
Zemu Users Manual

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This document is a quick reference manual for the zemu Z80 emulator.

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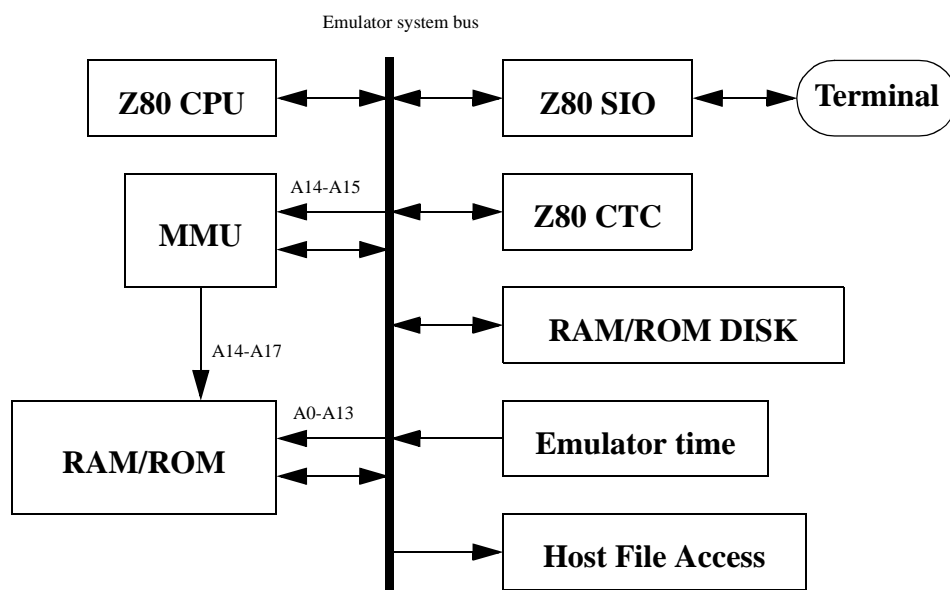
1.0 Overview

The zemu Z80 emulator is a software emulation of a Z80 system with CPU, timer/counter device (CTC), serial communication device (SIO), bank switched address space (MMU), RAM, ROM and a special I/O-mapped RAM/ROM disk device.

Zemu handles Z80 interrupt modes (IM0, IM1, IM2) and supports real world code for interrupt driven use of timers, serial ports etc.

1.1 Emulator block diagram

In the picture below a logical block diagram of the emulated Z80 system is shown.



1.2 Memory address map

Emulator memory as seen by the Z80 processor is 64KB from 0000-FFFFh. The actual memory allocated inside the emulator program is divided into 16 pages of 16KB each, giving a total of 256KB physical memory. At startup a default mapping from Z80 memory to some 64KB of the physical memory is initialized as shown below.

Z80 logical address space	Physical page	Description
0000-3FFF	0	ROM area, read-only, loaded from image file.
4000-7FFF	1	RAM area, loaded from image file if > 16KB.
8000-BFFF	9	RAM area, loaded from image file if > 32KB.
C000-FFFF	8	RAM area

Table 1.

Zemu default memory map.

1.3 I/O address map

The emulator I/O address space is shown below. Basic 8 bit I/O address decoding is used. Access to I/O-ports not defined below are allowed but have no effect.

I/O address	Description
00-03	CTC counter/timer registers chan 0 - 3.
10	SIO chan A data register, output discarded, input from terminal.
11	SIO chan A control register, input status bit is valid.
12	SIO chan B data register, used for terminal I/O
13	SIO chan B control register, input status bit is valid.
30	ROM disk block select register, write only. The device byte offset counter is also cleared on write. Next data read will be 1st byte in logical block.
40	ROM disk data read register, the device byte offset counter is incremented after each read. Execute 1024 consecutive reads to read one complete logical block from ROM disk.
90	Watchdog timer reset, NOT USED.
A0-A3	MMU logical page 0-3 setup register.
F0	Host file system access, command register.
FE	Emulator instruction counter LSB, read only.
FF	On read: emulator instruction counter MSB. On write: emulator interrupt latency counter reset.

Table 2.

Zemu I/O address map.

1.4 Bank switching - MMU

The MMU or bank switching device provides individual mapping of four Z80 logical 16KB pages to any of the 16 physical 16KB memory pages. There are four MMU mapping registers, one for each logical page. Each mapping register contains a 4 bit value which selects 1 of 16 physical pages.

A default mapping is defined when emulation begins but it can be easily re-defined by writing to the MMU registers.

1.5 RAM/ROM disk device

2.0 Zemu operation

2.1 Starting zemu

The Z80 emulator is a text-based command line application and should be started from a DOS/Windows/UNIX command prompt. There are some pre-compiled versions of zemu for different host platforms as summarized in the table below.

Host platform	Zemu executable file
DOS/Windows/NT	zemu.exe
Linux x86 PC	zemu
Solaris/SunOS	zemu

Table 3.

Zemu Z80 emulator executable for various host platforms.

When starting zemu a file containing the Z80 binary image to be run must be supplied. First the image file is loaded into the emulated ROM at memory address zero and then the Z80 emulator begins executing from address zero as after a hardware reset. Default mode when starting zemu is 32KB ROM at 0000-7FFFh and 32KB RAM at 8000-FFFFh. This memory layout can be modified during emulation by re-programming the MMU (bank switch) device.

Note: because zemu is just a Z80 system emulator there is no built-in operating system of any kind. The behaviour of the program is completely controlled by the loaded Z80 binary image file! The image file should be thought of as the boot PROM content of your Z80 computer.

2.2 Command line options

The zemu program accepts a number of command line options to control some aspects of the emulation. Zemu command line syntax looks like:

```
zemu [ -pmN file | -dump ] image_file [ ROM_disk_image_file ]
```

All items between brackets are optional, only the image file name is required.

Parameter/option	Description
image_file	Name of mandatory image file for Z80 boot ROM.
-pmN file	Optional image file to be loaded into physical memory page N. Pages 8, 9, 10 are valid for this option. Each page is 16KB and may be loaded in any combination.
-dump	Enable dump of emulator memory to file on exit/error. A raw image of the Z80 64KB address space will be written to the file zemu.dmp on exit.
ROM_disk_image_file	Name of optional image file to be loaded into emulator ROM disk device.

Table 4.

Zemu command line parameters and options.

2.3 Terminating zemu

To terminate the Z80 emulation hit CTRL-C (ASCII code 3). This will immediately stop the emulation, display some running statistics and exit the program.

Emulation will be terminated if a fatal error occurs such as illegal opcodes, non-serviced pending interrupts etc.

If the -dump option is enabled the 64KB Z80 memory image will be written to the zemu.dmp file.