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ZX SPECTRUM

SPECTRA+128
supplement manual

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SPECTRA+128 supplement manual

by Paul Farrow

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Reset button and expansion bus *Page 35*

There is no change in functionality of the reset button or rear expansion bus.

CHAPTER 1

Introduction

This is a supplement manual to the original SPECTRA manual that details the new facilities provided by the SPECTRA+128 interface, along with its differences to the SPECTRA interface. It should be read in conjunction with the original SPECTRA manual as each chapter presented corresponds to the equivalent chapter in the SPECTRA manual.

The SPECTRA+128 interface differs from the SPECTRA interface in the follow ways:

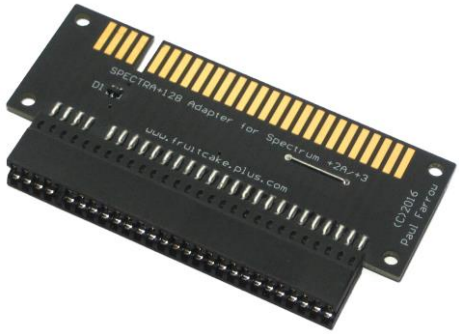
- It can be used with the Spectrum 128 and the Spectrum+2 as well the 16K/48K Spectrum (50Hz models only).
- It generates an improved quality picture that is less susceptible to jitter.
- It is no longer necessary to fit the missing video links inside issue 1 and issue 2 16K/48K Spectrums.
- A ROM cartridge socket is fitted as standard (the onboard ROM facility is no longer supported).
- It supports the dual display file mechanism of the Spectrum 128 and Spectrum+2.

Spectrum compatibility

Sinclair issued a number of recommended modifications to the early issue 16K/48K Spectrums, particularly for the issues 1 and 2 versions. If picture instability is seen when using the SPECTRA+128 with an issue 1 or 2 Spectrum then check whether all recommended modifications have been fitted to the Spectrum. Refer to the ***Servicing Manual for the ZX Spectrum*** released March 1984 by Sinclair Research Ltd for details of the modifications.

SPECTRA+3 Adapter board

The SPECTRA+128 interface does not directly support the Spectrum+2A and Spectrum +3, but can be used with these models via the SPECTRA+3 Adapter board. The SPECTRA+3 Adapter can be seen in the photograph below.



SPECTRA+3 Adapter board

The adapter board performs two functions:

- The adapter routes the 12V line to the unused pad that used to carry the raw 9V on the earlier Spectrum models. The SPECTRA+128 interface therefore derives its internal 5V line from 12V rather than 9V. Note that when the adapter is used, the '9V' pad on the SPECTRA+128's rear expansion pad will present 12V to any device connected behind it.
- The adapter drives both the /ROM1OE and /ROM2OE lines from the unused pad that used to carry to /ROMCS line on the earlier Spectrum models. This allows the Spectrum+2A/+3 to use ROM cartridges designed for operation with the ZX Interface 2.

When the SPECTRA+128 interface is used via the SPECTA+3 Adapter board on a Spectrum +2A/+3, the special memory configuration modes available only with these models are not supported.

CHAPTER 2

Setting up the interface

Configuration switches 1, 3, 4, 5 and 6 of the SPECTRA+128 interface provide identical functionality to that of the SPECTRA interface. Switch 2 has a new purpose, which is to inform the SPECTRA+128 interface of the type of Spectrum that it is connected to. When the SPECTRA+128 interface is connected to a 16K or 48K Spectrum then switch 2 must be set to the *off* position. When the SPECTRA+128 interface is connected to a Spectrum 128 or a Spectrum+2 (or to a Spectrum +2A or Spectrum +3 via the SPECTRA+3 Adapter board) then switch 2 must be set to the *on* position. If switch 2 is not set to match the type of Spectrum used then screen corruption and screen jitter will occur.

Sound output

The 128K Spectrums support two forms of sound generation – the software driven beeper of the 16K/48K Spectrum and the 3-channel AY-3-8912 sound generator IC. The SPECTRA+128 interface only outputs the beeper sound to the television speaker(s) via its SCART socket. However, it is possible to output both types of sound to the televisions speaker(s) using a custom SCART cable, as described in Chapter 3.

CHAPTER 3

SCART connection

The SCART socket provided by the SPECTRA+128 interface provides the necessary control voltages required to instruct the television to automatically select the RGB signal of the SCART socket, which provides a benefit over the RGB monitor socket of the 128K Spectrums since they do provide suitable voltages.

The SCART socket of the SPECTRA+128 interface only outputs the sounds of the software driven beeper when used with a 128K Spectrum. However, it is possible to obtain the sounds of both the beeper and AY-3-8912 sound generator IC using a custom SCART cable. Rather than obtain the sound signal from the SPECTRA+128's SCART socket (pins 1 and 3), the cable should instead be equipped with a flying lead fitted with a 3.5mm mono jack plug that connects to the MIC socket of the Spectrum 128, and to the SOUND socket of all other 128K models. The tip of the jack plug should be connected to the two audio channel signals from the SCART cable and the outer contact of the jack plug should be connected to the Audio Ground connection of the SPECTRA+128's SCART socket (pin 4).

Interrupt signal absent indicator

The SPECTRA+128 interface no longer uses the luminance (/Y) signal from the Spectrum's expansion bus to synchronise the display it outputs from the SCART socket with the standard TV picture generated by the Spectrum. Instead it uses the clock (/CLK) and interrupt (/INT) signals for this purpose. As a result it is no longer necessary to fit the missing video links inside issue 1 and early issue 2 16K/48K Spectrums. The onboard LED of the SPECTRA interface used to indicate the absence of the luminance signal but since this is now no longer relevant to the SPECTRA+128 it is instead used to indicate the absence of a signal on the interrupt line.

If a picture is not obtained from the SPECTRA+128 and the *interrupt signal absent indicator* LED is constantly illuminated then it may be that the interrupt line from the Z80 CPU within the Spectrum is not being exposed on the Spectrum's expansion bus.

CHAPTER 4

New display modes

The SPECTRA+128 provides the same range of new display modes as available from the SPECTRA interface. In addition, the SPECTRA+128 supports the dual display file mechanism introduced by the Spectrum 128, ensuring that all programs specifically written for this model of Spectrum are displayed correctly.

RGB picture generation

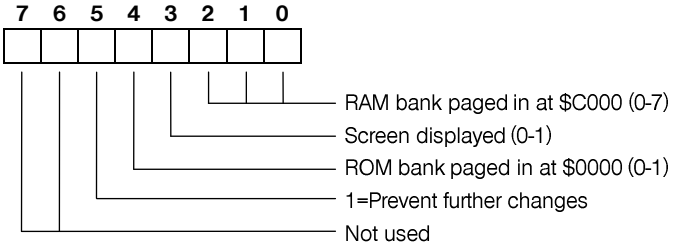
Like the SPECTRA interface, the SPECTRA+128 interface must generate its picture in perfect synchronisation with the standard TV picture output by the Spectrum. The SPECTRA interface achieved this using the interrupt (/INT) and luminance (/Y) signals exposed on the Spectrum's expansion bus, but the SPECTRA+128 cannot use this technique since the luminance signal is no longer available from the Spectrum 128. So instead it uses the interrupt (/INT) signal to determine the start of a TV frame and the clock (/CLK) signal to track the position within the frame. Should a signal not be found on the interrupt line then the *interrupt signal absent indicator* LED will be constantly illuminated, as described in Chapter 3.

The number of clock cycles corresponding to the duration of each television scan line differs between the 16K/48K Spectrum and the 128K Spectrum models. The 16K/48K Spectrum uses 224 clock cycles per scan line whereas the 128K Spectrums use 228 clock cycles. Configuration switch 2 is used to inform the SPECTRA+128 interface which type of Spectrum it is connected to and hence how many clock cycles there are per scan line. The state of the switch is also used to enable / disable support for the dual display file mechanism available only on the 128K Spectrums. The functioning of configuration switch 2 is described in Chapter 2.

Spectrum 128/+2 dual display file mechanism

The Spectrum 128/+2 dual display file mechanism works in conjunction with the paging mechanism that allows access to the 128K of RAM. The RAM is divided into 8 banks of 16K and any one bank may be paged in at memory address $C000. RAM bank 5 contains the standard display file (referred to as screen 0), which is always accessible at $4000 and at $C000 when RAM bank 5 is paged in here. The second display file (referred to as screen 1) is contained in RAM bank 7 and is only accessible when this bank is paged in at $C000. The Spectrum 128/+2 can display either screen 0 or screen 1 irrespective of the RAM bank paged in at $C000.

The screen displayed and the RAM bank paged in are controlled through output port $7FFD. A byte written to this port is interpreted by the Spectrum 128/+2 as follows:



Support for the dual display file mechanism of the Spectrum 128/+2 is achieved in the SPECTRA+128 interface by overlaying this functionality with the existing SPECTRA shadow screen bank facility. Since original Spectrum 128/+2 software is unaware of the SPECTRA shadow bank facility, it will not attempt to use it. This means that the additional 16K RAM normally used for this facility be can safely utilised to mimic the second display file of the Spectrum 128/+2.

Overlaying the shadow bank facility with that of the Spectrum 128/+2 dual display file mechanism opens up the ability for custom software to output one display file to the RGB monitor socket of the Spectrum 128/+2 and the other to the SCART socket of the SPECTRA+128 interface. A 128K Spectrum can therefore be connected to two TVs and output a different picture to each.

The following table lists the available screen output permutations.

Options selected			Screens displayed	
SPECTRA shadow bank	SPECTRA display bank	Spectrum 128 display file	SPECTRA SCART socket	Spectrum 128 RGB socket
Bank 0	Bank 0	Screen 0	Screen 0	Screen 0
Bank 0	Bank 0	Screen 1	Screen 1	Screen 1
Bank 0	Bank 1	Screen 0	Screen 1	Screen 0
Bank 0	Bank 1	Screen 1	Screen 0	Screen 1
Bank 1	Bank 0	Screen 0	Screen 0	Screen 0
Bank 1	Bank 0	Screen 1	Screen 1	Screen 1
Bank 1	Bank 1	Screen 0	Screen 1	Screen 0
Bank 1	Bank 1	Screen 1	Screen 0	Screen 1

Screen output permutations

The selection of the Spectrum 128/+2 display file (screen 0 or screen 1) determines how writes to the display file memory at $4000 and at $C000 (when RAM bank 5 or 7 is paged in) are shadowed by the SPECTRA+128 interface. This is shown in the following table.

Options selected			SPECTRA+128 banks shadowed to		
SPECTRA shadow bank	**SPECTRA display bank**	**Spectrum 128 display file**	**Writes to 128 bank 5 at $4000**	**Writes to 128 bank 5 at $C000**	**Writes to 128 bank 7 at $C000**
Bank 0	Bank 0	Screen 0	Bank 0	Bank 0	Bank 1
Bank 0	Bank 0	Screen 1	Bank 0	Bank 0	Bank 1
Bank 0	Bank 1	Screen 0	Bank 0	Bank 0	Bank 1
Bank 0	Bank 1	Screen 1	Bank 0	Bank 0	Bank 1
Bank 1	Bank 0	Screen 0	Bank 1	Bank 1	Bank 0
Bank 1	Bank 0	Screen 1	Bank 1	Bank 1	Bank 0
Bank 1	Bank 1	Screen 0	Bank 1	Bank 1	Bank 0
Bank 1	Bank 1	Screen 1	Bank 1	Bank 1	Bank 0

SPECTRA+128 bank shadowing

CHAPTER 5

Joystick socket

The functionality of the joystick socket provided by the SPECTRA+128 interface is identical to that provided by SPECTRA interface.

CHAPTER 6

RS232 socket

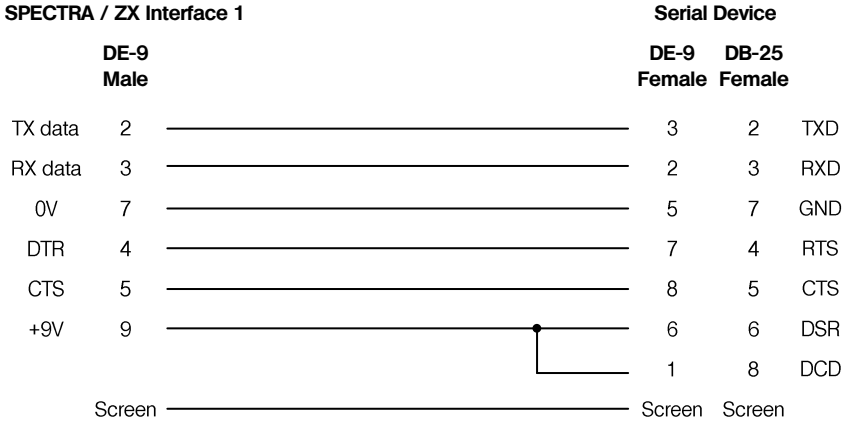
The functionality of the RS232 socket provided by the SPECTRA+128 interface is identical to that provided by the SPECTRA interface.

RS232 data cable wiring

The RS232 cable wiring presented on page 50 in Chapter 6 of the SPECTRA manual is suitable for connecting to a printer or for receiving data from a PC. It can also be used to send data to a PC but does not necessarily guarantee reliable communication. This is because a printer uses the DTR line to signal when it can receive data whereas a PC uses the RTS (*ready to send*) line for this purpose (when using *RTS/CTS handshaking)*. A PC application will generally be able to consume data faster than the Spectrum can send it and so buffer overruns are not likely to occur. However, should an application attempt to halt the flow of data from the Spectrum using the RTS line then the Spectrum will not detect this and so any further data it sends will simply be lost. It is only possible to guarantee reliable transmission of data to a PC if the receiving application is explicitly written to manipulate the DTR line to control when the Spectrum can send.

One of the primary intentions for the ZX Interface 1 RS232 socket (which the SPECTRA interface replicates) was to connect to a printer, and since a printer is a DTE device then the ZX Interface 1 adopts the role of a DCE. This explains why the pins of the ZX Interface 1 RS232 socket are labelled as a DCE.

To ensure reliable transmission to a standard PC application, such as a terminal program, the following RS232 cable wiring should be used:



Wiring of a SPECTRA / ZX Interface 1 RS232 cable using RTS/CTS handshaking

Some applications monitor the DCD (*data carrier detect*) line instead of, or in combination with, the DSR line and so both lines should be connected as shown. The filter circuit presented in the cable wiring diagram on page 50 in Chapter 6 of the SPECTRA manual

can be included to minimise transmission glitches when controlling the RS232 socket using a copy of the ZX Interface 1 ROM.

RTS/CTS handshaking was introduced in the RS232-E specification, but at the time of release of the ZX Interface 1 the current version was RS232-C. In RS232-C, the RTS/CTS lines are defined to be used to coordinate half-duplex communication, e.g. with a modem, and the DTR line used to signal when the DCE can send. The DTE asserts RTS to indicate it wishes to send and the DCE asserts CTS in response to grant permission. In RS232-E, the RTS line can also be used with CTS to achieve duplex communication, and in this mode the RTS line was re-designated as RTR for *ready to receive*. The DTE asserts RTR (i.e. RTS) to grant permission for the DCE to send, and the DCE asserts CTS to grant permission for the DTE to send.

CHAPTER 7

ROM support

The SPECTRA interface supports an external ROM via an optional ROM cartridge socket or via an optional onboard ROM socket. The SPECTRA+128 interface does not support the onboard ROM socket facility but instead comes fitted with a ROM cartridge socket as standard.

CHAPTER 8

Reset button and expansion bus

Reset button

The reset button of the SPECTRA+128 interface functions identically to that of the SPECTRA interface.

Rear expansion bus

The rear expansion bus provided by the SPECTRA+128 interface is identical to that provided by the SPECTRA interface.

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