RC2014

Classic][soldering kit assembly and user guide

Introduction

The RC2014 Classic][is a modular Z80 based retro computer kit. It consists of individual modules for the Z80 CPU, 32k RAM, 8k banked ROM, serial I/O and 7.3728MHz clock, all connected via a passive backplane. This arrangement allows programming in either BASIC or Z80 Assembly Language through a terminal emulator. Many other expansion modules designed for the RC2014 can be used in the spare expansion slots, and the standard modules can be swapped out for different spec modules. The Classic][is based on the original RC2014 Classic but with enhanced features such as standardised module sizes, easier assembly, and improved electrical design.

> Full schematic available at
>   https://rc2014.co.uk
> or last page if viewing
> this doc digitally
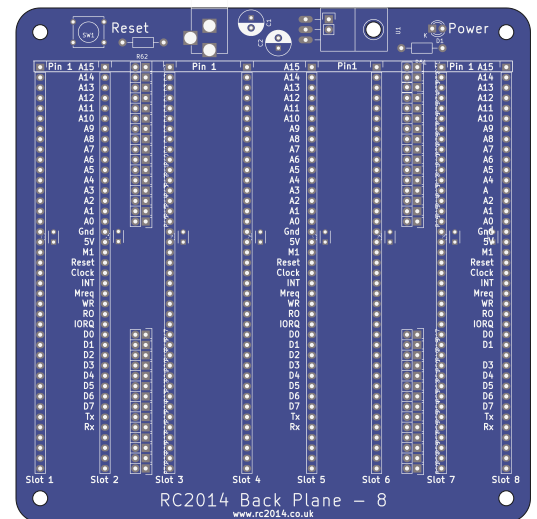
Kit's content

There are six PCBs in the package, one 'backplane' and five modules. These are the components included in the kit:

x8 40-pin SIL socket
x5 40-pin right-angle header
x1 6-pin right-angle header
x1 11-pin header
x1 40-pin DIL socket
x2 28-pin DIL socket
x1 24-pin DIL socket
x5 14-pin DIL socket
x1 Z80 CPU
x1 62256 RAM
x1 27C512 EPROM BASIC
x1 MC68B50
x3 74HCT04
x2 74HCT32

x1 3.3KΩ resistor
x2 2.2KΩ resistor
x1 330Ω resistor
x4 1KΩ resistor
x1 1MΩ resitor
x2 22pF ceramic capacitor
x17 100nF ceramic capacitor
x1 7.3728 MHz crystal
x4 blue jumpers
x1 2.1mm power jack
x1 3mm green LED
x1 pushbutton
x1 right-angle pushbutton
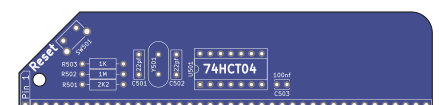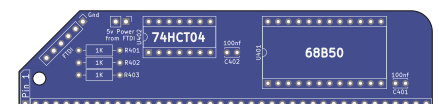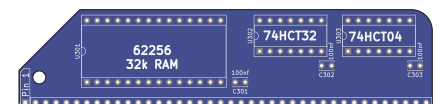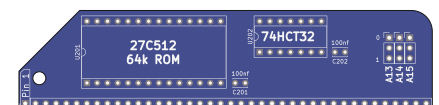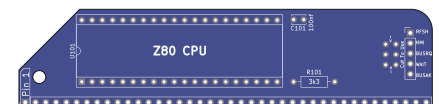
> Resistors, crystals, and ceramic capacitors have no 'polarity'. That is, they can be soldered in any direction. Pay attention to polarity for LEDs, diodes, and electrolytic capacitors that normally have an indication on the soldering direction
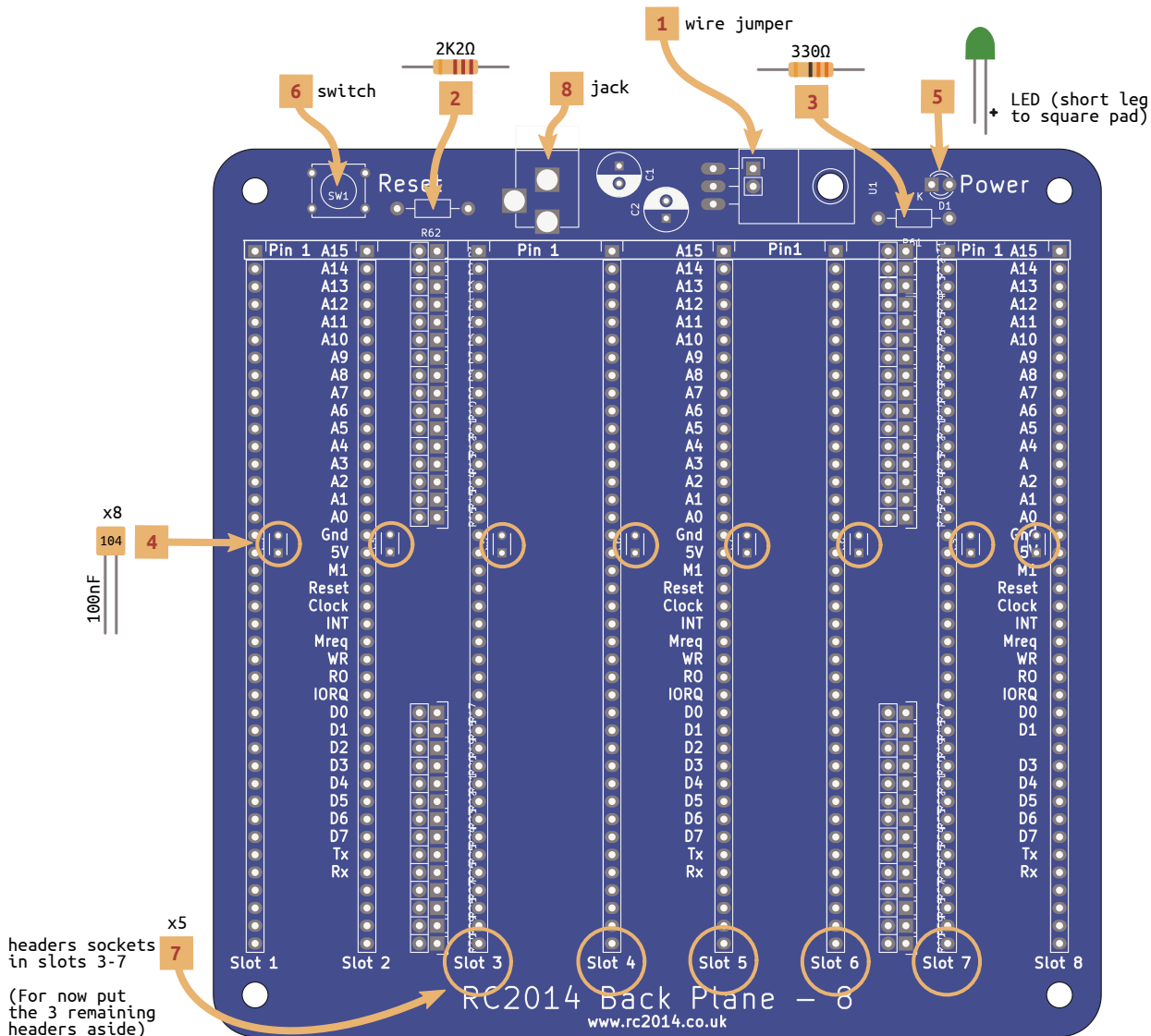
Assembly

When soldering and building this project use all appropriate safety equipment. We also recommend using ESD protection in order to not damage the components.

Pay attention to solder the components on the 'component side' of the PCB

We start with the backplane. Place the components on the face of the board shown below. Use the height of the components as a rough guide for assembly order; this order is indicated inside of the square base of the arrows.

1 wire jumper

6 switch

2 2K2Ω

8 jack

3 330Ω

5 LED (short leg to square pad)

4 x8 104 100nF

7 headers sockets in slots 3-7 x5

(For now put the 3 remaining headers aside)

Backplane — component side

The input voltage is 5V center positive through the jack. For higher input voltage use a fixed 5V regulator in U1 — *put insulating tape on top of the jumper to avoid shorts* — and populate C1 and C2 appropriately.
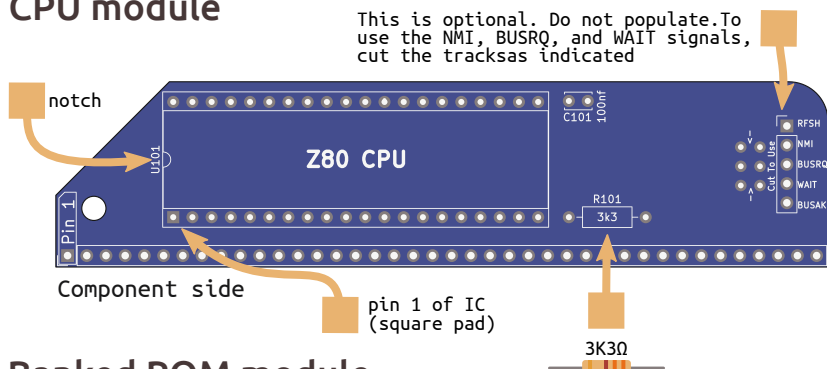
In order to use slots 1 & 2, bridge the two 2 sets of isolation pads between them (square pad jumped to the round pad on its left). We'll use Slot 7 for the Clock & Reset module which doesn't require any bridging, but if you want to fully use slots 7 & 8 you'll need to bridge those pads too.

For quick and easy bridging see rc2014.co.uk/1543/backplane-motherboard-lacing/

The values and types of components are indicated on the component-side of each module in silkscreen. We suggest that you solder the components in the following order: resistors, capacitors, sockets, switch/crystal, headers. Only then plug the ICs into sockets. Below are module-specific notes.

CPU module

This is optional. Do not populate.To use the NMI, BUSRQ, and WAIT signals, cut the tracksas indicated

notch

Z80 CPU

C101 100nf

U101

R101
3k3

RFSH
NMI
BUSRQ
WAIT
BUSAK

Cut To Use

Pin 1

Component side

pin 1 of IC (square pad)

3K3Ω

> When placing sockets, match the notch on one of the narrow sides to the notch indicated by the outline on the board

Banked ROM module

27C512
64k ROM

74HCT32

U202

U201

100nf
C202

100nf
C201

0

1

A13
A14
A15

Pin 1

Component side

When placing the ICs in the sockets, make sure that the notch on one of the narrow sides matches the notch on the component's silkscreen outline
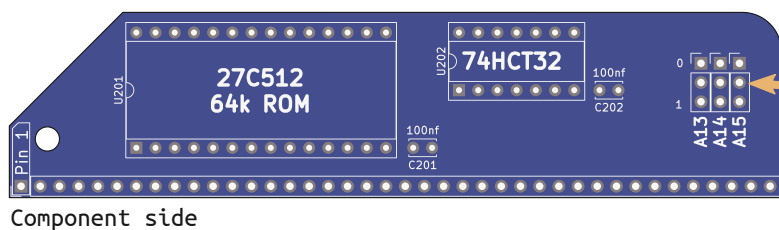
Cut the 11-pin header into 3 3-pin segments and solder them here. Put the 2-pin remainder to one side for now.
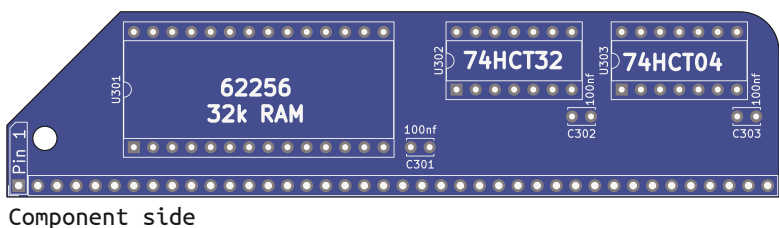
Using the 3 blue jumpers to set to these modes:
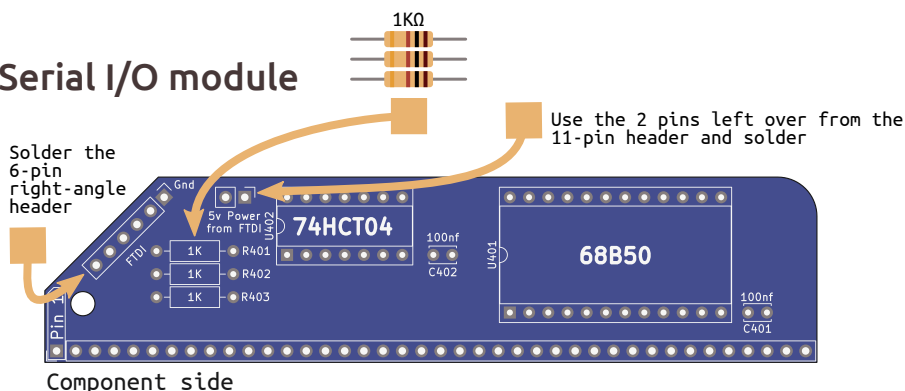
000: boot to BASIC
111: boot to ROM monitor

The remaining settings are blank on this ROM.
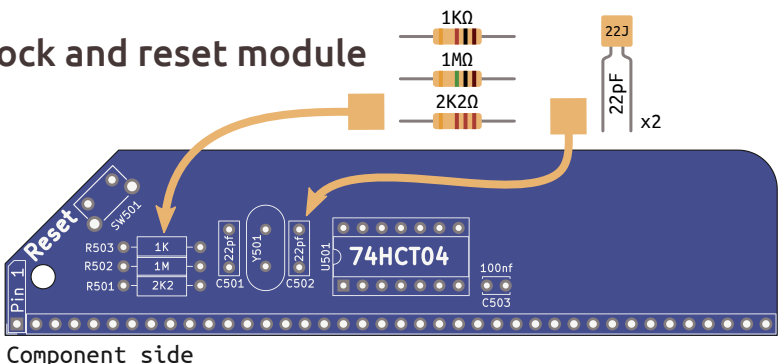
Use 000 for the example in the next page.

RAM module

62256
32k RAM

74HCT32

74HCT04

U301

U302

U303

100nf
C302

100nf
C303

100nf
C301

Pin 1

Component side

Serial I/O module

1KΩ

Use the 2 pins left over from the 11-pin header and solder

Solder the 6-pin right-angle header

Gnd

5v Power from FTDI

U402

74HCT04

100nf
C402

U401

68B50

FTDI

1K R401
1K R402
1K R403

100nf
C401

Pin 1

Component side

Clock and reset module

1KΩ

1MΩ

2K2Ω

22J

22pF

x2

Reset

SW501

R503 1K
R502 1M
R501 2K2

22pf
C501

Y501

22pf
C502

U501

74HCT04

100nf
C503

Pin 1

Component side

> The ROM has a sticker on it indicating what firmware was loaded onto it. Decoding information is here:
>
> https://rc2014.co.uk/1515/decoding-rom-labels

Now that we have the backplane and modules soldered, let's connect them. But first it's a good idea to inspect all the PCBs for shorts, bad solder joints, and check that the ICs were inserted in the right orientation (notch-to-notch). Then, **carefully insert the 'Clock & Reset' module into slot 7**. The 'Pin 1' marking on the module should be next to 'Pin 1' marking on the backplane. Insert the CPU, ROM, RAM and serial I/O modules in to slot 3 - 6 respectively.

First power-up!

For power either use the jack with 5V or power via the FTDI cable by putting a jumper on the 2-pin header of the Serial I/O module. When power is applied, the green LED should turn on.

Now connect the FTDI cable, matching the colours on the solder side of the Serial I/O module.

When connecting the FTDI cable, match the colours or ground to get the right orientation

Solder side

When inserting the module into the backplane match the module's 'cut corner' and 'Pin 1' to the backplane's 'Pin 1' of each slot

Never power the Classic][from both the power jack and the FTDI cable!

Connect the FTDI cable to a computer and launch your favourite terminal emulator (putty, minicom, tera term etc.). Set the appropriate port to 115200bps and 8-N-1. Press either reset button — they're equivalent — and you should get the following on your screen:

```
Z80 SBC By Grant Searle

Cold or warm start (C or W)? C

Memory top?
Z80 BASIC Ver 4.7b
Copyright (C) 1978 by Microsoft
32382 Bytes free
Ok
10 for a=1 to 5
20 print "RC2014 is cool"
30 next a
run
```

Press C

Press ENTER

Start typing BASIC :)
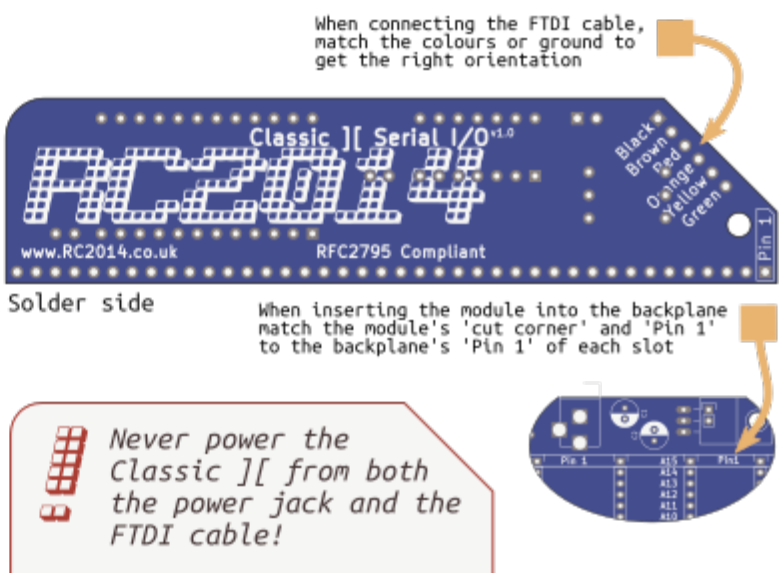
Official FTDI colours are
* Black   GND
* Brown   CTS
* Red   VCC
* Orange   TXD
* Yellow   RXD
* Green   CTS
You may need to match the signals if you have different colours

Troubleshooting

Check if power is applied correctly (5V and LED is on). Check that the correct ICs are pluged into their respective sockets and that they are in correct orientation. Check the orientation of the FTDI cable and port settings. Try presseing the pushbutton again; does anything appear on the screen? Additional help is at rc2014.co.uk/troubleshooting/
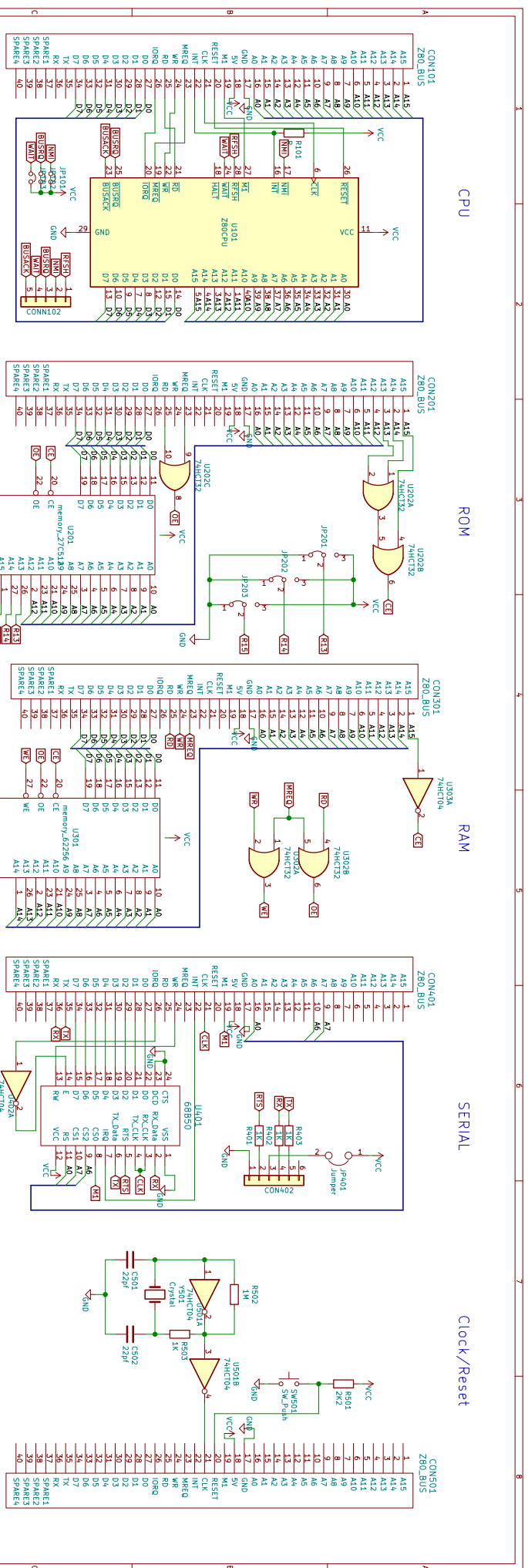
CPU

ROM

RAM

SERIAL

Clock/Reset
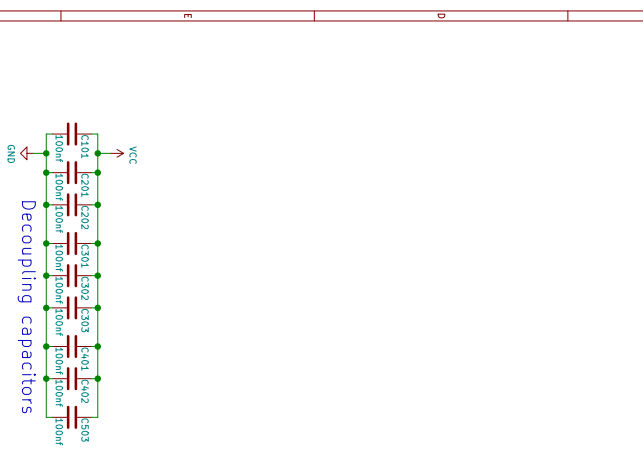
Decoupling capacitors
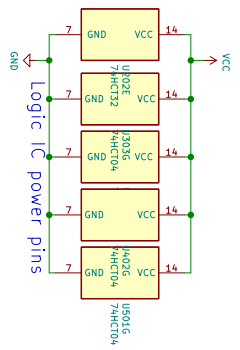
Logic IC power pins

Unused logic gates