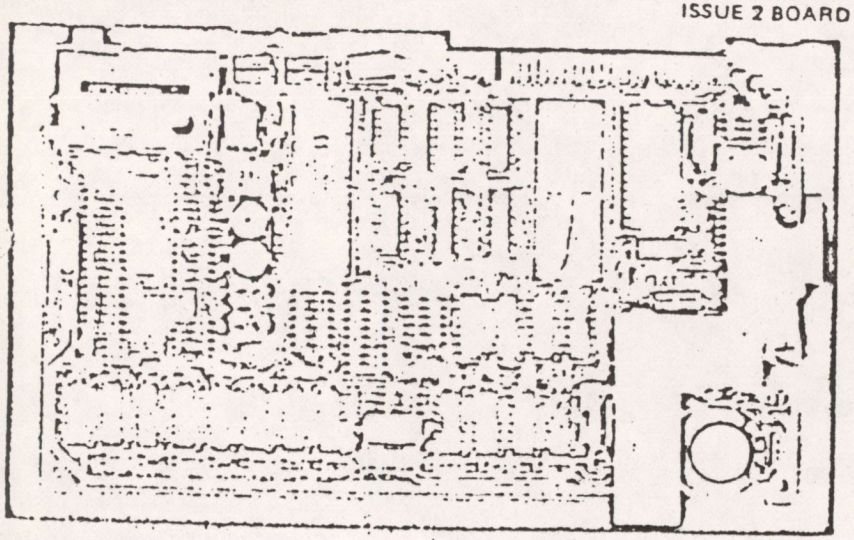
ISSUE 2 BOARD



ISSUE 1 BOARD

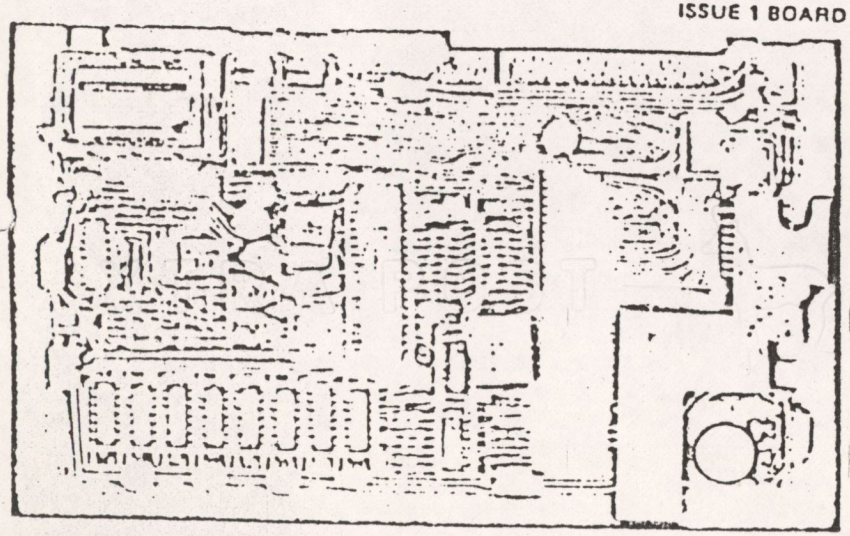


PLATE 3 – PHOTO OF MAIN SPECTRUM BOARD
WITH Z80A CHIP OUTLINED

4. THE Z80A CENTRAL PROCESSING UNIT

This is the microprocessor chip itself. Housed in its 40 pin plastic package, this chip is the computing centre of your Spectrum. It is the big chip labelled IC2 in Appendix D. The CPU is able to perform several basic functions. These are:

Read data from memory
Write data to memory
Read data from an input/output (I/O) device
Write data to an I/O device
Perform arithmetic and logical operations on data

What the Z80A does at any particular time is determined by the instructions which it obtains from memory. There are 158 different types of instructions which the Z80A can understand. Programming the Z80A in machine code is a complete subject in itself. You should look at a specialised book on programming if you wish to know more.

You may have seen other computers using the Z80 chip, and wondered what the difference between it and the Z80A is. Both are identical in their operation: The only difference is that the Z80A can operate at speeds up to 4MHz whereas the Z80 can only operate at speeds up to 2.5MHz. More recently, a new chip called the Z80B has been introduced. This is still the same as the Z80 chip, but can operate at speeds up to 6MHz.

As was mentioned earlier, the Z80A is an 8 bit microprocessor. It transfers data 8 bits at a time. The first microprocessor chips were 4 bit devices, but now some microprocessors are 16 bit or even 32 bit devices. They tend to be rather faster than the 8 bit ones because they can transfer more information in the same time. However, they are much more expensive, so the 8 bit micros are more popular in home computers.

The Z80A clock signal runs at 3.5 MHz (except when accessing video/program memory — see chapter 8) in the Spectrum. All CPU operations are referenced relative to this clock signal, so the 0—1 and 1—0 transitions must be very fast to ensure that all operations start each cycle at exactly the same point. This is why TR3 and its associated resistors and diode are required. The 3.5 MHz clock signal from the ULA does not have a sufficiently fast logic 0 to logic 1 transition. Since all internal CPU circuits may start at slightly different voltages in the +0.8 volt to +2 volt range, if the time for the clock signal to go from +0.8 volts to +2 volts is significant (in nanoseconds!), different parts of the internal circuitry may start at different times. If there is a difference in start times, the Z80A may malfunction. TR3 ensures that the transition at the CPU clock pin is fast enough.

Z80A CPU PIN DESCRIPTIONS*

A0 — A15 The address bus — tristate outputs (ie 0 or 1 or floating. When floating, another device can provide the address bus instead of the CPU). This bus provides 2^{16} = 65536 different addresses for memory data exchanges or 2^{8} = 256 input/output device addresses (the lower eight address lines are used during I/O). The CPU can also refresh memory (see refresh pin) by providing

*note that signals with a bar over them such as $\overline{RD}$ are 'active low'. This means that a read is occuring when $\overline{RD}$ = 0. Normally, 1 = true and 0 = false but all Z80A control signals with a bar over them are inverted so that 0 = true and 1 = false.