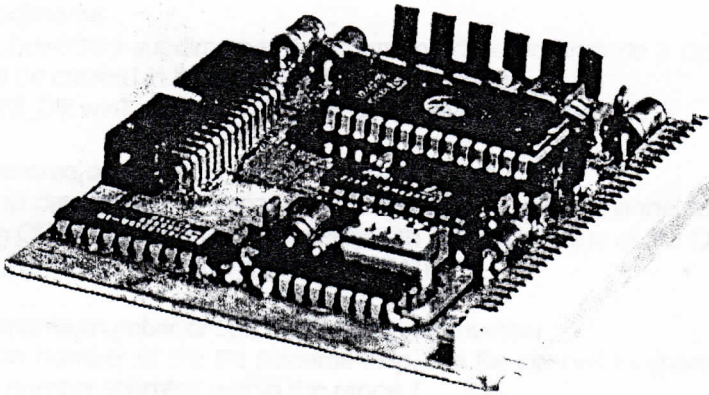


Handwritten notes in the top left corner:
2.4.91
L. Falkenberg
(Autobroadband)
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QL-WIN-Card



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INTRODUCTION

The JFC QL-WIN-Card is a powerful and versatile interface for the SINCLAIR QL expansion port for connection of a harddisk of ST506 standard (MFM or RLL) together with an additional PC harddisk controller.

The QL-WIN-Card is fully compatible to its predecessor the QL-HDD-Card. The improvements of the WIN-Card are its much smaller dimensions and a more versatile connection of the controller with a special flex cable now.

The device driver for the new directory device win1_ is included in the on-board eprom and supports winchesters of any size.

MFM-Harddisks

For the set-up of a MFM-winchester one of the following MFM-controllers is needed:

OMTI: 5520A, 5520B

Western Digital: WD-1002A-WX1

DataTech: MFM-Controller

RLL-Harddisks

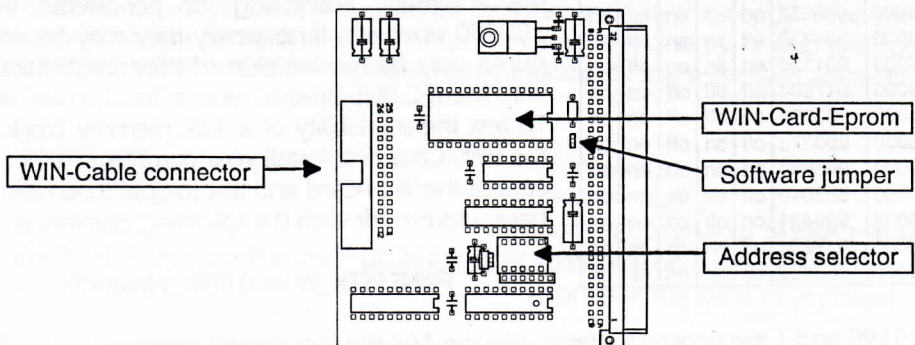
RLL-winchesters may be connected with one of the following RLL-controllers:

OMTI: 5527A, 5527B

Western Digital: WD-1002-27X, WD-1002A-27X

PCB-Layout

The draft below shows the board layout and the position of eprom, connector, software jumper and the address selector:



INSTALLATION

The QL-WIN-Card has been developed according to the Sinclair standard for expansion boards. However like all other JFC peripherals it does not support the mechanical and electrical critical through-porting of the QL-Bus with automatic addressing of following boards. For a reliable expanded system with several add-on cards we recommend the use of a bus expander or bus driver with several card sockets.

In principle the WIN-Card may be plugged directly into the QL system bus, the through-ported bus of a QL card, any socket of the JFC QL-BUS-Expander, any socket of the JFC QL-BUS-Driver or any other (reliable) QL bus-expander or -driver.

Addressing

The base address of the WIN-Card may be selected like with all other JFC peripherals individual, clear and versatile with switches. It uses 16K memory range and may be put to one of the 17 expansion 16K-slots and three additional 16K blocks which are not supported by QDOS but usually also available for expansions. The desired base address will be set up with one of the below listed valid switch combinations:

base address		switch				
hex	dec	1	2	3	4	5
C000	49152	on	on	off	off	off
10000	65536	off	off	on	off	off
14000	81920	on	off	on	off	off
1C000	114688	on	on	on	off	off
C0000	786432	off	off	off	off	on
C4000	802816	on	off	off	off	on
C8000	819200	off	on	off	off	on
CC000	835584	on	on	off	off	on
D0000	851968	off	off	on	off	on
D4000	868352	on	on	on	off	on
D8000	884736	off	on	on	off	on
DC000	901129	on	on	on	off	on
E0000	917504	off	off	off	on	on
E4000	933888	on	off	off	on	on
E8000	950272	off	on	off	on	on
EC000	966656	on	on	off	on	on
F0000	983040	off	off	on	on	on
F4000	999424	on	off	on	on	on
F8000	1015808	off	on	on	on	on
FC000	1032192	on	on	on	on	on

Using the WIN-Card with other QL peripherals you have to ensure that an expansion slot is not used twice. 512K RAM expansions are addressed in the memory from \$40000 up to \$BFFFF and never will give problems. By their clear addressing with switches there also should be no problem to avoid twice memory occupation with other JFC cards. Peripherals of other manufacturers usually are adjusted to fix addresses (eprom boards) or will use the automatic addressing for peripherals from \$C0000 upwards. If necessary they may be configured only by modification of their electronics or with the JFC BUS-Driver.

To test the availability of a 16K memory block for the WIN-Card, first install your complete system except of the WIN-Card and test the planned decimal base address adr with the following command:

```
PRINT PEEK_W (adr),PEEK_W(adr+2).
```

If 19195 and 1 are printed to the screen the 16K slot is occupied already.



Addressing notes

If a JFC QL-ROM-Card is installed for expansion of the basical operating system ROM memory (\$00000 to \$17FFF, ROM-Card page 1) \$C000, \$10000 and \$14000 are not available for the WIN-Card of course.

The Miracle TrumpCard occupies the slots \$10000, \$14000 and \$1C000 in any case. If it is supplied with 768K RAM also the slots from \$C0000 upwards are not available and the WIN-Card only may be addressed to the ROM-Port (\$C000).

With a Miracle GOLD-Card installed only the ROM-Port is available for peripherals (\$C000). By its special design the GOLD-Card will not work with the QL-BUS-Driver and both cards only may be installed using the QL-BUS-Expander.

Please note, that for older GOLD-Cards with yellow pcb the WIN-Card has to be addressed to \$CC000 due to a fault in the layout of these GOLD-Cards.

The Miracle Super-GOLD-Card supplies the slots from \$C0000 again so these "standard" expansion addresses may be used also beside the ROM-port (\$C000).

The addresses \$10000, \$14000 and \$1C000 have been reserved by Sinclair for special applications but never used. QDOS does not check there for expansions and the driver eeprom will not be recognised. If you want to use this (with exception of the TrumpCard) unused memory, the winchester driver has to be linked in after the boot phase with the command CALL address+48 with address replaced by the according decimal base address (65536, 81920 or 114688). If you are familiar with assembler and QDOS, you easily may add a check for ROM-software at these addresses to the operating system with an additional eeprom (ROM-Port or QL-ROM-Card) or by modifying the internal ROM.

Older versions of QDOS (up to JM) only check the ROM-Port (\$C000) and the first upper ROM slot (\$C0000) for expansions. With these ROM versions the linkage by additionally calling is necessary also for the expansion slots from \$C4000 upwards.

Initialisation

During its initialisation after power-up or a reset the driver gives a ROM message with copyright hint and driver version number:

JFC WIN-Card V 3.xx © JFC/JS

and tries to read track 0 of the harddisk. If a correctly formatted winchester is found, the ROM string will be extended with the size xx MB of the harddisk found. The output of the size 0 MB will indicate a not formatted harddisk found.

If, little useful, no controller or no harddisk are installed the driver will hang up itself. No size message will be printed and the QL does not continue booting.

Connection of the controller card and harddisk

For the winchester application one of the PC harddisk controllers listed on page 3 has to be connected to the WIN-Card using the special WIN-Card-cable. Please make sure that the component side of the controller looks directly to the flex cable side of the WIN-Card-cable connector. According to the geometric layout of your QL-system the controller then may be screwed on the top of the WIN-Card or positioned seperately near the winchester itself.

Any jumpers installed on the controller card may be removed completely. Only the jumper W4 and W8 have to be set to 2-3 on the Western Digital controllers.

The harddisk will be connected with two flex-cables to the 20 pin and 34 pin connectors positioned side by side on the controller card. The flex-cables usually are shipped with the harddisk but they also may be supplied from your dealer or JFC. Take care that the pins 1 on the harddisk are connected to the pins 1 on the controller.

Place the flex-cables far away of parts of the power-supply and ensure that the winchester is jumpered to drive 1 (see its datasheet).

The perhaps available second 20 pin connector on the controller may be used in future versions of the WIN-Card driver for a second harddisk which has to be jumpered to drive 2 and connected with the 34 pin cable parallely.

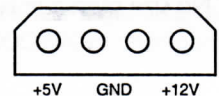
Power-supply and case

By the various expansions of different OLs and requirements of the users the JFC harddisk system with the OL WIN-Card has been developed as an "open solution", without winchester of fixed size, power-supply and case. So OL-users familiar with electronics or those with a QL-2000 kit will be able to install a harddisk much less expensive than a ready-to-use winchester set. Of course we also may supply a harddisk kit completely assembled as a seperate unit.

The winchester controller inserted in the WIN-Card will be powered from the OL. If you are still using the original OL power-supply you have to ensure that it will not become overloaded, especially if further peripherals are connected to the OL. A hot power-supply or dark horizontal lines moving vertically over the screen will indicate an overload and the power-supply has to be replaced by a more powerful one.

In any case a seperate power-supply with +5V and +12V and sufficient power is required for the harddisk. Specialists in electronics may interrupt the power-supply of the WIN-Card from the OL and instead supply it and the controller externally from the winchester power-supply. If the OL has been installed in a PC case with integrated power-supply this may be used for the winchester supply and the drive easily may be assembled in the PC case like the floppies. Else you will need an additional metal case with sufficient room for installation of the winchester and its power-supply.

Harddisks use the same power-supply connector like 5.25" floppies with the identical pin layout, like shown in the grafic right in direct view onto the connector of the winchester:





THE WINCHESTER-DRIVER

The on-board eprom of the QL-WIN-Card adds the new directory device win1_ to ODOS. The winchester may be used like any other OL directory device (floppy, micro-drive, RAM-disk, MOS-disk) for saving, loading, copying etc. of files. Besides the much higher capacity compared to floppies the winchester allows a much quicker access to your files with up to 500 KB/s data transfer on a QL with GOLD-Card.

The driver supports winchesters of any size. It is full compatible to the new filing-system level-2 standard and supports real subdirectories and the additional file attributes like the level-2 floppy drivers of GOLD-Card, JFC FLP-Card and TrumpCard/QBoard with JFC level-2 replacement eprom.

Formatting the harddisk

Before using the newly installed winchester you first have to format it like a new floppy disk or microcartridge. To prevent you from formatting the harddisk by accident you first have to prepare the format by defying the physical harddisk parameters with the WIN_FORMAT command:

WIN_FORMAT int,cls,spt,hds,cyl,psc,rsc

- int The interleave factor (sector screwing) is important for the speed of the harddisk. Usually 2 will give best results. Some combinations with GOLD-Card may work more quickly with int=1; slowly internal RAM expansions may require 3. Test for yourself!
- cls cluster size in sectors (512 bytes each). A cluster is the smallest amount of memory which a file will need independant of its true size. Since a copy of all clusters (the FAT) is always stored in the RAM, large clusters will save RAM but files will waste more harddisk memory. Below 40MB 4 should be used for the cluster size, above 8 will be a good value. Please note that ODOS only may handle up to 65536 clusters.
- spt the number of sectors per track, 17 with MFM-, 26 with RLL-harddisks/controllers.
- hds the number of heads, see datasheet of the harddisk.
- cyls the number of cylinders, see datasheet.
- psc the precompensation start cylinder, see datasheet. In case of doubt set psc=0.
- rsc reduced write-currency start cylinder, see datasheet. In case of doubt set rsc=0.

Example for a Miniscribe 8438 RLL -harddisk: WIN_FORMAT 2,4,26,4,612,128,0

The logical and physical (low-level) formatting then may be started like used from floppies with FORMAT win1_[name] with the optional mediumname name if required. The format will take about one minute per 150 tracks and 4 heads and all data stored on the harddisk will be deleted.

After formatting the usual output xxx/yyy sectors will show you the number of good/over all clusters available on the winchester.

Now the harddisk may be used like a formatted disk.

The directory of the harddisk

Standard QDOS is capable of displaying up to 32767 sectors (=16MB) only. Harddisks however usually have a much higher number of sectors and the winchester driver instead displays the number of free/good clusters with the medium size output `xxx/yyy` sectors of a directory.

If the filing-system 2 extensions are loaded however (see below) the above mentioned lack of QDOS is corrected and the directory output `xxx/yyy` sectors then indeed displays the number of free/good sectors like used from floppies or microdrives.

Filing-System level-2 extensions

Besides the above noted lack in the sector number management standard QDOS also does not support subdirectories. This also is improved with the extensions of the filing-system 2 which may be added to the winchester device driver from the WIN-Card eprom, including new commands for subdirectory creation and support of the additional file attributes. To make them available and install automatically at system boot, the software jumper shown in the PCB-layout figure on page 3 should be inserted. Please note that the winchester extensions have to be linked in *after* the TK2 for full efficiency. If the WIN-Card ROM message appears before your TK2-ROM message or the TK2 has to be linked in explicitly with `TK2_EXT`, you have to re-install the winchester extensions with the `WIN_EXT` command after installing TK2.

If you have a GOLD-Card or a TrumpCard V1.31 or higher (or TrumpCard/QBoard with level-2 upgrade eprom), its software already includes the filing-system 2 extensions and the jumper may be removed.

Subdirectories

Due to the high capacity of a harddisk with hundreds of files stored on it a filing-system with subdirectories is required for efficiency. In QDOS terms, this means making the names longer by adding a pathname in front of them. Put 'letter_' at the beginning of all the files which are letters, 'acct_' at the beginning of all the files which are accounts etc. Subdirectories may include further subdirectories. The only restriction is not to exceed a length of 36 characters for the complete file- and pathname. So pathnames should be short and/or directory levels not too deep tree-structured.

If the level-2 extensions are available, the new command `MAKE_DIR` will create a new subdirectory. Already existing files with the same pathname automatically will be moved in newly created subdirs. At a `DIR` command you will see only the subdirs highlighted with `"->"` added to their name and files of the actual level. Files (and subdirs) stored within a subdirectory level will become visible only by switching in the subdirectory level or by input of the complete pathname, `DIR win1_letters_` e.g.

The access to a single file may be done little comfortable by input of the complete medium-, path- and filename or by use of the TK2-default-device management with `PROG_USE`, `DATA_USE`, `DEST_USE` and the commands `DUP` and `DDOWN` to change the directory level (see TK2 manual).

A subdirectory may be erased with `DELETE win1_subdir` if no file is stored in it.



Auto-Boot

If a correctly formatted harddisk is found in the boot phase the driver will look for the file "win1_boot" and run it after pressing the <F1> / <F2>-key like used from floppy or microdrive.

The basical mechanism for this auto-boot is included in the QL-internal ROM: QDOS first tries to load a BASIC program from a device "boot". If this fails the operating system will try to load the file "boot" from the device "mdv1_".

The floppy drivers for the QL use this auto-boot routine like described following: During initialisation the driver checks if a disk is inserted in the floppy drive. If a disk is found the driver links the floppy with the medium name "mdv" (!) into QDOS instead of "flp" and reminds to rename itself after the first access. During the boot phase QDOS will look first for (the usually not existing) device "boot" and if not found for "mdv1_boot" which will access the floppy and allow the driver to rename itself to "flp". The user does not remark this procedure.

This method becomes critical and little comfortable if further auto-bootable directory devices are installed in the system. That's why the harddisk (as well as the floppy driver of the JFC FLP-Card and the MOS-Driver of the JFC ROM-Card) select another method: Beneath the device "win1_" the harddisk driver also adds the device "boot" to QDOS, a short basic program which tries to run "win1_boot". So there will be no name conflicts. If several devices "boot" have been linked in from different expansions QDOS will find only the last expansion linked in with the highest base address. By an according set-up of the addresses of several peripherals you may select your preferred boot-device.

Due to the higher "boot priority" of the boot device, the winchester will prevent booting from "mdv1_boot" and so a standard floppy driver from renaming itself to "flp" if it has been linked in as "mdv" due to an inserted disk. By this you should save a boot file on the harddisk which at least includes the command FLP_USE flp.

Much better, the boot program of the winchester additionally can check with the TK2-function FTEST(\flp1_boot) if a disk has been inserted in the floppy drive (which now has its correct name due to the FLP_USE in any case) and try to load and run its boot program. This would be the most elegant method for a redirected autostart. So you "win1_boot" should look like this:

```

100 TK2_EXT                               (if required)
110 FLP_USE flp                            (rename floppy)
-                                          (further commands always required)
200 IF FTEST(\flp1_boot)=0 THEN LRUN flp1_boot (continue on floppy, if found)
-                                          (continue standard boot phase)

```

If the boot program of the winchester includes an dramatic error which will hang or crash the system, it may be stopped easily by repeatedly pressing <Ctrl> & <Space> to stop it prior to execution of the first line.

New Basic commands of the driver

The winchester driver adds six new commands to SuperBasic to control the hardware:

WIN_FLUSH

For an optimised quickly harddisk handling the winchester driver makes full use of the QL slave block mechanism. WIN_FLUSH will write all slave blocks still not written and the controller buffer immediately to disk. This command should be used always in advance of starting "dangerous" programs or before you switch-off the system.

WIN_FORMAT int,cls,spt,hds,cyl,psc,rsc

suspends the format protection and defines the physical winchester parameters (see "Formatting the harddisk", page 7).

WIN_PARK [time]

defines the delay in seconds, before the winchester will be parked automatically if it has not been accessed. Parking moves the heads to the innermost (unused) cylinder to prevent the harddisk from damage of the magnetic surface. In daily use this is recommended only for older drives, but always before a transport of the winchester.

For time=0 the automatic parking will be switched off completely; giving no time parameter will park the harddisk heads immediately. In advance of the parking a WIN_FLUSH will be executed also. Preset is time=300.

WIN_SEC level

allows definition of the harddisk security level to 0 or 1. With level=1 selected an explicit WIN_FLUSH will be executed after each close operation. Preset is level=1.

WIN_STEP time

defines the length of the stepping pulse for the harddisk according to the time given in the right hand table.

The preset time=1 should be best in most cases. Testing other values (especially for older drives) may help to cover problems or reduce the winchester stepping noise.

time	OMTI	WD
0	3 ms	3.3 ms
1	10 µs	24 µs
2	25 µs	24 µs
3	50 µs	11 µs
4	200 µs	24 µs
5	70 µs	24 µs
6	3 ms	24 µs
7	3 ms / 10 µs	11 µs

WIN_USE new

renames the winchester to the new medium name new. Any following access to new now will use the harddisk.

This command is helpful for the execution of programs predefined to other devices ("flp" e.g.) to use the winchester without the need to newly configurate them. So the harddisk medium name "win" may be replaced by any three letters or the name of an already existing medium. If an already existing medium is used, this should be renamed also in advance.



Commands and functions of the filing-system 2 winchester extensions

The winchester extensions include identical basic extensions for subdirectory and file-attribute management like the TK2.2x of the above mentioned QL peripherals. If an older TK2 will be installed after the winchester extensions (if you have to enter TK2_EXT or the TK2 ROM message follows the WIN-Card message) the winchester extensions have to be re-installed with WIN_EXT.

WIN_EXT

re-installs the winchester extensions newly if they have been overwritten by TK2.

MAKE_DIR subdirname

creates the subdirectory subdirname. If subdirname does not include a device name the subdir will be created in the actual default data device.

Example: MAKE_DIR win1_quill or DATA_USE win1_ : MAKE_DIR quill

SET_FBKDT \filename,datval or SET_FBKDT #channel,datval

sets the backup date of the file filename resp. the file opened to channel to the given date datval (in QL-DATE format), in the example to the actual value of the QL clock.

Example: SET_FBKDT \win1_basicprg_prog_bas,DATE

SET_FVERS \filename,vnumber or SET_FVERS #channel,vnumber

sets the version number of the file filename resp. the file opened to channel to the given version number vnumber within the range 1 ... 255.

Example: OPEN #3,win1_basicprg_prog_bas : SET_FVERS #3,15

val=FMAKE_DIR(filename)

creates the new subdirectory subdirname and returns the QDOS error code of the operation to val to avoid a program break if an error occurs.

Example: PRINT FMAKE_DIR(win1_quill)

val=FBKDT(filename) or val=FBKDT(#channel)

returns the backup date of the file filename resp. the file opened to channel in the QL-DATE format. With DATE\$(val) it may be converted into a date string.

Example: date=FBKDT(win1_basicprg_prog_bas)

val=FVERS(filename) or val=FVERS(#channel)

returns the version number of the file filename resp. the file opened to channel.

Example: OPEN #3,win1_basicprg_prog_bas : PRINT FVERS(#3)

Direct sector access and drive parameters

If you are sure that no files are open on the harddisk the drive sectors may be accessed directly like used from floppies:

```
OPEN #3,"win1_*D2D" : GET #3\sectornr,a$: CLOSE #3
```

with $\text{sectornr} = \text{sector} + \text{sectorspertrack} * (\text{head} + \text{numberofheads} * \text{cylinder})$

Sectors, heads and cylinders are counted up from 0, always 512 bytes are returned.

The physical drive parameters are stored in the first sector of the harddisk and read in newly after each system start:

Offset	type	description
\$00	long	identification "QLWA"
\$04	string	mediumname (up to 20 characters)
\$1A	3 words	000000
\$20	word	interleave factor
\$22	word	cluster size
\$24	word	number of sectors/track
\$26	word	number of heads
\$28	word	number of tracks
\$2A	word	number of clusters
\$2C	word	number of free clusters
\$2E	word	max. number of sectors/directory
\$30	word	number of directories
\$32	word	first free cluster
\$34	word	file-ID of the highest directory
\$36	long	length of the highest directory
\$3A	word	first cylinder of the logical drive
\$3C	word	reduced write-currency start cylinder
\$3E	word	precompensation start cylinder
\$40...	words	FAT

Each file has a signless word at \$3A in the file header pointing to the first cluster of the file. The second cluster is stored in the FAT at the position of the first one, the last cluster always points to 0.

The free clusters are managed in the same way in a concatenation list.

The FAT is stored completely in the RAM memory and will be updated frequently on the winchester, at the latest after a WIN_FLUSH.