

Z80 Motherboard For RC2014 User Guide

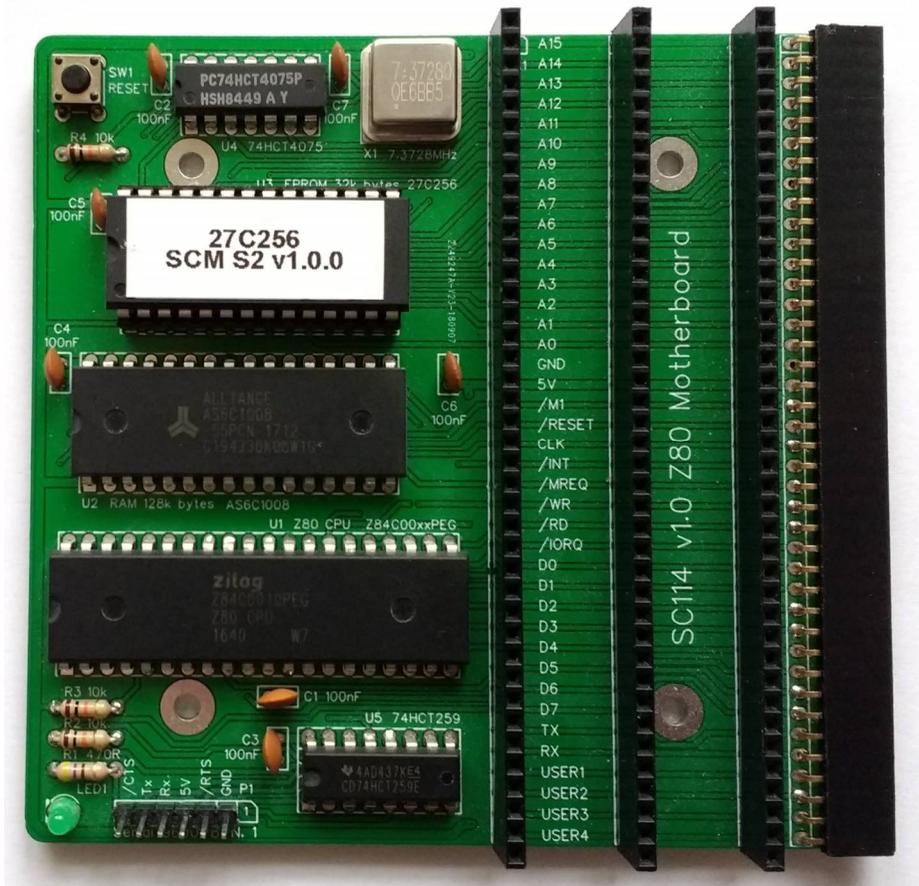
For PCB: SC114 version 1.0

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Overview

The Z80 Motherboard is designed to be low cost and easy to assemble, with the ultimate aim of making it a more reliable build.



It has few components and thus less soldering, and can even be assembled without the expansion sockets to further reduce the amount of soldering. Jumper options have been avoided to reduce complexity and confusion.

Circuit Board

Full details of the circuit board, suppliers, components, assembly and fault finding can be found in the SC114 Assembly Guide, available at www.scc.me.uk

This motherboard contains the following:

- Z80 running at 7.3728 MHz
- 128k bytes of RAM (second 64k not easy to use, so best consider it to be 64k usable)
- 32k bytes of ROM, which can be paged out with the usual write to port 0x38
- Simple bit-bang serial port to get you started
- Four RC2014 standard bus sockets
- Simple reset button (no power on reset or reset debounce)
- LED for power and status indication
- Runs the Small Computer Monitor configuration S2, with ROM BASIC and the CP/M loader included

Getting Started

Below is a very brief guide to getting started with the Z80 motherboard (SC114).

It is assumed the Z80 motherboard is fully assembled, but with no modules fitted in the RC2014 bus sockets. The ROM should contain the Small Computer Monitor v1.0 configuration S2 (available from www.scc.me.uk).

Connect a suitable FTDI style TTL level serial to USB adapter from P1 to a powered USB socket on a PC (or similar). Press the reset button and check the LED lights. It should flash off and on again either once or twice.

- One flash off and on indicates a serial module has been detected on the RC2014 bus and is being used to connect to a terminal. Serial modules usually work at 115200 baud, 8 data bits, 1 stop bit, no parity and hardware flow control (RTS/CTS).
- Two flashes off and on indicates a serial module has not been detected and the on-board serial port (P1) is being used to connect to a terminal. This port works at 9600 baud, 8 data bits, 1 stop bit, no parity and hardware flow control (RTS/CTS).
- If the LED continues to flash the self test has failed, most likely indicating the RAM is not working.

Start a suitable terminal emulation program, such as Tera Term, on the PC. Configure the PC's serial port as indicated above.

Press the reset button on the Z80 motherboard. You should see the terminal program display something like "Small Computer Monitor - SC114".

You are now ready to play!

This would be a good time to read the Small Computer Monitor tutorial and user guide.

Port Addresses

The motherboard includes some simple input and output functions.

The following are the output port addresses and their functions.

<i>Hex</i>	<i>Decimal</i>	<i>Function</i>
0x08	8	Status LED (low = on)
0x20	32	Serial port, request to send (RTS)
0x28	40	Serial port, transmit data (TXD)
0x30	48	RAM bottom 64k selected (active low)
0x38	56	ROM selected (active low)

In each of the above cases, bit zero of the data byte determines the state of the output. If the on-board serial port is not in use, the serial port outputs can be used as simple digital output lines. These may be used for such purposes as turning LEDs on or off.

A single input port is provided to read the serial data.

<i>Hex</i>	<i>Decimal</i>	<i>Function</i>
0x28	40	Serial port, receive data (RXD)

Bit 7 of the input port is the serial receive signal. This is a very crude input port and it is not recommended it be used for anything other than the serial receive input.

The output port addresses are not tightly decoded. The full ranges of the output port addresses, expressed in binary and hexadecimal, are listed below.

<i>Bits: 7654 3210</i>	<i>Hexadecimal</i>	<i>Function</i>
0000 10XX	0x08 to 0x0B	Status LED (low = on)
0010 00XX	0x20 to 0x23	Serial port, request to send (RTS)
0010 10XX	0x28 to 0x2B	Serial port, transmit data (TXD)
0011 00XX	0x30 to 0x33	RAM bottom 64k selected (active low)
0011 10XX	0x38 to 0x3B	ROM selected (active low)

If the on-board serial port is not being used for serial output or simple digital output, the addresses 0x20 to 0x23 and 0x28 to 0x2B can be used by other devices on the RC2014 bus.

Software in ROM

In order for a computer to do anything useful, it needs some program code to execute. Even reading a program from a disk drive requires program code to perform that read. Thus a computer needs some program code permanently available to execute when it is first switched on. This is the function of the ROM chip.

The SC114 motherboard has been designed to have the Small Computer Monitor installed in the ROM chip, although any compatible code can be used instead. Currently the recommended version of the Small Computer Monitor for this board is v1.0 configuration S2. This is available as both source code and HEX file from www.scc.me.uk as part of the Small Computer Workshop download. The hex file is in the folder: SCWorkshop\SCMonitor\Builds

This ROM contains a capable machine code monitor, a version of BASIC and a CP/M loader.

Monitor

The Monitor program provides a means of writing, entering, running and debugging machine code programs.

Documentation for the Monitor includes a tutorial, an installation guide, a user guide and a reference sheet.

BASIC

The version of BASIC included in the ROM is the one supplied with most RC2014 systems. Documentation can be found on-line with support available on the RC2014-Z80 google group.

CP/M

The ROM contains a CP/M loader, but not CP/M itself.

To run CP/M you need a Compact Flash module, such as the official RC2014 Compact Flash module, and a prepared Compact Flash card (with CP/M installed on it).

The version of CP/M should be one of the versions produced for the RC2014. As CP/M includes its own device drivers, it is necessary to pick a version that matches the hardware you have.

In this case the recommended version of CP/M is supplied as part of the Small Computer Workshop download. Tools to prepare a Compact Flash card are also included.

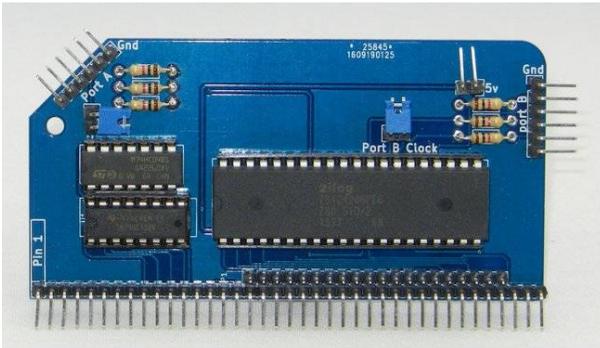
The recommended version of CP/M does not currently support the simple and slow software serial port built into the motherboard. This port is very BASIC and is really only there to get you started with the simplest possible hardware. It is recommended that you add a more capable serial port module, even if you are not using CP/M. However, if you want to use CP/M you must add a suitable serial module. Suitable modules are described below.

Serial Port Modules

There are a number of quite different serial port modules available for the RC2014 bus. It is recommended that a module be used which is based on a Z80 SIO chip and having addressing compatible with the official RC2014 SIO module. The following modules are suitable, but others may also be available.

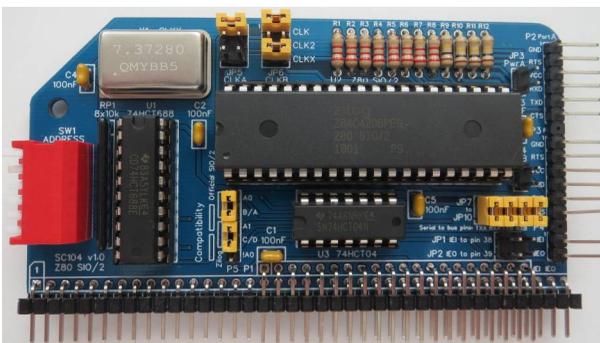
Official RC2014 SIO module

This is the simplest to build, but when used with this motherboard is really limited to only working at 115200 baud.



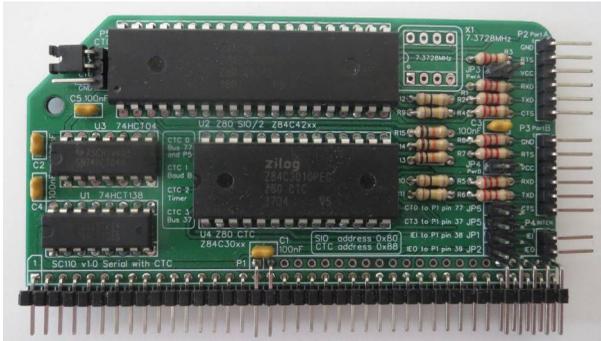
SC104 SIO module

This is the most flexible serial module, but is limited a little when used with this motherboard.



SC110 SIO+CTC module

This module includes a Z80 counter/timer (CTC) which allows the baud rate of one of the serial ports to be set in software. The CTC also provides counting and timing functions, which are free for use by any compatible software.



Other Modules

Below is a small selection of RC2014 compatible modules which can be added to the motherboard.

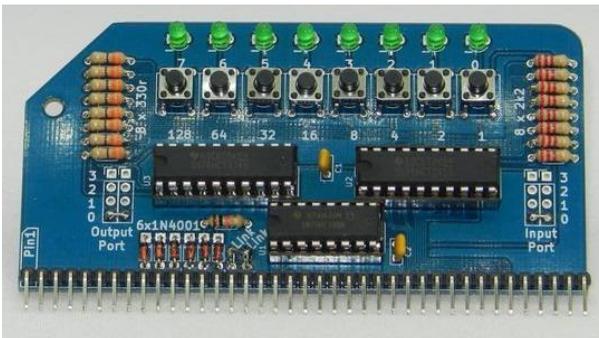
Compact Flash module

The official RC2014 Compact Flash module is the recommended way to add CP/M to the motherboard.



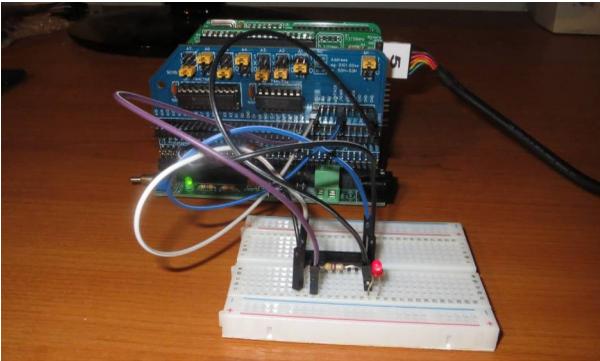
Digital I/O module

The official RC2014 digital I/O module provides a nice simple input and output device.



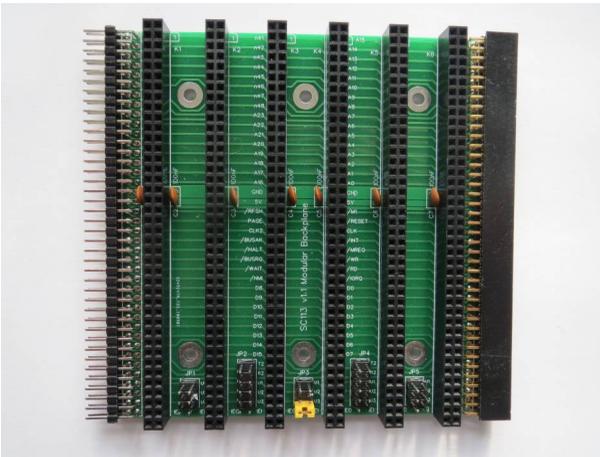
SC115 Prototyping Breakout module

This is a good way to breakout signals to a solderless breadboard.



SC113 Modular backplane

Plug in this backplane section to get 6 extra expansion sockets.



History

2018-10-15	v1.0	First circuit boards
2018-12-31	v1.0	This User Guide (e1.0.0) released
2018-12-31	v1.0	This Assembly Guide (e1.0.0) released

Contact Information

If you wish to contact me regarding this document, or the hardware and software it relates to, use the contact page at www.scc.me.uk

Stephen C Cousins, Chelmsford, Essex, United Kingdom.

RC2014 information

Information about the RC2014 system can be found at www.rc2014.co.uk

RC2014 support

Issues related to the RC2014 can be posted on the google group "RC2014-Z80".

RC2014 supplies

Parts can be purchased through Tindie at www.tindie.com (search "RC2014")

Official RC2014 parts are at:

<https://www.tindie.com/stores/Semachthemonkey/>