

## 1. Specifications

### 1.1 Memory

- One static RAM chip of 32 KB with battery back-up and adjustable voltage supervisory circuit, subdivided in two 16 KB banks:

- 'BASIC ROM'
- 'Shadow ROM'

which can be paged in at address 0000, under software control

- A voltage supervisor disables the memory paging if the supply voltage drops below 4.75 V for longer than 2 microseconds.
- The 'BASIC ROM' and the first 11.5 KB of the 'Shadow ROM', used to store the operating system (OpSYSs), are write-protected, under software control
- The last 4.5 KB of the 'Shadow ROM' are used as general purpose RAM.

### 1.2 Storage

- One micro-SD card, operating in SPI mode at 12 MHz.
- One non-volatile 128 KB serial SRAM chip (optional)

### 1.3 Peripheral ports

#### 1.3.1 Kempston joystick port

#### 1.3.2 Auto-configuring PS/2 mouse / keyboard / 115200 baud 5V asynchronous serial / EAR audio output port

#### 1.3.3 Full-speed USB 2.0 device port, used to connect to a server machine

#### 1.3.4 12MHz SPI port with /SEL /INT and /RST control lines

#### 1.3.5 4000000 baud 3.3V asynchronous serial port

#### 1.3.6 One auxiliary control line available on the edge connector

### 1.4 Controls

#### 1.4.1 Multi-function pushbutton with dedicated microcontroller

Four different functions can be performed depending on the duration of the push

- ON/OFF function: > 1.2 s toggles the 'active' - 'inactive' state of the interface
- RESET function: 0.5 - 1.2 s pulls the /RESET line low for 5 ms  
The /RESET control output is open-drain
- NMI function: 0.2 - 0.5 s pulls the /NMI line low for 5 ms  
The /NMI control output is open-drain
- SYSLD function: > 2.5 s the interface reloads its operating system from a file server or the SD card.

#### 1.4.2 Control LEDs

The six control LEDs indicate:

- LED 'O' the 'ON / OFF' state of the interface
- LED 'B' the 'BASIC ROM' is paged-in
- LED 'S' the 'Shadow ROM' is paged-in
- LED 'M' when on: the mouse is active as 'Kempston' mouse  
when blinking: the mouse is active as 'Kempston' joystick
- LED 'C' the SD card has been identified
- LED 'U' serial SRAM selected, if installed, otherwise  
the connection to the server has been established

#### 1.4.3 ZX Spectrum model selector

The interface may be fitted with a jumper header for selecting the edge receptacle's pins that carry the 'ROM disable' signal

##### 1.4.3.1 'One ROM' (48k, +128, +2) machine

- Jumpers: 1-2, 3-4
- Signal pins: 4B, 25A

##### 1.4.3.2 'Two ROMs' (+2A, +2B, +3) machine

- Jumpers: 2-3, 4-5
- Signal pins: 4B, 15A

## 1.5 Connectors

### 1.5.1 USB port: Micro USB type B receptacle (J5)

Pin	Name	Dir	Description
1	VBUS	IN	Voltage sense
2	DAT-	I/O	USB D-
3	DAT+	I/O	USB D+
4	NC		Not connected
5	GND		Ground

### 1.5.2 PS/2 port: 6-way Mini DIN socket (J9)

Pin	Name	Dir	Description
1	DT	I/O	PS/2 Data
2	NC		Not connected
3	GND		Ground
4	VCC	OUT	Regulated 5V
5	CK	I/O	PS/2 Clock
6	EAR	OUT	Tape player port

### 1.5.3 Kempston joystick port: 9-pin D-Sub plug (J3)

Pin	Name	Dir	Description
1	nUP	IN	Not Up
2	nDOWN	IN	Not Down
3	nLEFT	IN	Not Left
4	nRIGHT	IN	Not Right
5	NC		Not connected
6	nFIRE1	IN	Not Fire1
7	VCC	OUT	Regulated 5V
8	GND		Ground
9	nFIRE2	IN	Not Fire2

### 1.5.4 SPI port: 6-pin header (J8)

Pin	Name	Dir	Description
1	SDO	OUT	Serial Data Out
2	VDD	OUT	Regulated 3.3V
3	SCK	OUT	Serial clock
4	NC		Not connected
5	SDI	IN	Serial Data In
6	GND		Ground

### 1.5.5 Control / Serial port: 8/10-pin header (J7)

8P	10P	Name	Dir	Description
	1	VDD	OUT	Regulated 3.3V
	2	GND		Ground
1	3	nEIT	IN	External interrupt
1	3	RX	IN	Async Serial Receive
2	4	NC		Not connected
3	5	nECS	OUT	External chip select
3	5	TX	OUT	Async Serial Transmit
4	6	NC		Not connected
5	7	nDIS	OUT	External reset
6	8	nRCS	OUT	RAM drive chip select
7	9	GND		Ground
8	10	nRCS	OUT	RAM drive chip select

## 2. Input / output port assignment

- The I/O address space used by the interface is: XXX11111

Port	IN	OUT
Peripheral control		
#1F	Kempston Joystick	Peripheral Data
#5F	Peripheral Status	
#9F	Peripheral Data	
#DF	Mouse / Keyboard	
Memory control		
#3F	Auxiliary line set	RAM write disable
#7F	Auxiliary line reset	Page-in the 'BASIC ROM'
#BF		Select the Spectrum ROM
#FF		RAM write enable
		Page-in the 'Shadow ROM'
		Select the IF1bis OpSys

2.1 Kempston Joystick / Kempston Mouse X: IN #1F / IN #FBDF

- Bit assignment for Kempston joystick:

- Bit 0 = not Right
- Bit 1 = not Left
- Bit 2 = not Down
- Bit 3 = not Up
- Bit 4 = not Fire
- Bits 5-7 = 0

- Bit assignment for Kempston mouse X:

- Bits 0-7 = X-coordinate

2.2 Peripheral Status / Kempston Mouse buttons: IN #5F / IN #FADF

- Bit assignment for Peripheral status:

- Bit 0 = Serial device not connected
- Bit 1 = Printer not connected or  
= Serial receive buffer empty
- Bit 2 = IP network module connected
- Bit 3 = PS/2 device connected
- Bit 4 = SD card identified
- Bit 5 = USB port connected
- Bit 6 = Data ready
- Bit 7 = Peripheral busy

- Bit assignment for Kempston Mouse buttons:

- Bit 0 = Right button not pressed
- Bit 1 = Left button not pressed
- Bits 2-7 = Not used

2.3 Peripheral Data: IN #9F / OUT #9F

2.4 Kempston Mouse Y / Keyboard: IN #DF / IN #FFDF

- Bit assignment for Kempston Mouse Y:

- Bits 0-7 = Y-coordinate

- Bit assignment for Keyboard:

- Bits 0-5 = Key number (0-38)  
= No key (39)
- Bit 6 = Symbol Shift on
- Bit 7 = Caps Shift on

2.5 Memory paging: ROM / RAM: OUT #7F / OUT #FF

- Bit assignment:

- Bits 0-7 = Not used

2.6 Memory paging: 'Basic ROM' / 'Shadow ROM': OUT #3F / OUT #BF

When the RAM is paged in

- Bit assignment:

- Bits 0-7 = Not used

2.7 Memory paging: RAM write disable - enable: OUT #3F / OUT #BF

When the RAM is paged out

- Bit assignment:

- Bits 0-7 = Not used

## 2.8 Auxiliary line: Set / Reset:

IN #3F / IN #BF

### - Bit assignment:

Bits 0-7 = Not used

- The auxiliary control line is intended for the '80 KB Spectrum', where 64 Kbit DRAM chips have been fitted as 'upper RAM'.

Wiring the DRAM type selector for 'OKI', replacing the 'H' jumper with a pull-up resistor and connecting the common 'L'-'H' pad to the otherwise unused 28B pad of the edge connector, allows the mapping of two different 32 KB DRAM banks at address #8000

- The auxiliary line control output is open-drain and is connected to the interface's edge receptacle's pin 28B, for 'One ROM' and respectively 15A, for 'Two ROMs' ZX Spectrum models

## 2.9 Spectrum 128k ports

OUT #7FFD / OUT #FFFD / OUT #1FFD

- The last values sent to ports #7FFD, #FFFD and #1FFD are stored by the microcontroller and can be retrieved using the command CAT 0;"r", which also resets the stored values to #FF.

The command returns four bytes representing:

Offset	Value
0	Last OUT to port #7FFD
1	Last OUT to port #1FFD
2	0
3	Last OUT to port #FFFD

## 3. Interface states

### 3.1 The 'OFF' state

- The 'OFF' state is indicated by the 'O' LED being off
- After power-up the interface enters the 'OFF' state
- The interface can also be switched 'OFF' at any time, using the multi-functional pushbutton
- The interface does not respond to any I/O requests and implicitly cannot page memory
- The pushbutton is operational but no other interface functions are available

### 3.2 The 'ON' state

- The 'ON' state is indicated by the 'O' LED being on while both 'B' and 'S' LEDs being off
- The interface can be switched 'ON' using the pushbutton
- The interface does respond to I/O request but its RAM is not paged in
- The ZX Spectrum is running the '48k BASIC', from its internal PROM
- The Kempston joystick and mouse are operational

### 3.3 The 'Active' state

- The 'Active' state is indicated by either the 'B' or 'S' LEDs being on
- The interface can be switched from the 'ON' state to the 'Active' state by triggering a NMI, using the pushbutton
- The interface can be switched back from the 'Active' state only to the 'OFF' state, using the pushbutton
- The interface is fully operational
- The ZX Spectrum is running the 'Extended BASIC' from the interface's on-board non-volatile RAM.
- The 'B' and 'S' LEDs indicate whether the 'BASIC ROM' or respectively the 'Shadow ROM' is paged in