

# APEDSK99 (Arduino Peripheral Expansion for the TI-99/4a)

OK, you decided to build one yourself; great!

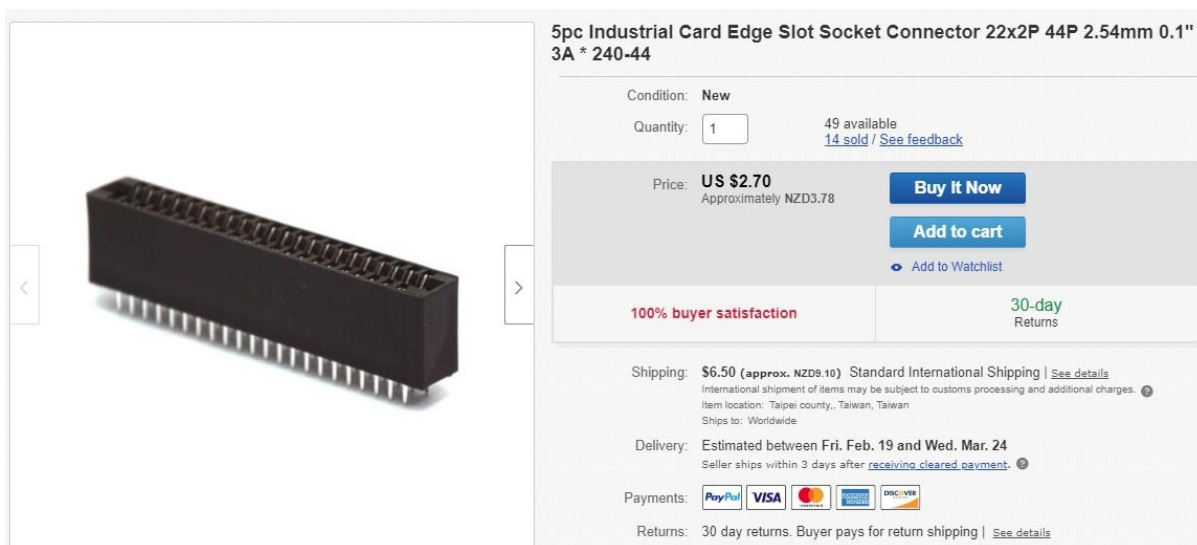
Putting the APEDSK99 shield together is straightforward. No risk of sneezing ruining your SMD day and it can be put together by anybody with basic soldering skills.

You will need a suitable programmer to program the GAL with the supplied PLD file; alternatively I can send you a programmed one.

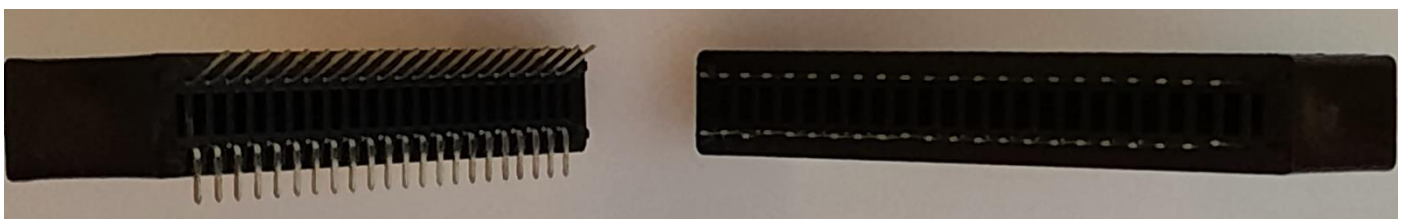
The KiCad files can be sent to your favourite online PCB maker (I use [PCB Prototype & PCB Fabrication Manufacturer - JLCPCB](#) )

The three things that need a little bit of attention are:

## 1. Mounting the edge connector



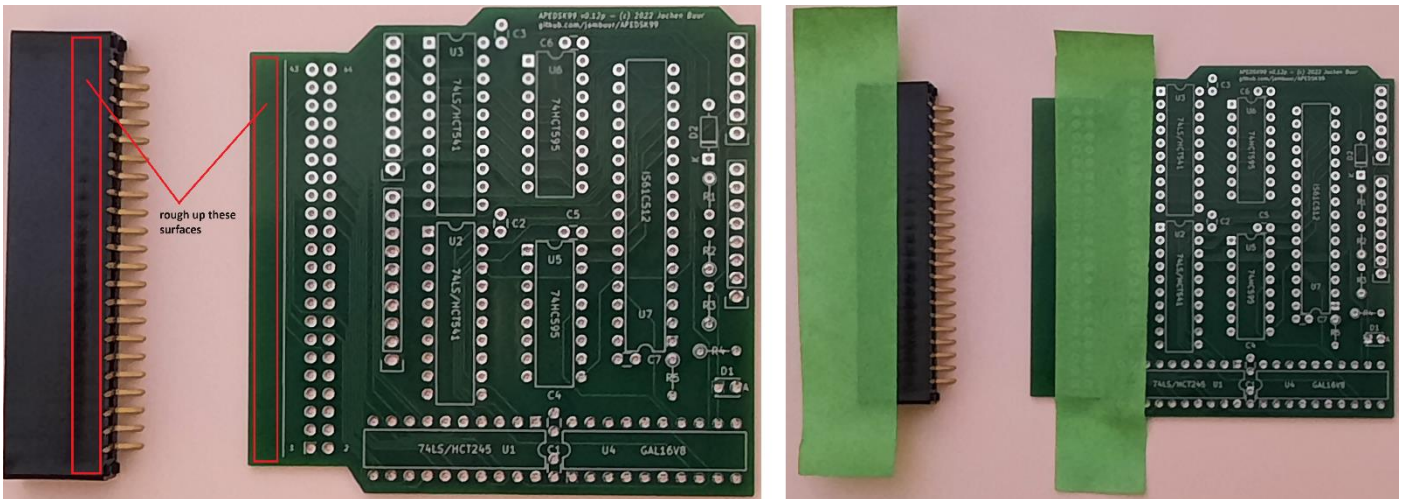
The bottom row of pins need to be bent 90 degrees downwards and the top row bent ~45 degrees upwards:



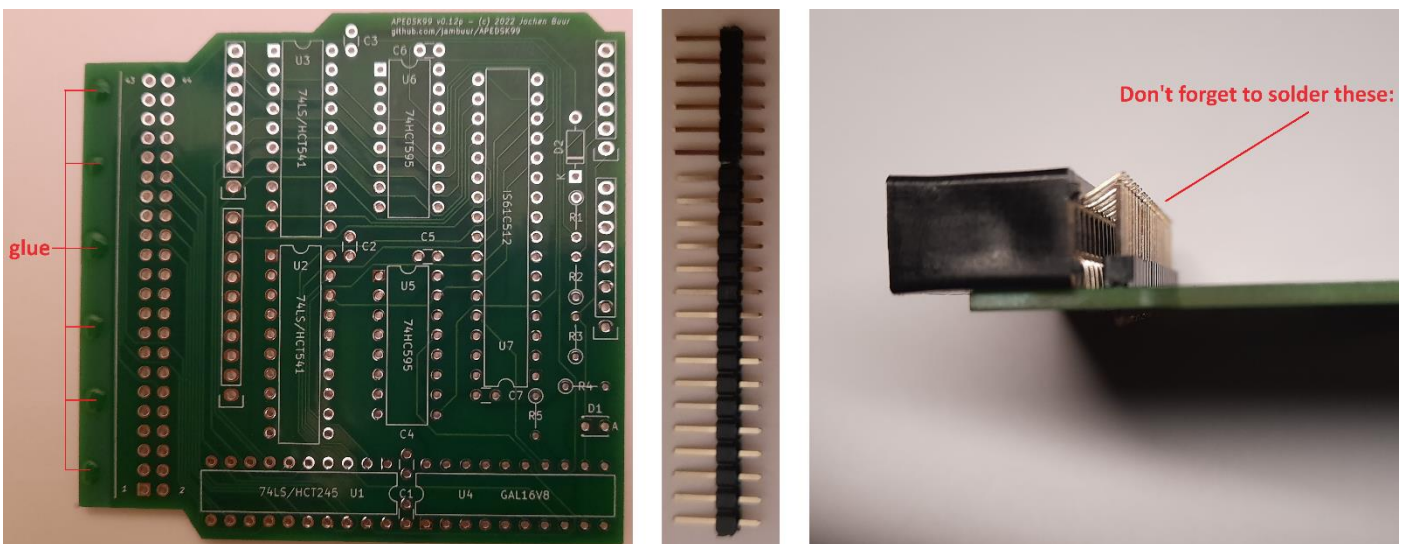
*modified vs unmodified*

I use the edge of my desk for bending but you could also use a steel ruler or needle nose pliers.

Next, rough up both the bottom side of the connector housing and the PCB area it will sit on with Scotchbrite, sandpaper etc. Painters tape is your friend here:



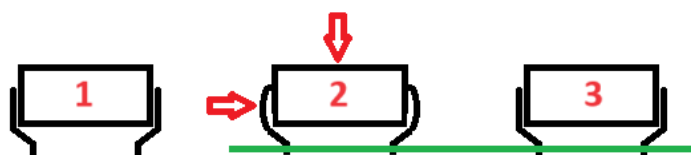
Clean the 2 surfaces and apply dots of superglue across the length of 1 area. Line up the bottom connector pins with the row of PCB holes marked 1-43 and press the connector firmly on the PCB, making sure all connector pins stick through to the soldering side. After clamping it for a bit to let the glue dry, the bottom row pins can now be soldered. The top row pins are soldered to the PCB via a suitable length of standard header:



## 2. Installing the RAM IC

The initial APEDSK99 version used a slim line 8Kx8 RAM and little did I know that the eventual 32Kx8 RAM would not be so slim line. I decided against a major PCB redesign so you have to make the RAM fit. This is not that difficult:

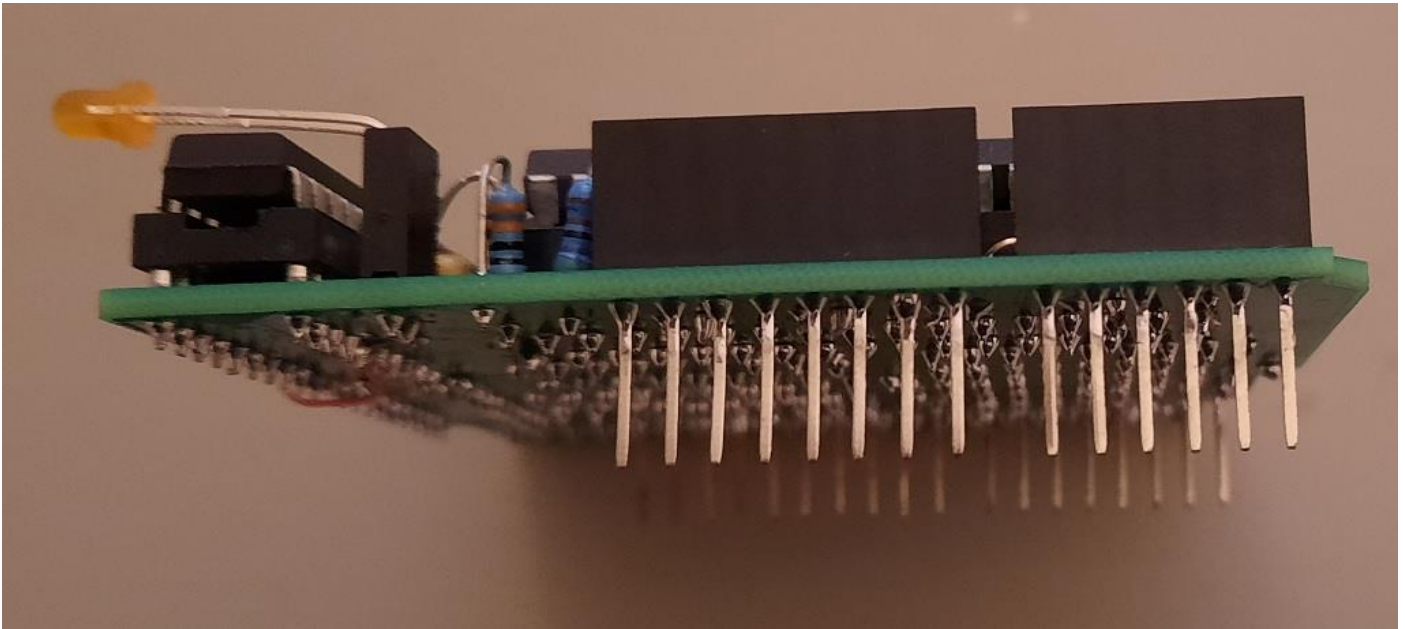
- (1) Bend the pins at sharp angle under the chip and then bend the very end of the pins back straight (needle nose pliers).
- (2) Without too much fiddling the IC will fit the PCB hole pattern. Notice that because you're pushing down on the IC, the pins will likely become bow-shaped. You could solder the IC like this and it will be perfectly fine.
- (3) However, you can get a bit more pin sticking through: if you push down on the IC while at the same time pushing against the bowed-out bit of a pin with a small screwdriver you will restore the (1) shape



Alternatively, you could apply the above procedure to an IC socket and then mount the RAM if you worried about damaging the RAM pins.

The Arduino shield sandwich is attached to the TI I/O port. I suggest you use some sort of padding between the Arduino UNO at the bottom and your desk to prevent the stack from flapping in the breeze. Although APEDSK99 works fine without it, I have designed a suitable case for it; see my GitHub page for pics and the 3D design files.

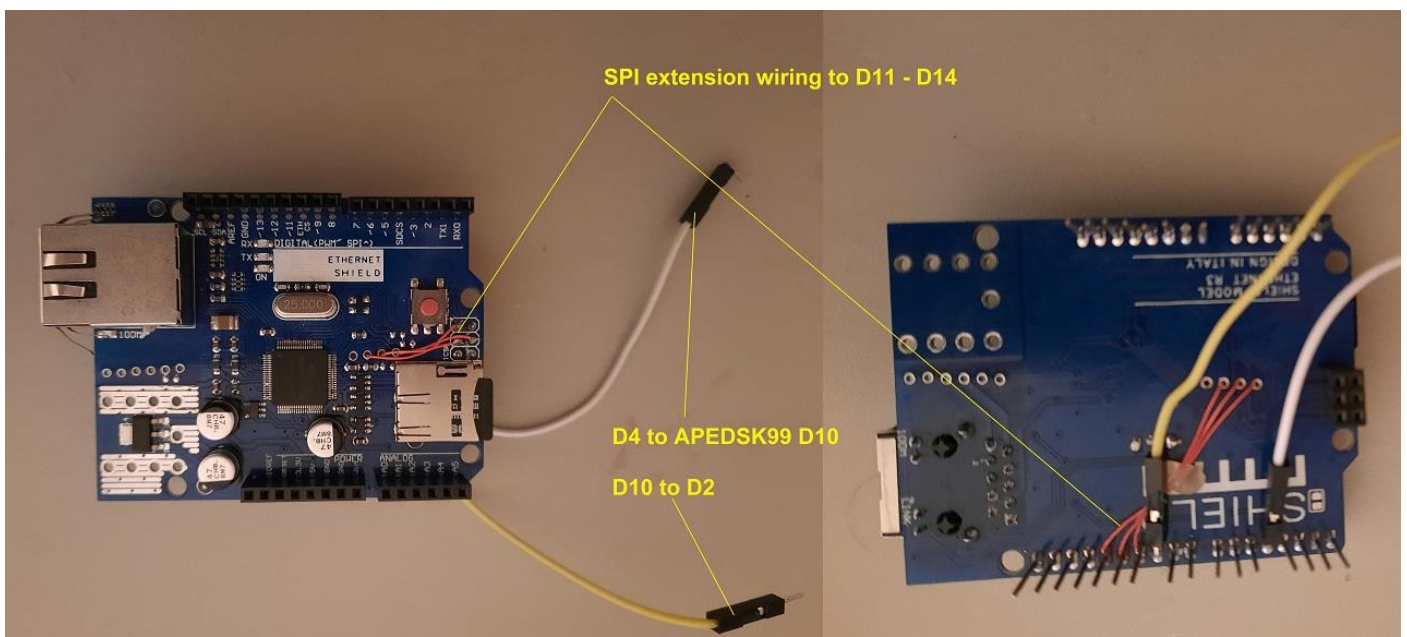
One other thing to note is that the Arduino stackable headers seem to come in a long and a short version (short version pictured):



The short version won't let the APEDSK99 shield fit properly on the Arduino UNO as it interferes with the USB type B and power adapter connectors. Make sure you either get the long header version or use an UNO with a micro-USB connector and de-solder its power adapter connector. Also note that the short version won't fit the current case design.

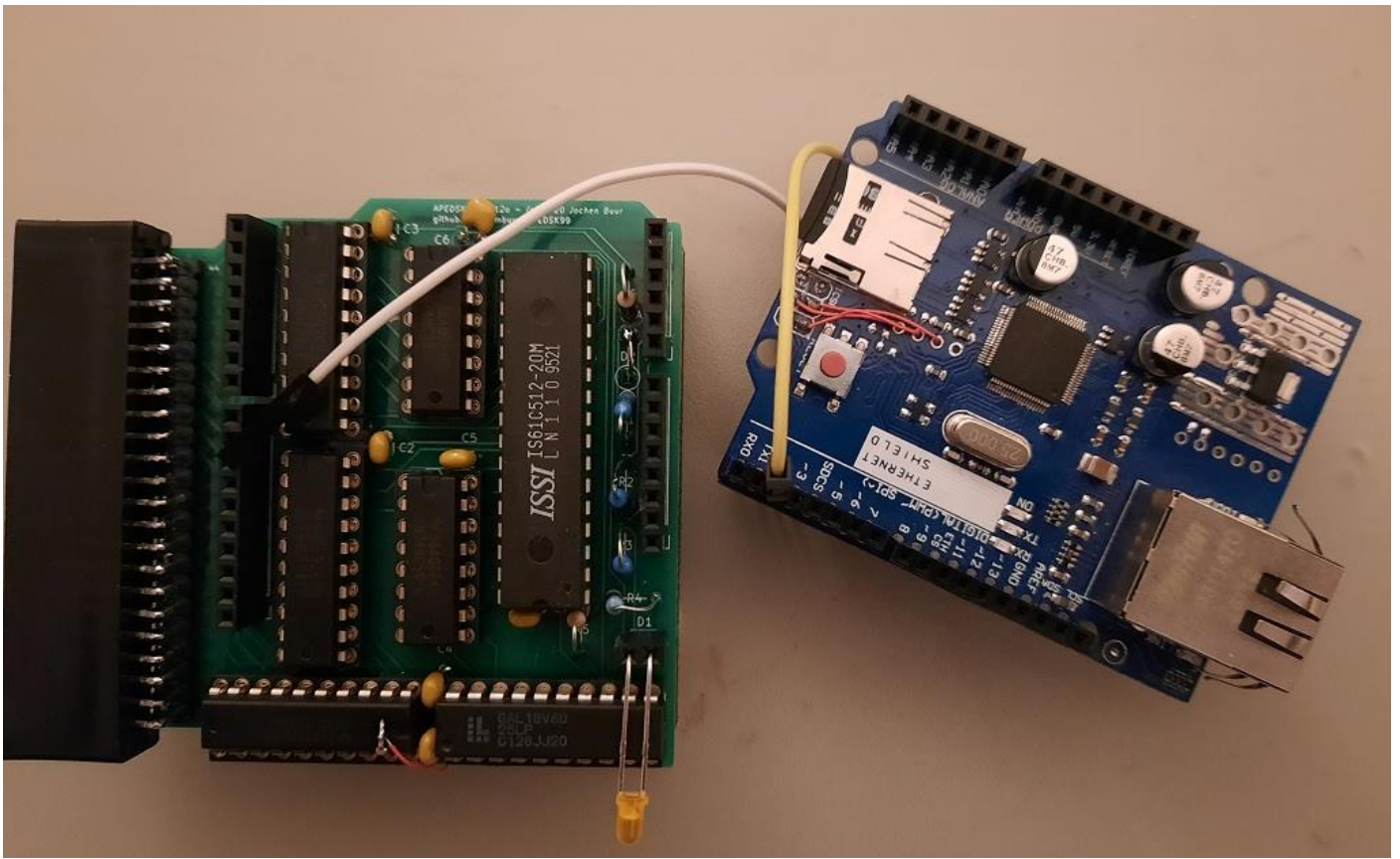
### 3. Ethernet / SD shield modifications

Depending on your Ethernet / SD shield version some minor surgery may be necessary. My version has SPI available through a separate 6 pin header only, not at the familiar D11-D14 (why? why?). If this is the case with your shield, you will need to extend the SPI signals to D11-D14 with wiring:





Most Ethernet / SD shields use D4 for the SD CS pin. This also happens to be APEDSK99 D3 (as in data bus, not in Arduino digital pin) and this combo function doesn't work. Bend D10 and D4 inwards and connect 2 jumper wires:



D10 to D2 (moves Ethernet CS to D2) and D4 to APEDSK99 D10 (moves SD CS to D10).

For my latest version I don't solder these bodge wires to the shield anymore but use a combination of standard Arduino jumper wires. An Italian user used those plastic cable wraps with an iron core to make it even easier; very smart.