

## QL-SD

Native QL hardware users have a storage problem. Floppy disks have become obsolete, and USB memory sticks and memory cards have taken their place.

There have been several successful attempts to use memory cards on a QL. At the 2011 Quanta AGM Rich Mellor used one attached to a Trump Card via a floppy disk emulator, and in the same year Adrian Ives of Memory Lane Computing had produced a QL SER - USB interface.

However most of the interest in 2011 centred around proposals of Peter Graf for a SD/MMC card hard disk for the QL. Peter made 4 suggestions how this could be done:

- 1: *External interface using the Super Gold Card parallel port.*
- 2: *External interface using the ROM port.*
- 3: *Internal interface plugging into the CPU socket.*
4. *Internal interface in the microdrive socket.*

The general consensus was in favour of the fourth option followed up by the second. Peter later released details of the design:

*"The QL SD hardware system has two parts:*

*1) A board which plugs into an internal QL ROM socket. It has a Minerva style EPROM socket on top, EPROMs with QL operating system plus QL-SD driver could be used here*

*2) A board which is mounted behind a microdrive slot inside the original QL case. After the microdrive has been removed (which is quite simple) the new SDHC-card drive can be mounted with two screws. SDHC cards can be inserted just like microdrives . The drive LED for the SDHC card is separate from the original microdrive LED so no internal wiring must be changed. It is visible beside the card socket.*

*Both parts are connected by a simple ribbon cable."*

Pressure of work limited the time Peter Graf had to complete the project and he passed on development to Memory Lane Computing. Adrian Ives reported:

*"The hardware is working on black box QLs but there are still some issues to be overcome relating to noise pickup. This is especially problematic if the SD card holder is mounted in a vacated microdrive slot. Peter has already redesigned the PCB to get around this problem. There are problems with the Super Gold Card that have not yet been resolved. The Gold Card has not been tested at all because I don't have one.*

*The software is written. There are two drivers available.*

*1) QL-SD a driver written in C derived from Dirk Steinkopf's QL-HD driver At present this is too big to fit into a 16K EPROM and needs further optimisation.*

*2) An EDDE 2 driver that is both compatible with the Ser-USB and USBWiz over Q-BUS and is able to mount FAT32 volumes holding file system images, This is ROM-able and supports booting from an SD Card. AII v 2.x Ser-USB/Q-BUS utilities (Partition Manager etc) work with this and the partition formats are identical.*

*3) An EDDE 2 Block Device Interface driver for Q-emulator's emulated hardware interface. This allows file system images to be accessed on the PC and read/written by*

*QL software running under Q-emuLator."*

Adrian Ives demonstrated a prototype at the 2012 Quanta AGM Workshop. He reported continuing problems with noise in the microdrive slot that he thought was caused by the proximity of the video circuitry. There were also problems with the Super Gold Card. He was however unable to reproduce the problems at the show using a borrowed Gold Card.

Later in 2012 Adrian Ives had to halt work on the QL-SD after making a decision to leave the QL market. The small size of the market meant that he was unable to make bulk purchases of the necessary parts and these would mean the price of any card would be too high to guarantee large sales.

In Autumn 2013 Peter Graf announced that he had continued development of the QL-SD and that it was near completion. However there were still some problems with the Super Gold Card:

*"Sometimes the ROMOE signal massively exceeds the maximum TTL low voltage of 0.8V while in logic low state. This happens for about tens of nanoseconds.*

*The 30 year old circuitry of the QL was too slow to see this, so the fault did not have immediate effects. But the QL-SD had to use a contemporary PLD, with over 300 MHz maximum operating frequency, which considers it a valid ROMOE signal and can malfunction. (Other signals than ROMOE may also be affected.)*

*I have also measured with a Gold Card, where a similar effect can be seen, but it exceeds the maximum TTL low voltage by a smaller amount."*

Peter concluded there was no easy way to make the QL-SD work reliably with a Super Gold Card. Although in practice it appears to work with the Gold Card in theory it is not safe.

At the beginning of December 2013 Peter announced further progress:

*"The restriction that a QL memory expansion is mandatory for QL-SD has been removed.*

*If a QL-SD file system of 3 MB size (and Group size 8) is attached, there still remains 62.5 KB free memory on an unexpanded QL. Not very much, but enough to load TK2 and still be able do useful things.*

*This way, even an unexpanded QL has more mass storage than the ED floppy interface of a (Super) Gold Card offers, and that at harddisk speed without moving mechanical parts."*