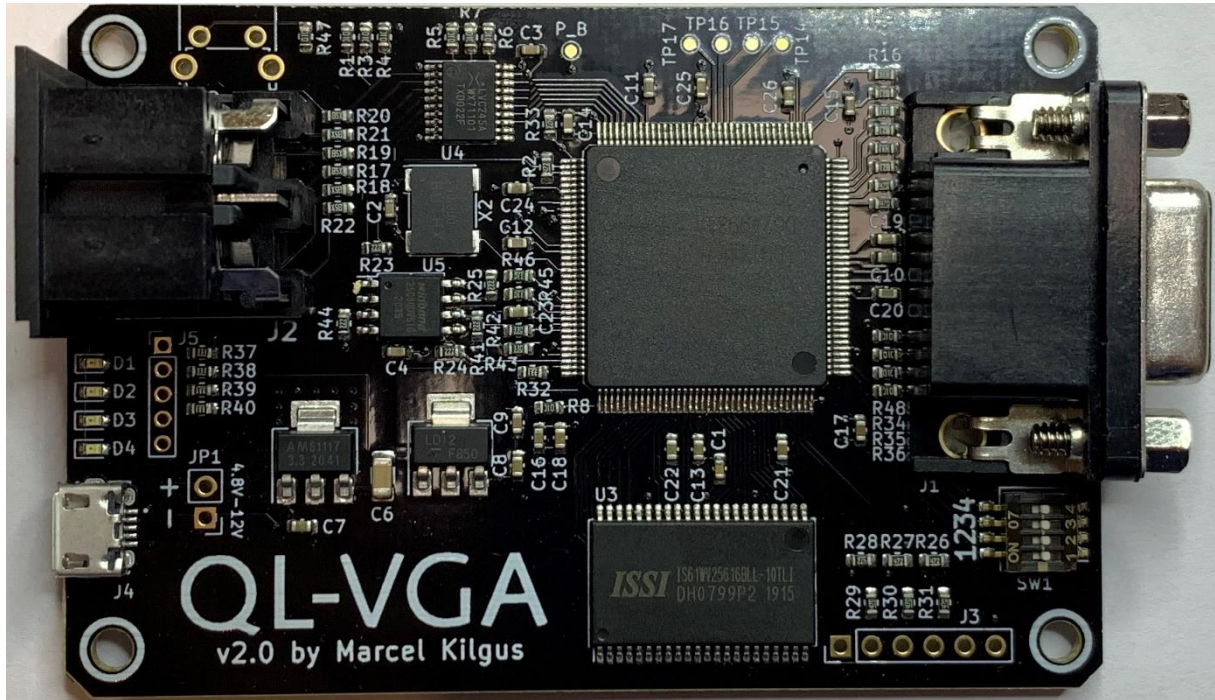# QL-VGA v2 manual

1   Description

QL-VGA is an FPGA based RGB to VGA converter specifically developed for the Sinclair QL. The input signal is buffered in a RAM chip and output as a standard VESA 1024x768 60Hz video signal. This format is so common that basically every monitor accepts it and it can be further converted to HDMI using any cheap converter (available for as little as 4€).

The QL's 512x256 50Hz signal is doubled in X direction and tripled in Y direction, giving an exact 1024x768 screen.

2   Quick start

Warning: do not connect QL-VGA to the QL while the QL is switched on. QL-VGA v2 includes current limiting resistors that may prevent the ULA from locking up, but the chip is still extremely allergic against hot-plugging and can die quickly.

The device is supposed to be "connect and work". Connect your QL (while powered down!) using the supplied RGB cable (straight 8-pin DIN to DIN) and your monitor using any suitable VGA cable. Connect the board to a Micro-USB power supply, amperage doesn't matter (QL-VGA only uses 100-200mA). Then power up the computer.

QL-VGA outputs a "screen saver" with the QL-VGA logo whenever it is working and no input signal has been detected. The logo should change position every few seconds.


During the first 5-10 seconds after powerup the FPGA core version is also shown in the lower right corner of the screen:

3   Bonus: ZX Spectrum modes

As a free bonus QL-VGA also has two Spectrum 128 ("Toastrack") modes: "normal" where the border colour is visible (X*3, Y*3) and "zoomed" where the screen contents takes over the whole screen (X*4, Y*4). Please note that unlike the QL mode the Spectrum mode is not very well tested and is strictly a bonus feature.

There are two variants of the Spectrum 128 +2 ("gray") named "Standard" and "Peritel". Only "standard" is compatible with QL-VGA (when R12, R13 and R14 are not fitted).
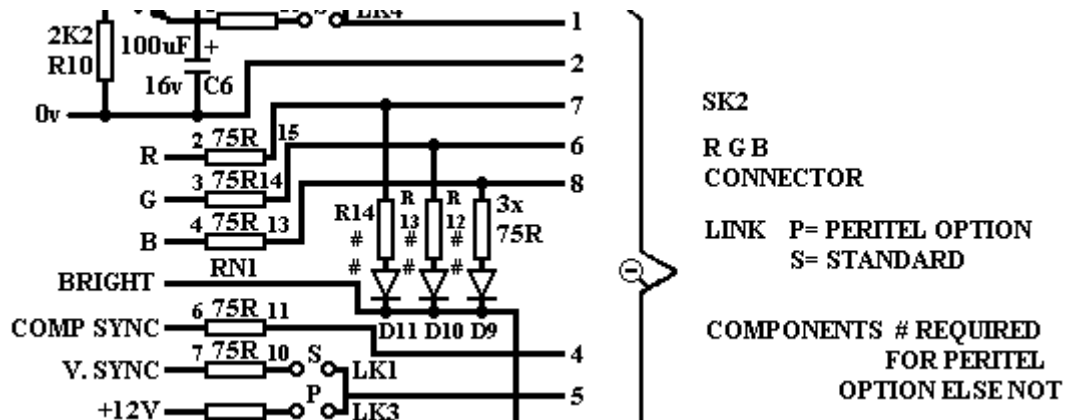
The +2A/+2B ("black") and +3 are not compatible.

4   Details

There are a few LEDs on the board that can be used for debugging:

LED	Meaning
D1	The board has power
D2/D3	D2 off, D3 off: Auto detect mode, waiting for valid signal
	D2 on, D3 off: QL mode
	D2 off, D3 on: Spectrum 128, normal mode
	D2 on, D3 on: Spectrum 128, zoomed mode
D4	This mirrors the CSYNC signal

By default, QL-VGA starts in "auto detection" mode and waits for a valid QL or Spectrum 128 signal. Once a signal is detected the mode is displayed using the LEDs. Auto detection works by checking if there is a colour in the border region, which is black on a QL and **usually** coloured on a ZX Spectrum. But if the ZX border is also black on startup (like when it boots with a DivMMC interface) it can wrongly be identified as a QL.

There is also a 4-way DIP switch which can be used to explicitly select a mode:
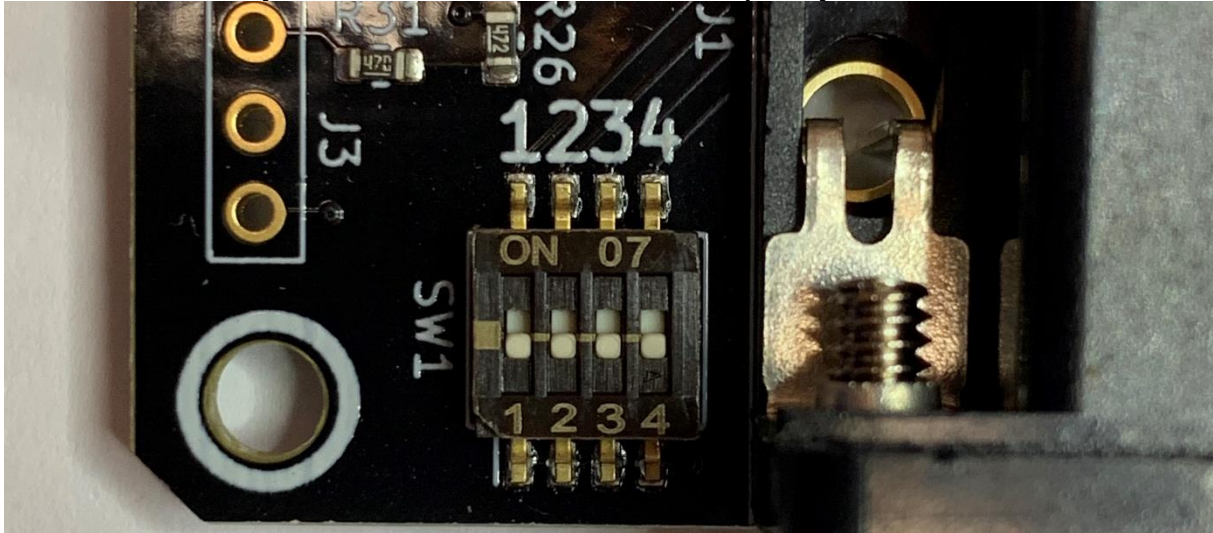
1	2	3	4	Meaning
0	0	0	0	Auto detection active (default)
1	0	0	0	Force QL mode
0	1	0	0	Force ZX Spectrum 128 mode ("normal")
1	1	0	0	Force ZX Spectrum 128 mode ("zoomed")

Switch 3 and 4 are currently not used and should be left at "off".

5   Troubleshooting

5.1   The monitor does not show anything

Check the power LED D1. If that is dark check the USB cable and power supply. If it's on, check your VGA cable and monitor input selection.

5.2   The monitor only outputs the QL-VGA logo

Check LED D4. If it's off, then no CSYNC signal is detected. In this case check the RGB cable. If the cable is okay there might be a problem with your computer. If you can, check using a different connection like SCART.

5.3   A few lines/columns are missing

The VGA signal is analog and subject to interpretation of the monitor. QL-VGA outputs a 100% VESA compatible VGA picture which should be pre-set in pretty much every monitor in existence. But if not try adjusting the picture in the monitor settings. QL-VGA's picture is always complete!

5.4   The colours are weird

Switch off the computer and check if the QL-VGA logo is white. If not, your VGA cable is probably the problem.