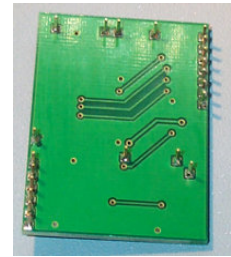# ZX Spectrum Upper RAM Module

WARNING: The module's mounting pins may be sharp on both sides; take care when handling it. Observe anti-static precautions while installing the module and store it in its static-shielding bag prior to installation.

This module can be used to replace the eight 4532 (or equivalent) ICs that form the upper 32 kilobytes of RAM in a 48K ZX Spectrum computer or to upgrade a 16K ZX Spectrum to a 48K model. The ZX Spectrum must be an issue 2 or later.

Support Logic

The upper RAM support ICs IC23, IC24, IC25 and IC26 must be present and functioning.

| IC:	Type:	
IC23	74nn32	Where it is recommended nn is LS or HC. Other 5 volt 74 logic families should also work.
IC24	74nn00	
IC25 & IC26	74nn157	

Table of upper RAM support logic IC types.

RAM Type Selection Links

ZX Spectrum computers have positions for wire links that normally must be installed to tell the computer which type of upper RAM is in use.

Issue 2 ZX Spectrums have two possible link positions. It does not matter which is used when this module is installed, but one or the other should be. A few issue 2 ZX Spectrums have been modified to support RAM manufactured by OKI and this requires no link to be installed. In this case the easiest option is probably to modify the upper RAM module to make it emulate OKI RAM. How to do this will be described shortly.

Issue 3 and later ZX Spectrums have link positions to select Texas Instruments (TI) or OKI RAM and others to indicate which variant of each is installed. The upper RAM module works like TI RAM and so it is recommended the TI link be installed. Any one of the TI sub-type links should also be installed.

The annotated images below show the possibilities; other combinations may cause the computer not to operate correctly.
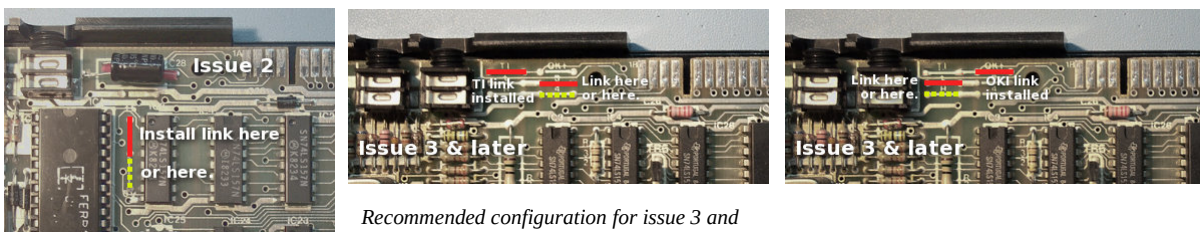
*Recommended configuration for issue 3 and later ZX Spectrums.*

OKI RAM Emulation

As supplied, the upper RAM module emulates Texas Instruments RAM. If necessary, it can be modified to emulate OKI RAM instead. To do this, cut the trace between the two pads labelled **T LNK** and solder a short piece of wire or 0 Ω SMD resistor between the pads labelled **O LNK**. Use a continuity tester to make absolutely certain the **T LNK** connection is broken.

Installation

If you have to remove existing RAM ICs, check the ZX Spectrum PCB very carefully for damage or short circuits caused during the removal. It is suggested standard 16 pin DIL sockets be installed in the eight upper RAM IC positions. Note that the module cannot be properly plugged in to most turned-pin DIL sockets.

The connecting pins should be perfectly perpendicular to the lower surface of the module's circuit board. Use thin-nosed pliers to gently straighten any that have become bent during transportation or storage.

The module should be aligned squarely over the DIL sockets as shown in the photograph below, using the **TOP LEFT** indicator to orientate it correctly.
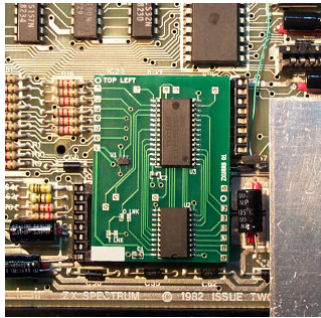
The circle printed in the top left hand corner of the face of the upper RAM module must be placed directly over contact 1 of the socket in position IC22. The module's lower rightmost pin must be inserted in contact 9 of the socket in position IC15. The leftmost column of contacts of the socket in position IC18 and the rightmost column of contacts of the socket in position IC19 are not covered by the upper RAM module.

Slowly and evenly press the module into the sockets until little or no space remains between the two. Press down on the module's circuit board rather than its components. When installing the module, take care to make sure that all its pins are properly inserted into the correct socket contacts.

Alternatively, the upper RAM module can be soldered directly to the ZX Spectrum without the use of sockets. In this case, a gap of a few millimetres should be left between the module and the ZX Spectrum's circuit board.

Capacitors C58 & C59

Depending on their type and how you install the upper RAM module, these capacitors might cause an obstruction. They can be removed; they are not necessary when the upper RAM module is used. Alternatively, lower profile capacitors could be installed in their place.

Please visit **http://zx.zigg.net** if you have any questions about the ZX Spectrum upper RAM module.