

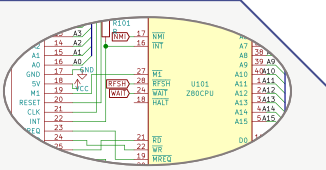
Introduction

The RC2014 Mini II CP/M Upgrade Kit transforms a standard RC2014 Mini II into a CP/M machine with 64k of RAM, pageable ROM, compact flash storage and even adds an expansion slot too.

As the Operating System of choice before the IBM PC and MSDOS took the lead, there is a wealth of CP/M software available from programming languages such as Pascal or BBC BASIC to office productivity tools like Wordstar and dBase II, games including Zork or Hitchhikers Guide To The Galaxy, and lots more.



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



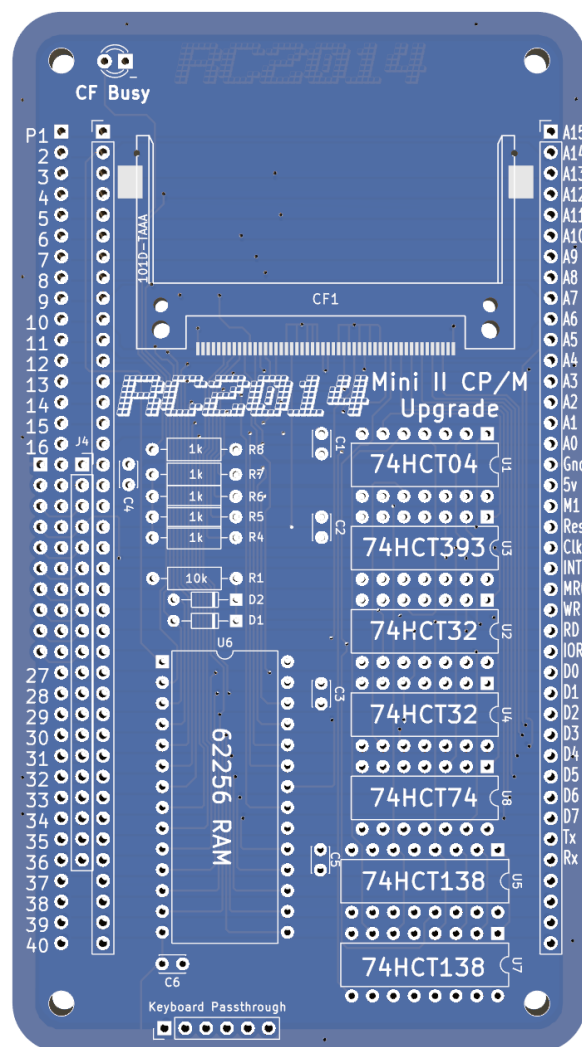
Kit's content

The contents of the kit are supplied in several packages grouped into similar components

- | | |
|------------------------------|------------------------|
| 1 x RC2014 Mini II CPM PCB | 1 x green 3mm LED |
| 1 x Compact Flash socket | 2 x 1N4148 |
| 1 x 28 pin wide DIL socket | 5 x 1k resistor |
| 2 x 16 pin narrow DIL socket | 1 x 10k resistor |
| 5 x 14 pin narrow DIL socket | 6 x 100nf |
| 2 x 40 way SIL socket | 1 x 74HCT04 |
| 1 x 20 way SIL socket | 1 x 74HCT393 |
| 1 x 40 pin header | 2 x 74HCT32 |
| 1 x 10 pin header | 1 x 74HCT74 |
| 1 x 6 pin long socket | 2 x 74HCT138 |
| 4 x M3 nylon 11.13 spacer | 1 x 62256 RAM |
| 4 x M3 nylon nut | 1 x Compact Flash card |
| 4 x M3 nylon 20mm | |

Optionally if your kit was ordered with a laser cut enclosure, it will also include

- 1 x laser cut top plate
- 1 x laser cut lower bumper
- 4 x 10mm M3 threaded spacers
- 4 x 6mm M3 screws



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



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

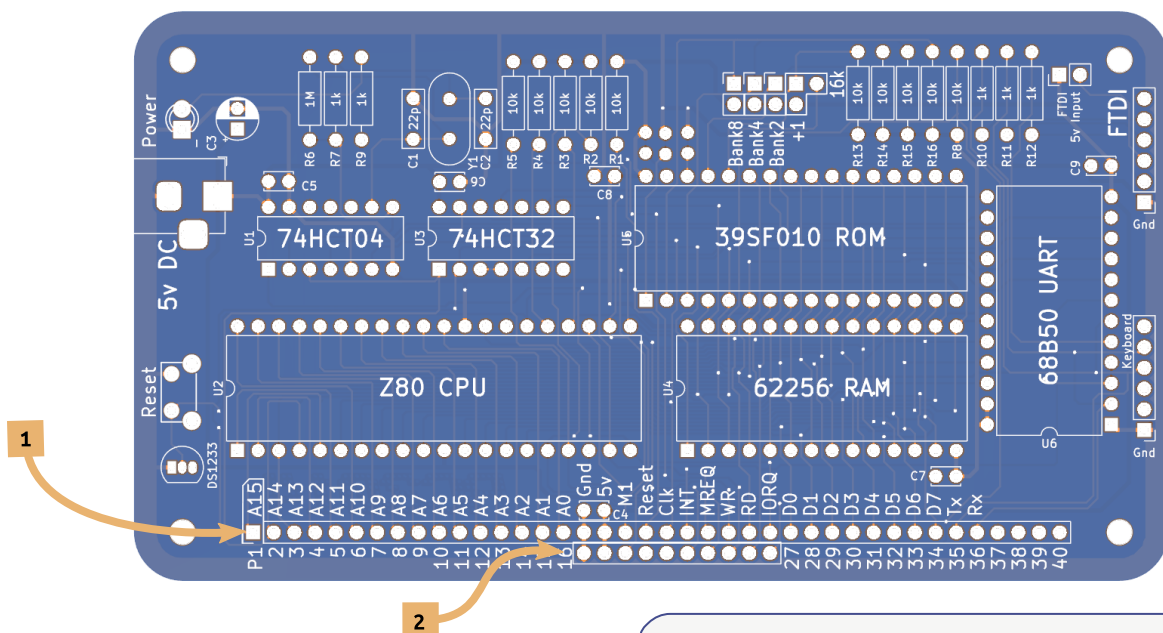
Preparation

If you haven't built your RC2014 Mini II, then do this first. A working RC2014 Mini II is an important prerequisite for this upgrade kit. It also helps if you are familiar with how to use it.



Don't worry if you used a 40 way pin header on your RC2014 Mini II. Simply use a SIL socket on the CP/M Upgrade Kit instead of pins when mentioned later in this guide

1. If you didn't attach the 40 way SIL socket that came with your Mini kit when you built it, do this now.



2. Also attach the 10 way SIL socket for the Enhanced Bus signals. This includes the /Page signal which is required to run CP/M.



Use a couple of spare header pins pushed into the 40 way and 10 way sockets so that they are parallel and the correct distance apart



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

Assembly

Assembly of the CP/M Upgrade Kit follows pretty much the same pattern as with the RC2014 Mini II. The values and types of components are indicated on the PCB silkscreen. We suggest you start with the lowest components, resistors and diodes, then work up through capacitors, LED and IC sockets. However, **do not solder any headers at this stage.**



Do not solder the header on the top of the PCB until the end of the build

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

LED (short leg to square pad)

CF Busy

CF1

Mini II CP/M Upgrade

74HCT04 U1

74HCT32 U2

74HCT32 U4

74HCT74 U8

74HCT138 U5

74HCT138 U7

62256 RAM U6

Key Card Passthrough

100nF

1KΩ x 5

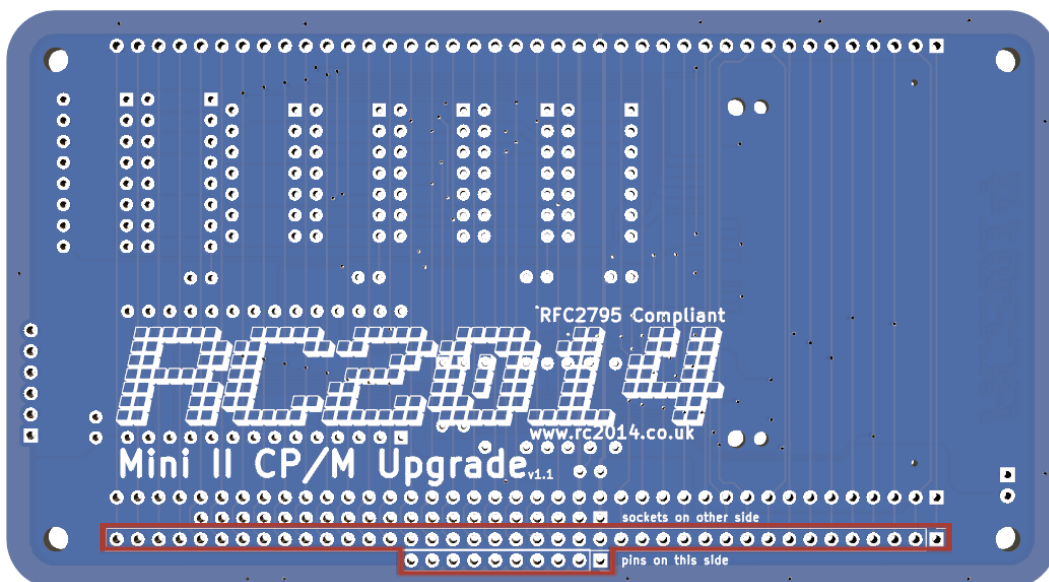
10KΩ

1N4148

brown, black, red

Brown, black, orange

When all of the components are in place, it is time to solder the pin headers that connect the CP/M Upgrade Kit to the RC2014 Mini II. In order to ensure correct alignment, push the 40 pin header into the 40 way SIL socket and the 10 pin header into the 10 way SIL socket on the Mini II, then place the CP/M Upgrade Kit on top of the pins, ensuring they line up with the **inner row of holes** and pin 1 matches. Use the screws and spacers to make sure the two PCBs are aligned and parallel, then solder all 50 pins on the upper side of the CP/M Upgrade Kit.



Once the header pins are soldered, you can remove the CP/M Upgrade Kit from the RC2014 Mini II. Check that you are happy with your soldering before moving on.



If you wish to use the RC2014 Micro Keyboard, then you can fit the 6 way long socket through the Keyboard Passthrough pads on the CP/M Upgrade Kit. Note that there is no electrical connection to the CP/M Upgrade Kit, but soldering the header gives mechanical rigidity



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

If you wish to expand your RC2014 Mini II CP/M machine with other RC2014 modules, you can fit the 2 40 way SIL sockets and the 1 20 way SIL socket on the top side of the board now.

RC2014 Enhanced Bus modules need to pug into the 40+20 socket.



The 20 pin Enhanced Bus connector only carries the extra CPU signals. There is no Tx2 or Rx2 signals due to the RC2014 only having a single serial port

Now that we have everything soldered, let's connect the CP/M Upgrade Kit to the RC2014 Mini. 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 Upgrade Kit into the expansion slot on the Mini**. The 'Pin 1' marking on both boards should line up. Slide the compact flash card in to the slot with the label facing upwards.

ROM Selection

The ROM supplied with the RC2014 Mini II includes CP/M in the 16k Bank 2 and Bank 3. You can boot to either of these banks with the following jumper settings



16k Bank 2 CP/M* (Grant Searle)



16k Bank 3 SCM R4 inc BASIC and CP/M* (Steven Cousins)

You can also boot to any of the other ROM images on the RC2014 Mini II, for example, Microsoft BASIC on Bank 0. See the Mini II documentation for the full list. Please note that the compact flash and full 64k of RAM is only accessible from CP/M.



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>

First power-up!

For power either use the jack with 5V or use the FTDI cable by putting a jumper on the 2-pin FTDI Power header of the RC2014 Mini II. When power is applied the green LED on the Mini PCB will turn on.

Now connect the FTDI cable, matching the black cable to the Gnd pin on the FTDI header.

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 the reset button and you should get a welcome screen.



Never power the RC2014 Mini from both the power jack and the FTDI cable!



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

8k Bank 0 - Microsoft BASIC

This is an enhanced version of Microsoft BASIC that was originally written for the Nascom 2. For links to the manual and to the enhancements see the RC2014 website.

```
RC2014 - MS Basic Loader
z88dk - feilipu
Cold | Warm start (C|W) ? C

Memory top?
Z80 BASIC Ver 4.7c
Copyright (C) 1978 by Microsoft
31948 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 :)

16k Bank 3 - SCM R4

Type ?
for list
of options

Small Computer Monitor - RC2014

*?

Small Computer Monitor by Stephen C Cousins (www.scc.me.uk)
Version 1.0.0 configuration R4 for Z80 based RC2014 systems

Monitor commands:

A [<address>] = Assemble
M [<address>] = Memory display
R [<name>] = Registers/edit
B [<address>] = Breakpoint
I <port> = Input from port
G [<address>] = Go to program

D [<address>] = Disassemble
E [<address>] = Edit memory
F [<name>] = Flags/edit
S [<address>] = Single step
O <port> <data> = Output to port

BAUD <device> <rate>

CONSOLE <device>

FILL <start> <end> <byte>

API <function> [<A>] [<DE>]

DEVICES, DIR, HELP, RESET

BASIC Grant Searle's adaptation of Microsoft BASIC

WBASIC Warm start BASIC (retains BASIC program)

CPM Load CP/M from Compact Flash (requires prepared CF card)

*cpm

Z80 CP/M BIOS 1.0 by G. Searle 2007-13

RC2014 port by Mitch Lalovic 2017

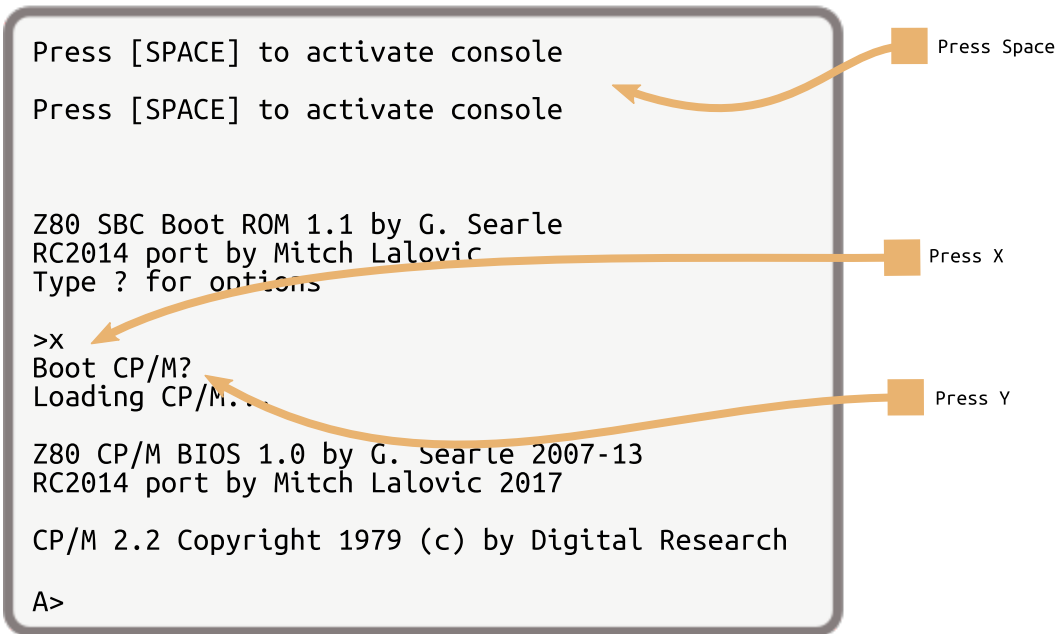
CP/M 2.2 Copyright 1979 (c) by Digital Research

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Note that
BASIC,
WBASIC
and CPM
are all
available
options

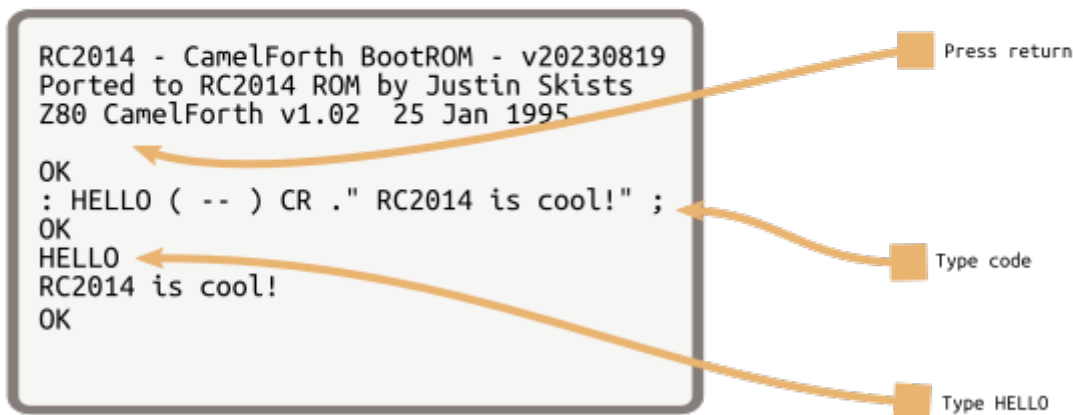
Type cpm
if you want
to boot
into CP/M
Alternatively
you can boot
BASIC, use
the Z80 monitor
or upload an
intel hex file

Bank 2 - CP/M 2.2



The compact flash card supplied with this kit includes CP/M 2.2 along with transient applications. For full details, including transferring new files, see rc2014.co.uk

8k Bank 8 - CamelForth



Troubleshooting

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

