**QSOUND / QPRINT**

This upgrade adds to the good characteristics of the QL a 'real' sound generation facility and a parallel printer interface .

Fitting the board

Ensure that the QL is disconnected from the mains. If you do not you may damage the QL, the QSOUND/QPRINT board or both. Remove the rectangular plastic cover on the left hand side of your QL which covers the expansion bus slot. This may require some effort.

Now push the QSOUND/QPRINT board firmly in the expansion slot. This may take also a little effort. You should be able to feel when the board is firmly in place.

To test your new upgrade connect the QL to the mains. After the usual memory test screen, the TV / Monitor selection screen will appear with an additional copyright message from the QSOUND/QPRINT board. If you have connected an amplifier you should hear a short sound like a bell: QSOUND/QPRINT tells you that It is OK! After pressing F1 (or F2) you can use the full power of your QSOUND/QPRINT expansion.

To connect an amplifier to the QSOUND/QPRINT card, there is a 3.5 mm cinch socket on the left hand side of the card. You will also find a centronics compatible printer inter face there.

**Obligatory notice**

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ABACUS, ARCHIVE, EASEL and QUILL are trade marks of Psion Ltd.

**PARALLEL INTERFACE**

Use

After powering up and initialisation you can use a new QL device named PAR.

You can connect a centronics compatible printer to the parallel interface and use it via the device name PAR. A procedure to list the actual SuperBASIC program to a printer connected to the PAR port could look like this:

30000 DEFine PROCedure llist

30001 OPEN #3,PAR : LIST #3 CLOSE #3

30002 END DEFine

Buffers

You can use a part of the QL’s RAM as a buffer for efficient print spooling. Its size in blocks of 512 bytes must be specified in the OPEN command as in the following examples:

 OPEN #3, PAR\_1 512 byte buffer

 OPEN #3, PAR\_32 16 kbyte buffer

The maximum buffer size is 63 kbytes .

Options

Two options are accepted as part of the device name.

PARC\_<bfsize> The ‘C’ flag is used if the <LF> character (chr$(10)) should be converted to a <CR> character (CHR$(13))

PARF\_<bfsize> The ‘F’ flag is used if a <FF> character should be sent when the channel is closed.

PARCF\_<bfsize> Combination of the two flags is allowed.

SER emulation

Using the new PAR\_USE command you can get the benefits of your new parallel interface without changing existing programs . This command accepts a three character device name (with or without string quotes) as a parameter .

PAR\_USE SER will emulate the SER ports of the QL. All output sent to the serial port will be send to the new PAR device.

Psion software

If you want to use the PAR interface with ABACUS, ARCHIVE EASEL and QUILL you may include the PAR USE command in the corresponding boot program.

Alternatively, you can also change the printer driver with the INSTALL\_BAS program supplied with the Psion software package: Load and run the program and choose the Microdrive as required. Choose the PAR port option by pressing the space bar. Get the list of printer parameters by pressing F2. Change the PORT by pressing either the left or right cursor key and then type 'PAR' as the valid device name

Don’t use a buffer unless you have a memory expansion as the Psion programs use the entire RAM of an unexpanded QL. Don't add the flags ‘C’ or ‘F’. You can obtain these options specifying the END OF LINE code as CR and by including FF in the POSTAMBLE CODE, respectively.

**ADDITIONAL SUPERBASIC COMMANDS**

The QSOUND/QPRINT firmware consists of 30 new SuperBASIC commands which allow you to utilize the PAR interface and the full capability of the sound chip. A few useful procedures/ functions are also included.

The commands are described below. Parameters enclosed in < > are optional. The default window is #1.

**BELL** procedure

 Causes the sound chip to emit a short bell like sound

**CONTROL** procedure

 Creates a job which opens a window in the upper right-hand corner of the screen shows the number of the job that is currently ready to receive input (i.e. whose cursor is flashing)

**CUR\_FLASH f** procedure

 Changes the flashing rate of the cursor

 f = 0 normal

 f = 1 medium

 f = 2 high

**CURDIS <#n>** procedure

 disables the cursor in window #n

**CURSEN <#n>** procedure

 enables the cursor in window #n

 The INKEY$ command doesn’t show a cursor. The following function also returns the character corresponding to the key pressed but shows a flashing cursor for the number of frames specified in wait

DEFine FUNction getkey$(chn, wait)

 CURSEN #chn

 r$=INKEY$(#chn, wait)

 CURDIS #chn

 RETurn r$

END DEFine

**m = D\_MODE** function

 returns the current display mode

 m = 4 high resolution (4 colours)

 m = 8 low resolution (8 colours)

**t = D\_TYPE** function

returns the current display type (which determines the default windows)

t = 0 monitor

t = 1 TV

**DOWN (#n)** procedure

moves the cursor in window #n one row down

**EXPLODE** procedure

causes the sound chip to emit an explosion like noise

**HOLD** procedure

 stops all interrupt sound lists

**HOLD n** procedure

stops the interrupt sound list n (1 .. 3)

**LEFT (#n)** procedure

moves the cursor in window #n one column to the left

**LIST\_AY r0..r13** procedure

 sends the value of r0 .. r13 to the registers 0 .. 13 of the sound chip

**nno = NET\_NR** function

returns the network station number of your machine which was assigned by the SuperBASIC command NET

**NEW\_FONT <#n>, add** procedure

assigns the new character font at address add to window #n

**OLD\_FONT #n** procedure

 Assigns the standard QL font to window #n

**PAR\_STOP** procedure

clears the PAR device buffer and stops printing via the PAR port

**PAR­\_USE ddd** procedure

renames the PAR device to the new three character name ddd. Useful for SER emulation.

PAR\_USE SER emulates the serial port 1.

**v = PEEK\_AY (r)** function

Returns the content of register r of the sound chip

**PLAY n, sound$** procedure

puts the string sound$ into the interrupt list of the sound channel n (1 .. 3) .

sound$ may contain various characters (case is not distinctive) to denote

notes: C D E F G A H

(H corresponds to B, HB to Bflat)

 Sharps: #

 Flats: b

 Rests: p (one length unit)

 Change octave: o0 o1 .. o7

 (default o2)

 Change volume: v0 v1 .. v15

 V16 switches to wrap control

 Duration of note in 1/50 sec: 10 .. 1255

 (default: 15)

 Change noise frequence: n0 n1 .. 31

 (default n0)

 Determine wrap curve: w0 w1 .. w15

 (default w0)

 Change length of wrap: x0 x1 .. x32767

 (default is x0)

 Synchronisation stop: 5

 causes a sound channel to wait

 activate a waiting channel: r1 r2 r3

 Sound example (try it):

 PLAY 1, 'pr15o4sCDEFGAHo5CDEFGAHp'

PLAY 2, 'pv15o2r1CDEFGAHo3CDEFGAHp'

**POKE\_AY r,v** procedure

 Sets one of the registers (0 .. 13) of the sound processor to value v (0 .. 255)

**vno$ = QDOS$** function

returns the version number of your QDOS operating system

**RELEASE** procedure

 Causes all interrupt sound lists to be played

**RELEASE n** procedure

Causes the sound list n (1 .. 3) to be played

**RIGHT <#n>** procedure

Moves the cursor in window #n one column to the right

**SHOOT** procedure

Causes the sound chip to emit a noise like a shot

**SOUND** procedure

Clears all sounds played by the sound chip. All tunes in the sound interrupt lists created with the PLAY command are cleared.

**SOUND n** procedure

Clears the sound channel n (1 .. 3)and the corresponding interrupt list

**SOUND n,f,v** procedure

Sets the sound output to sound channel n to the frequency f (400 … 5000 Hz) and the volume v (0 .. 15)

**UP <#n>** procedure

Moves the cursor in window #n one row up

**MACHINE CODE PROGRAMMING WITH THE AY-3-8910 SOUND PROCESSOR**

The QSOUND/QPRINT card could theoretically occupy any of the 16 expansion slots recognised by QDOS. To find the actual base address, read the system variable SV.AYBAS. The address to jump to is in the system variable SV.AYJMP.

The sound processor control routines are called with a code in the register D0 of the MC68000 (like the QDOS trap routines).

A call to the routine AY.RDREG (which reads a register of the AY-3-8910) should look like this:

MOVEQ #AY.RDREG,D0 code for AY-routine

MOVEQ #0,D2 read register $00

MOVE.L SV.AYJMP,A0 get address to jump to

JSR (A0) do it

A QDOS error code will be returned in D0.

**ROUTINE AND ADDRESS SUMMARY**

**ADDRESS DEFINITIONS**

|  |
| --- |
| **Name Address Description** |
| SV.AYBAS $28160 long Base address of the firmwareSV.AYJMP $28164 long Start address for machine code Routines |

**ROUTINES FOR SOUND CONTROL**

|  |
| --- |
| **D0 Name Description** |
| $00 AY.RESET clears sound, stops noise$01 AY.WRREG writes one AY-3-8910 register$02 AY.RDREG reads one AY-3-8910 register$03 AY.WRALL writes all (0 .. 13) registers$04 AY.RDALL reads all (0 .. 15) registers$05 AY.PLAY plays a tune$06 AY.TSTPL status query$07 AY.HOLD causes a sound channel to wait$08 AY.RELSE releases a waiting channel$09 AY.NOISE emits a predefined noise$0A AY.SOUND emits a user-defined sound |

**HARDWARE KEY**

|  |
| --- |
| **Name Address Description** |
| AY.PORTA $8000 PIA-Dataport AAY.CTRLA $8001 Control port AAY.PORTB $8002 PIA-Dataport BAY.CTRLB $8003 Control port B |

**D0 = $00 AY.RESET**

Clears the sound.

**Call parameters Return parameters**

D1 D1 undefined

D2 D2 undefined

D3 D3 preserved

A0 A0 preserved

A1 A1 undefined

 A5 undefined

**ERROR RETURNS**

 None

**NOTES**

 Also clears all sound interrupt lists.

**D0 = $01 AY.WRREG**

Writes a value to AY-3-8910 register.

**Call parameters Return parameters**

D1.B value D1 preserved

D2.B register D2 preserved

D3 D3 preserved

A0 A0 preserved

A1 A1 preserved

 A5 undefined

**ERROR RETURNS**

 ERR.OR Invalid register number (>13)

**NOTES**

 Please note, that only registers 0 .. 13 are used. The other ports are used for the PAR interface. Bit 6 and 7 of register 7 remain unchanged. They are also used for port managing.

**D0 = $02 AY.RDREG**

Reads a AY-3-8910 register.

**Call parameters Return parameters**

D1 D1 value read

D2.B register D2 preserved

D3 D3 preserved

A0 A0 preserved

A1 A1 preserved

 A5 undefined

**ERROR RETURNS**

 ERR.OR Invalid register number (>15)

**D0 = $03 AY.WRALL**

Writes all registers (0 .. 13) of the AY-3-8910.

**Call parameters Return parameters**

D1 D1 undefined

D2 D2 undefined

D3 D3 preserved

A0 A0 preserved

A1.L pointer to datablock A1 undefined

 A5 undefined

**ERROR RETURNS**

 None

**NOTES**

 The datablock must contain 14 bytes with the values for the registers in ascending order ($00 = r0 .. $0C = r13).

**D0 = $04 AY.RDALL**

Reads all registers (0 .. 15) of the AY-3-8910.

**Call parameters Return parameters**

D1 D1 undefined

D2 D2 undefined

D3 D3 preserved

A0 A0 preserved

A1.L pointer to buffer A1 undefined

 A5 undefined

**ERROR RETURNS**

 None

**NOTES**

 The 16 bytes buffer contains the values of the registers in ascending order ($00 = r0 .. $10 = r15).

**D0 = $05 AY.PLAY**

Puts a string to the interrupt sound list.

**Call parameters Return parameters**

D1.B AY-channel D1 undefined

D2 D2 preserved

D3 D3 preserved

A0.L pointer to the string A0 undefined

A1 A1 preserved

 A5 undefined

**ERROR RETURNS**

 ERR.OR AY-channel was not 1, 2 or 3.

ERR.BP String contains undefined sound items.

**NOTES**

 The string must be preceded by a word containing the string length.

**D0 = $06 AY.TSTPL**

Returns the status of a AY-3-8910 channel buffer.

**Call parameters Return parameters**

D1.B AY-channel D1 status

D2 D2 preserved

D3 D3 preserved

A0 A0 preserved

A1 A1 preserved

 A5 undefined

**ERROR RETURNS**

 ERR.OR AY-channel was not 1, 2 or 3.

 ERR.NO Sound list doesn’t exist.

**NOTES**

 Status return in D0: 0 waiting.

 1 playing

**D0 = $07 AY.HOLD**

Suspends playing a sound list.

**Call parameters Return parameters**

D1.B AY-channel D1 undefined

D2 D2 undefined

D3 D3 undefined

A0 A0 undefined

A1 A1 undefined

 A5 undefined

**ERROR RETURNS**

 ERR.OR AY-channel was not 0, 1, 2 or 3.

 ERR.NO Sound list doesn’t exist.

**NOTES**

 AY-channel number 0 stops playing on all channels.

**D0 = $08 AY.RELSE**

Releases a suspended sound list.

**Call parameters Return parameters**

D1.B AY-channel D1 undefined

D2 D2 undefined

D3 D3 undefined

A0 A0 undefined

A1 A1 undefined

 A5 undefined

**ERROR RETURNS**

 ERR.OR AY-channel was not 0, 1, 2 or 3.

 ERR.NO Sound list doesn’t exist.

**NOTES**

 AY-channel number 0 causes all channels to continue.

**D0 = $09 AY.NOISE**

Causes the sound processor to emit predefined noises.

**Call parameters Return parameters**

D1.B noise D1 undefined

D2 D2 undefined

D3 D3 preserved

A0 A0 preserved

A1 A1 undefined

 A5 undefined

**ERROR RETURNS**

 ERR.BP noise > 2

**NOTES**

 Values of noise: 0 explosion

1 gunshot

2 bell

**D0 = $0A AY.SOUND**

Emits a sound with a specific frequency and volume on the chosen channel.

**Call parameters Return parameters**

D1.B AY-channel D1 undefined

D2.W frequency D2 undefined

D3.B volume D3 undefined

A0 A0 preserved

A1 A1 preserved

 A5 undefined

**ERROR RETURNS**

 ERR.BP AY-channel was not 1, 2 or 3

 ERR.OR Frequency was out of range.

**NOTES**

The valid frequency is 400 .. 5000 Hz.

 The valid volume code is 0 .. 15.

**REGISTERS OF THE AY-3-8910 SOUND PROCESSOR**

The sound processor AY-3-8910 works with a 0.75 MHz time frequency on the QL. It uses 16 read/write registers. The use of the registers is described below.

|  |
| --- |
| **Reg bit 7 6 5 4 3 2 1 0** |
| $00 chn A tone LSB 7 6 5 4 3 2 1 0$01 chn A MSB x x x x B A 9 8$02 chn B tone LSB 7 6 5 4 3 2 1 0$03 chn B MSB x x x x B A 9 8$04 chn C tone LSB 7 6 5 4 3 2 1 0$05 chn C MSB x x x x B A 9 8$06 noise period x x x x 3 2 1 0$07 release ioB ioA nC nB nA sC sB sA$08 chn A amplitude x x x w 3 2 1 0$09 chn B amplitude x x x w 3 2 1 0$0A chn C amplitude x x x w 3 2 1 0$0B wrap period LSB 7 6 5 4 3 2 1 0$0C wrap period MSB F E D C B A 9 8$0D wrap curve x x x x w3 w2 w1 w0$0E I/O port A 7 6 5 4 3 2 1 0$0F I/O port B 7 6 5 4 3 2 1 0 |

NOTES

X: bit not used

ioA: If bit is set then port A is input channel else it is output channel

ioB: If bit is set then port B is input channel else it is output channel

nA .. nC: If bit is reset channel is emitting noise.

sA .. sC: If bit is reset channel is emitting sound.

w0 .. w3: Wrap curve (cf. page 22)

w: Bit activates wrap control.

Registers $00 .. $05 define the pitch of the channel. Two registers define a note. The main time is divided by 16. By counting down the 12-bit-counter the output frequency is generated.

Register $06 defines the noise frequency. This works like the pitch control but with 5 bits only.

Register $07 releases the sources. It selects silence, sound, noise or sound and noise for each channel.

Registers $08 .. $0A define the volume. The four LSBits denote the volume in logarithmic steps. The w-bit activates the wrap control.

Registers $0B and $0C define a 16-bit wrap period.

|  |  |
| --- | --- |
| W3 w2 w1 w0 | Wrap curve |
| 0 0 x x0 1 x x1 0 0 01 0 0 11 0 1 01 0 1 11 1 0 01 1 0 11 1 1 01 1 1 1 |  |

Register $0D selects the wrap curve as shown below.

Registers $0E and $0F describe the state of port A and port B.