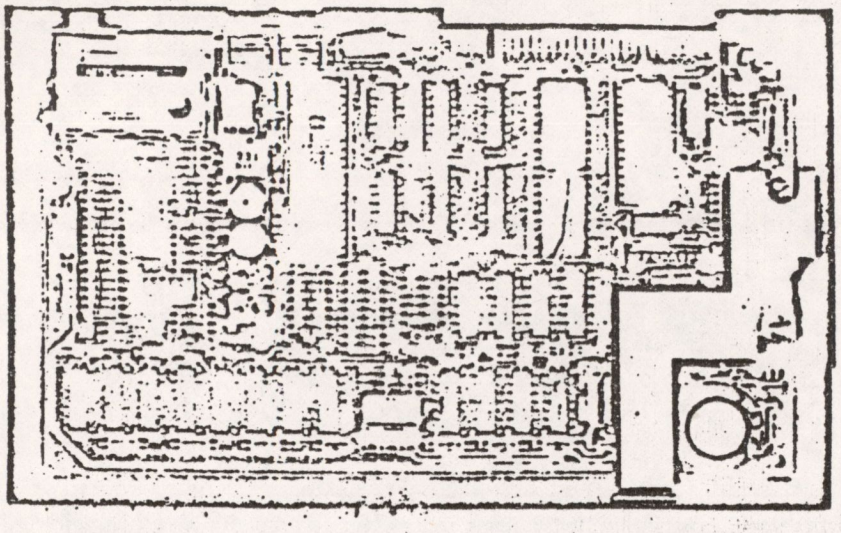
ISSUE 2 BOARD



ISSUE 1 BOARD

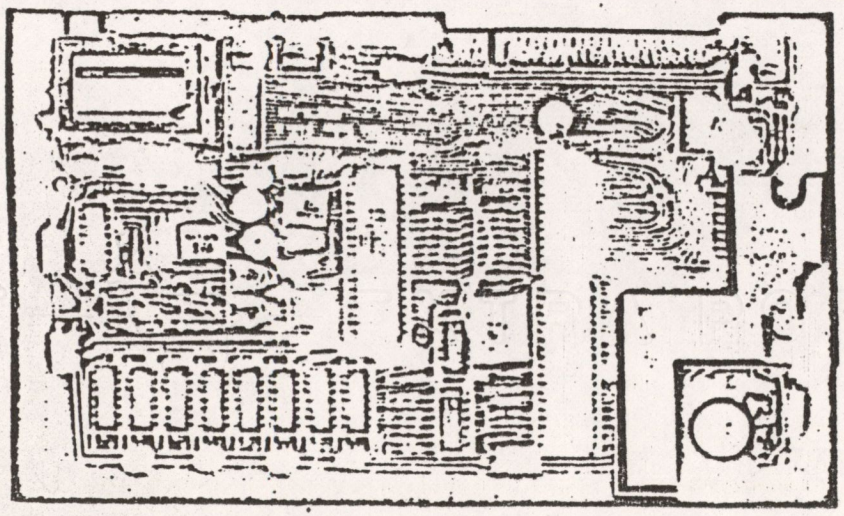


PLATE 2 – PHOTO OF MAIN SPECTRUM BOARD WITH POWER SUPPLY OUTLINED

3. THE POWER SUPPLY

The power supply of any computer is probably the piece of circuitry most often overlooked by the user. The computer is connected to the mains supply and it comes to life. It is just taken for granted that the correct currents and voltages will be generated. If you are going to add on your own hardware however, a complete understanding of the power supplies is necessary. This chapter therefore takes a close look at that forgotten piece of circuitry and its limitations. The chapter explains how to make the most of your Spectrum power supply. It also provides circuits for additional power supplies for use with your external circuits.

In the Spectrum, all of the power comes in at +9 volts at a current of up to 1.2 amps. This is supplied from a ZX Mains Power Supply. Unfortunately, none of the chips in the Spectrum use a 9 volt supply. Most of the logic, including the CPU operates from a +5 volt supply. The ULA demands a +12 volt supply as well. The video memory chips are most awkward of all, requiring +12v, +5v and −5v all at once!

The problem isn't simply one of producing a supply that is roughly constant at roughly the right voltage for most of the time. The +5 volt supply must be within 5% of +5 volts and the +12v and −5v supplies within 10% of their nominal value all over the circut all of the time. Even a microsecond's drop in voltage could spell disaster. How are these constant voltages produced?

THE +5 VOLT SUPPLY

This is the major supply in the Spectrum. In the 48K version it is really stretched to its limit supplying a full 1 Amp of current. Looking at the regulator, you will see that it is bolted onto a large piece of aluminum. The little +5 volt regulator integrated circuit with only three connections to the outside world, contains complex regulation circuitry.

Referring to fig. 2a, the 7805 regulator accepts +9 volts at its IN pin. The internal regulation circuitry then reduces this to +5 volts at the OUT pin. The fact that the input is +9 volts is irrelevant (except for the amount of dissipated power). It could equally well have been anything from +7 volts to +25 volts, the output would still remain at a steady +5 volts. You might wonder where the lost 4 volts has gone to. It is dissipated as heat by the aluminum heatsink. When the regulator is supplying 1 amp, 4 watts have to be dissipated by the heatsink (about one quarter of the heat from a small soldering iron!). That's why the Spectrum soon gets quite hot after it is switched on.

THE +12 VOLTS SUPPLY

The 5 volt supply was relatively easy to produce. 4 volts were simply dropped by the regulator. Producing the +12 volts with only +9 volts available is rather more complex. Referring to fig 2b, TR5, TR4 and their associated components produce the 12 volt supply. TR5 forms a current feedback for the oscillator formed by C43, R61, C1 and TR4 (the main power drive transistor). Operation of the circuit relies upon the induced reverse voltage across L1 which occurs on every cycle of oscillation. This reverse voltage pushes the collector of TR4 up above 9 volts to a maximum of about +13 volts. At this level, D15 conducts to charge up the +12 volt supply capacitor C44. C44 then discharges to provide a constant