ZX Interface Z

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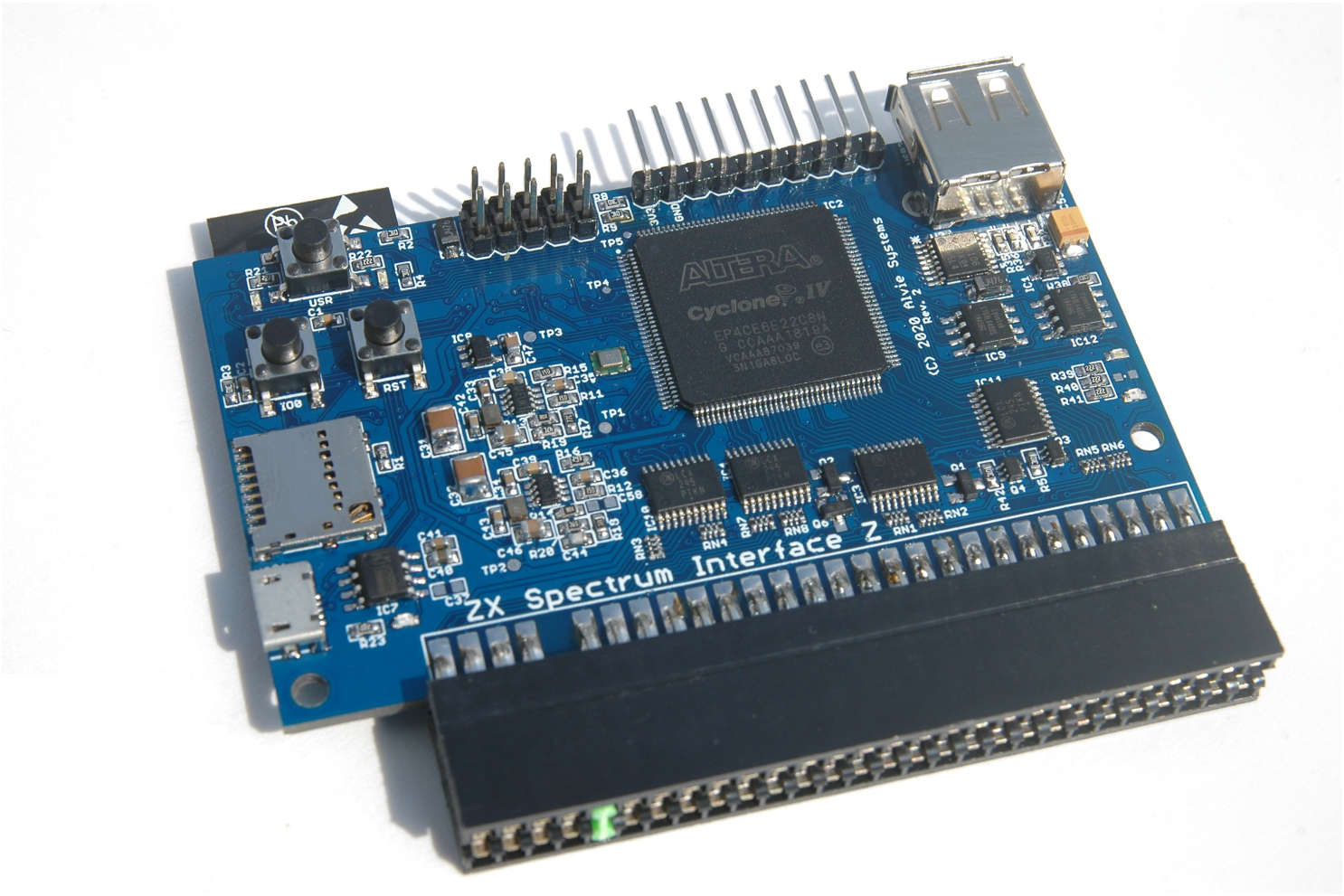

The *ZX Interface Z* is an expansion card for the ZX Spectrum which supports, among other

features:

- VGA and audio output via micro expansion card
- USB devices, such as keyboard, gamepads and memory sticks.
- Network access via WiFi
- Micro SD card
- Bluetooth [planned]
- YM2149 sound on all models

Internally, the *ZX Interface Z* includes:

- A dual-core CPU with WiFi and Bluetooth radio
- An Intel FPGA

- 64MB of RAM, also accessible from the ZX Spectrum
- USB for debugging and programming

the *ZX Interface Z* is **fully open source!**. The software, the board and the FPGA designs are available online under open source licences so anyone can modify them or build their own.

1.1 Current version

The current hardware version is 2.4. This hardware is compatible with the models described in this document.

1.2 Where is the source?

All sources are available in github:

https://github.com/alvieboy/ZXInterfaceZ

1.3 Supported hardware

The following ZX Spectrum hardware is supported:

- ZX Spectrum 16K
- ZX Spectrum 48K
- ZX Spectrum 128K (gray)
- ZX Spectrum 128K (toastrack)
- ZX Spectrum +2A
- ZX Spectrum +3

Some features might not be available depending on the model. See section Hardware Limitations for details regarding support of your ZX Spectrum model.

2 The board

The *ZX Interface Z* board has the following features available for user interaction and information:

- Two user buttons - USR and IO0
- 6 LEDs (one for power, 5 for information)
- One hard-reset button

The *ZX Interface Z* also includes one expansion port which can hold other boards. The VGA and audio output plug into this expansion port.

The USR button is used to access the *ZX Interface Z* main menu. The IO0 button is configurable and can be used for different purposes.

By default, holding the IO0 button for more than one second loads a Diagnostics ROM which you can use to diagnose your ZX Spectrum hardware.

3 Main menu

The main menu is normally accessible by pressing shortly the USR button. Most of the *ZX Interface Z* functionality is accessible using this menu.

From the main menu, you can:

- Load snapshots
- Save snapshots
- Play tapes
- Poke memory
- Change *ZX Interface Z* settings
- Reset the ZX Spectrum
- Debug the ZX Spectrum [experimental]
- See information about the system

Figure 1: The main menu

4 Loading software

It is possible to load a multitude of software using the *ZX Interface Z*. Loading of software is either done by restoring the ZX Spectrum state, or by using tapes.

Loading of software is possible from the following sources:

- microSD card
- USB flash drive
- USB CDROM [planned]
- Network [planned]

4.1 Loading tape files

The following tape files can be loaded using the *ZX Interface Z*:

- TAP tapes
- TZX tapes

See Tape Loading Methods for details on limitations of each file type and ZX Spectrum model.

4.2 Loading snapshot files

Snapshot files can also be loaded by the *ZX Interface Z*. The following snapshot files are supported:

- SNA [48K only, 128K planned]
- Z80 [experimental]

Figure 2: Loading snapshots

4.3 Tape loading methods

There are two methods for loading tape files. Depending on the tape file and on the platform it might or might not be possible to load them.

4.3.1 ROM-hooked LOAD (FastTAP)

This method allows for quick loading of tapes and relies on ROM hooks to perform loading. The following tapes are supported using this mode:

- Standard TAP and TZX tapes (not using custom loaders, like copy protection loaders or fast loaders)

4.3.2 Audio emulation loading

This method allows any tape to be loaded, but is not compatible with all ZX Spectrum models. The following tapes are supported using this mode:

- TAP and TZX tapes

See section Hardware Limitations for details regarding support of audio emulation of your ZX Spectrum model.

5 Saving software

It is possible to save software using the *ZX Interface Z* by either capturing the ZX Spectrum state (snapshot) or by saving to tape files.

Saving software is possible to the following devices:

- microSD card
- USB flash drive

5.1 Snapshots

It is possible to save a snapshot of the ZX Spectrum to a file. Support for snapshot might depend on the actual ZX Spectrum used. See section Hardware Limitations for details regarding support of snapshots for your ZX Spectrum model.

5.2 Automatic load/save menu

The ZX Interface Z comes with a method of automatic load menu. This means whenever you type in LOAD or SAVE commands in the ZX Spectrum BASIC, or if any program enters the standard ROM LOAD or SAVE routines, a pop up will show which allows you to select a TAPE file to load or save. It is possible to append to tape files as well.

6 Pokes

The *ZX Interface Z* supports pokes dynamically - all you have to do is to place POK files in your microCD or USB memory stick and load them using the menu. If any parameters are needed, the *ZX Interface Z* will ask your for their values.

Figure 3: The poke menu where you can select the trainer

7 Quick snapshot

This feature is still in the planned stage.

It will be possible to map inputs to trigger a quick snapshot, which is quite useful if you want to immediatly save what is going on in your ZX Spectrum, such as a particular game you are playing.

See General input device support for more details.

8 Audio support

The *ZX Interface Z* supports audio output using a dedicated expansion card. This is usually done by the VGA+Audio companion adaptor.

The *ZX Interface Z* includes an YM2149 sound chip inside the main FPGA, which can output audio to the Audio adaptor on the expansion port.

The audio output is stereo, and includes a mixer for the internal audio and the YM2149 three-channel outputs. Each of these can be adjusted in volume and balance between the left and right channels.

Figure 4: Configuring audio

The audio configuration is persistent, it will be stored and restored next time you power the *ZX Interface Z*.

9 Video support

The *ZX Interface Z* supports digital video output through the expansion port. This is often done by plugging the VGA+Audio companion adaptor.

It also supports streaming of the video output via networking, using a custom video encoding prototol.

There are a set of different modes available for VGA output, which can be configured on the settings menu.

The video is generated by capturing the Z80 interaction with the video memory, so even if your ZX Spectrum lower ram is malfunctioning, the video output will still work as expected (so diagnostics ROM will work properly).

10 General input device support

The *ZX Interface Z* is very versatile in terms of input support, being it joysticks, gamepads, mice and keyboards. These connect through the USB port.

The behaviour of each input device (or, more specifically, each physical entity of each device) can be mapped to a particular action. For example, it is possible to configure certain USB keyboard keys to act as a mouse press, or to bring up the main menu, or to perform a quick snapshot save. Also possible, for example, is to map a joystick to keys, or a particular gamepad button to mute the audio output.

The following mappings are available for each physical input:

- Keyboard press+release
- Joystick axis movement or button
- Mouse movement or button
- Main Menu
- Quick save/load [planned]

11 Wireless Support

The ZX Interface Z supports WiFi in one of two modes. It can act as a standard WiFi client device (station) connected to a WiFi Access Point, or it can work in standalone mode, where the ZX Interface Z is itself an Access Point where you can connect to.

11.0.1 WiFi modes

- 802.11b/g/n support

11.0.2 WiFi authentication modes

- WPA2
- Open (no authentication)

12 Settings configuration

You can access the settings configuration on the main menu.

Figure 5: Settings menu

From the settings menu you can configure:

- WiFi
- Bluetooth [planned]
- USB [experimental]
- Video output settings
- Audio settings

13 Networking support

There is full networking support inside the main firmware. A subset of the networking API is available to the ZX Spectrum via a separate API.

14 Firmware upgrade

The ZX Interface Z firmware can be upgraded using one of the following methods:

- Micro USB cable using a dedicated tool
- Over-the-air upgrade [planned]
- Upgrade via USB flash drive [planned]

15 The web page

The *ZX Interface Z* includes a web site which you can use to perform several configuration and operations.

The web page is accessible by pointing your browser to http://interfacez.local/.

The web page is under active development, and will likely change heavily during development phase.

16 Hardware considerations

Take this information into account before using the *ZX Interface Z*:

- For all models, the USB port is powered by the ZX Spectrum 5V rail. This limits the amount of current that can be drawn by the USB port without interfering with the ZX Spectrum or lead to overheat of the internal ZX Spectrum regulator. **DO NOT CONNECT ANY USB DEVICE THAT DRAWS MORE THAN 200mA!!!** This may lead to destruction of the ZX Spectrum regulator. The Interface Z team cannot be liable for damage of the ZX Spectrum if such a device is connected. For safety reasons, shorting the USB power lines will temporarly disable the USB port.
- For the ZX Spectrum models powered by +9V supply, the Interface Z power is drawn directly from the +9V rail.
- For the ZX Spectrum models **not** powered by +9V supply, the Interface Z power is drawn from the +12V rail.

17 Hardware limitations

The following platforms might have limitations due to ZX Spectrum hardware design:

17.1 ZX Spectrum 16K

No limitations

17.2 ZX Spectrum 48K

No limitations

17.3 ZX Spectrum 128K (gray)

Snapshots are only possible for 48K mode (128K support is planned)

17.4 ZX Spectrum 128K (toastrack)

Audio emulation for tape loading is not supported

Snapshots are only possible for 48K mode (128K support is planned)

17.5 ZX Spectrum +2A

Audio emulation for tape loading is not supported.

Snapshots are only possible for 48K mode (128K support is planned)

17.6 ZX Spectrum +3

Audio emulation for tape loading is not supported

Snapshots are only possible for 48K mode (128K support is planned)

17.7 Other models

Other ZX Spectrum models, clones and TIMEX models are currenly unsupported.