3-slot Backplane For RC2014

User Guide

For module: SC116 version 1.0
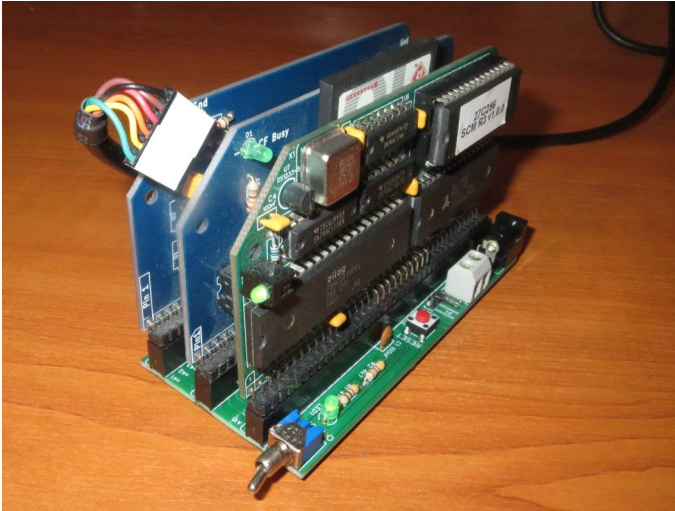
Design and Documentation by Stephen C Cousins   Edition 1.0.1, 2019-03-05
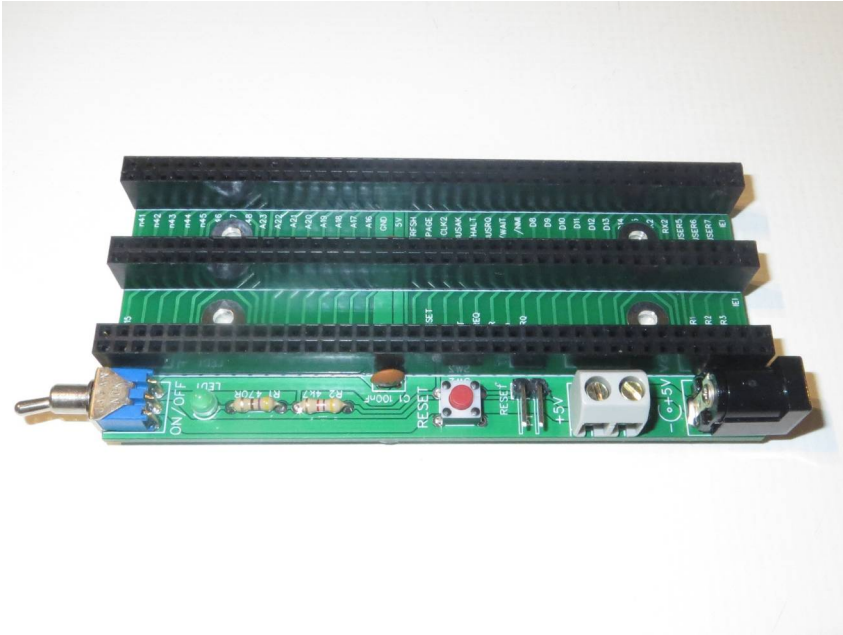
CONTENTS

Overview

A three slot backplane is all that is required for a minimal RC2014 system.

The picture below shows a CP/M system made from:
- SC108 - Z80 CPU, RAM & ROM module
- RC2014 Compact Flash module
- RC2014 Dual Serial module (other suitable serial modules are available)

This backplane has three RC2014 (80 pin) card sockets and a power supply input.
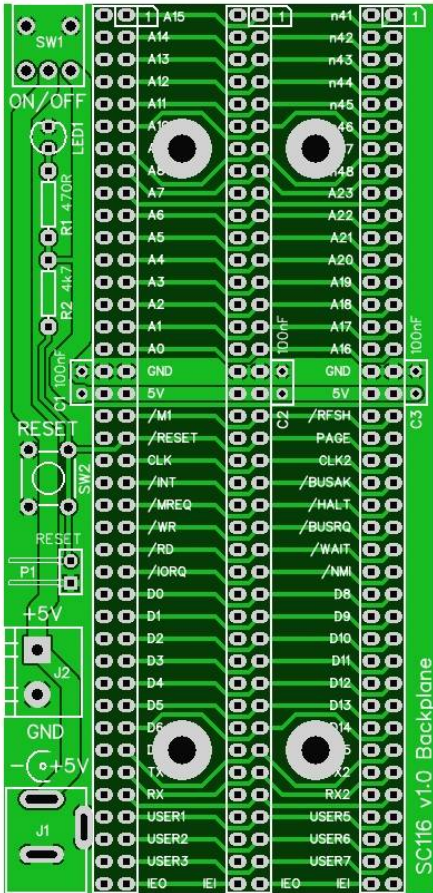

Pin 40 of the standard RC2014 bus is used for the Z80 interrupt daisy chain signal IEO, with the 40th pin of the enhanced bus, sometimes called pin 80, being used for the IEI signal. These two pins therefore do not connect to all 3 sockets in parallel, but instead link pin 40 of one socket to pin 80 of the next, forming a chain.
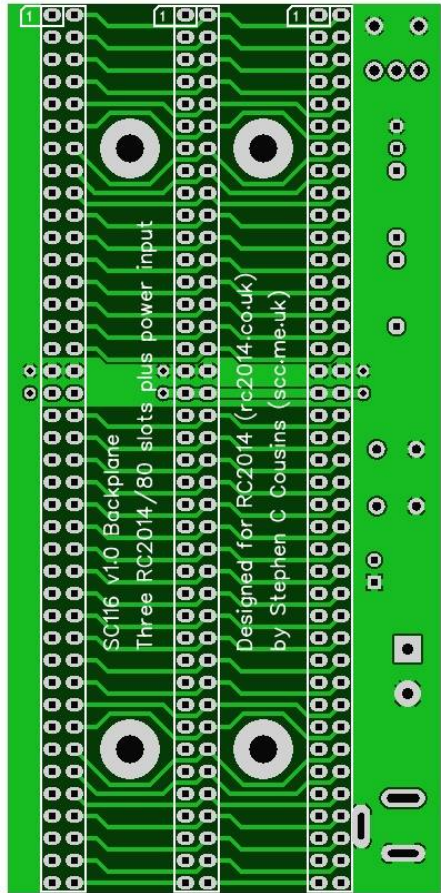
Printed Circuit Board

The printed circuit board is 101.6 mm by 49.5 mm (4.00 inches by 1.95 inches).
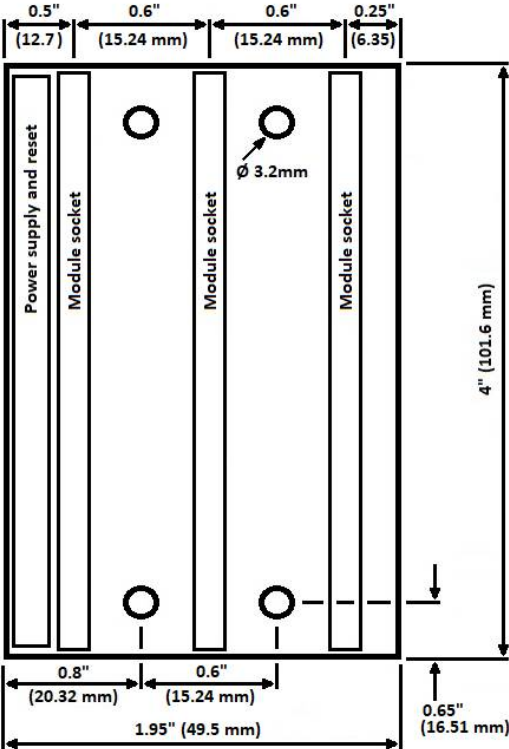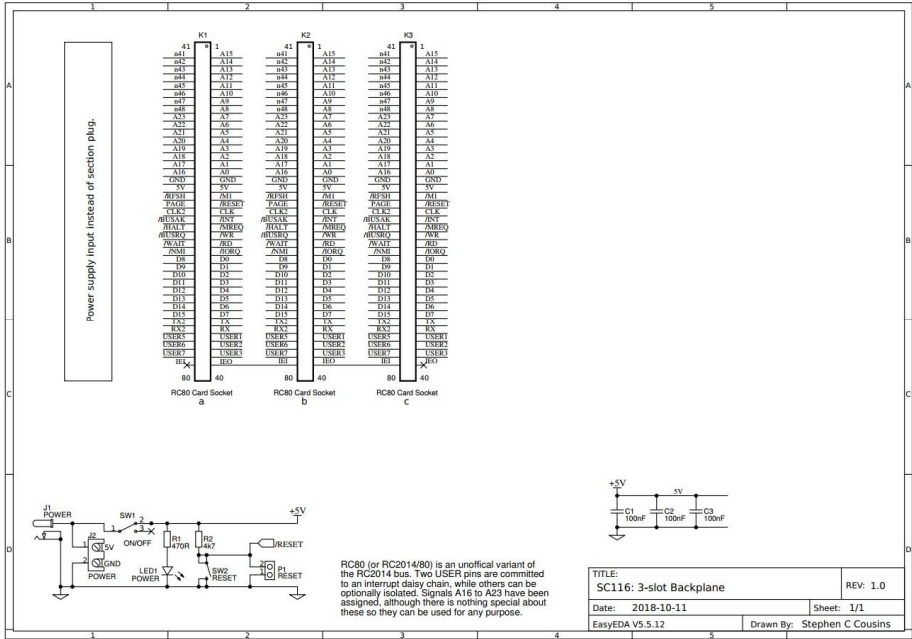
Circuit board, top/component side   Circuit board, bottom/solder side

The circuit board's layout and dimensions are shown below.

Schematic

A high quality version of the schematic is available as a separate PDF.

Errata

None yet.

What You Need

The following components are required to assemble the module with its full functionality and jumper options. Header pins P1, may need to be cut from longer strips.

Image	Qty	Reference	Description
	1	PCB	Printed circuit board SC116 Backplane with PSU
	7	C1 to C3	Capacitor 100nF, ceramic, lead spacing = 2.54mm
	1	P1	Pin header, male, 1 row x 2 pins, angled
	3	K1 to K3	Pin header, socket, 2 rows x 40 pins, straight
	1	R1	Resistor 470R, axial, 5%, carbon film, 0.25W or 0.125W
	2	R2	Resistor 4k7, axial, 5%, carbon film, 0.25W or 0.125W
	1	LED1	LED, green, 3mm
	1	SW1	Switch, tactile toggle, sub-miniature, SPDT
	1	SW2	Switch, tactile button
	1	J1	Socket, power, barrel, 2.1mm
	1	J2	Screw terminal, 2 way, 5.08mm pitch

Also required to assemble the module from the above components:
- Long nose pliers
- Side cutters
- Soldering iron

- Solder
- PCB cleaning materials

Components: What They Do & Where To Get Them

Each component is described below. I have listed multiple sources for most components, but have not actually tried all of them, so best treat the specified part numbers as guidance only. Where eBay is listed as a supplier, the part is likely to be cheaper there than the other sources, sometimes considerably cheaper. Further savings are usually possible by ordering parts direct from countries like China.

PCB

Image	Qty	Reference	Description
	1	PCB	Printed circuit board SC116 Backplane with PSU
		Supplier	Part number
		EasyEDA	Search EasyEDA.com for RC2014 Backplane
		Tindie	Search Tindie for SC116 or RC2014 Backplane

The PCB is currently only available to be ordered from EasyEDA.com, although you can download the Gerber and send it to your preferred manufacturer.

C1 to C3

Image	Qty	Reference	Description
	3	C1 to C3	Capacitor 100nF, ceramic, lead spacing = 2.54mm
		Supplier	Part number
		Farnell	1100533
		Mouser	75-1C10Z5U104M050R
		RS	699-5027

These capacitors provide power supply decoupling (or bypass). The fast switching in digital circuits creates spikes on the power supply lines which are suppressed with decoupling capacitors placed at key points on the circuit board.

P1

Image	Qty	Reference	Description
	1	P1	Pin header, male, 1 row x 2 pins, angled
		Supplier	Part number
		eBay	200906546562 (1x40 pin to be cut to length)
		Farnell	2356192 (1x40 pin to be cut to length)
		Mouser	710-61304011021 (1x40 pin to be cut to length)
		RS	156-077 (1x40 pin to be cut to length)

This header allows an external reset switch to be connected to the backplane. Fitting this header is optional.

K1 to K3

Image	Qty	Reference	Description
	3	K1 to 3	Pin header, socket, 2 rows x 40 pins, straight
		Supplier	Part number
		eBay	200906546562 (from UK)
		eBay	362278235395 (from Hong Kong)
		Farnell	1807410 (very expensive)
		Mouser	200-BCS140LDTE (very expensive)
		RS	765-5859 (very expensive)

These connectors are the sockets into which RC2014 modules are plugged.

R1

Image	Qty	Reference	Description
	1	R1	Resistor 470R, axial, 5%, carbon film, 0.25W or 0.125W
		Supplier	Part number
		Farnell	9339531
		Mouser	603-CFR-25JR-52470R
		RS	707-7647

This is the current limit resistor for the power LED indicator. The value can be reduced to 330R if you want a really bright light, or increased to about 1k if you'd rather have a very dim light. If in doubt use the suggested value of 470R.

R2

Image	Qty	Reference	Description
	2	R2	Resistor 4k7, axial, 5%, carbon film, 0.25W or 0.125W
		Supplier	Part number
		Farnell	9339540
		Mouser	603-CFR-25JR-524K7
		RS	707-7726

This resistor pulls up the reset line when the reset switch is not being pressed.

LED1

Image	Qty	Reference	Description
	1	LED1	LED, green, 3mm
		Supplier	Part number
		Farnell	1581114
		Mouser	859-LTL-4231N
		RS	127-8401

Power to the backplane is indicated by this LED.

SW1

Image	Qty	Reference	Description
	1	SW1	Switch, tactile toggle, sub-miniature, SPDT
		Supplier	Part number
		eBay	361064456690
		Farnell	9574590
		Mouser	706-34CMSP12B2M6RT
		RS	734-7220

This switch turns on and off power from J1 or J2. It does not control power from other sources, such as FTDI style serial cables.

SW2

Image	Qty	Reference	Description
	1	SW2	Switch, tactile button
		Supplier	Part number
		Farnell	2468761 (red button)
		Mouser	612-TL1105BF100 (black button)
		RS	479-1413 (black button)

This is the reset switch, which pulls down the backplane's RESET signal.

J1 socket

Image	Qty	Reference	Description
	1	J1	Socket, power, barrel, 2.1mm
		Supplier	Part number
		Farnell	Could not find a matching part
		Mouser	163-179PH-EX
		RS	448-382

The barrel connector provides one means of connecting a regulated 5 volt DC supply to the backplane. The centre pin is positive.

J2 terminal

Image	Qty	Reference	Description
	1	J2	Screw terminal, 2 way, 5.08mm pitch
		Supplier	Part number
		Farnell	2859589 (green)
		Mouser	649-220316-H021B01LF (green)
		RS	146-8345 (green)
		RS	425-8720 (black)

The screw terminal connector provides one means of connecting a regulated 5 volt DC supply to the backplane.

The power supply must be regulated 5 volt D.C. ideally in the range of 4.9 to 5.1 volts. The components will tolerate up to 5.5 volts, but the nearer to 5.0 volts the better.

The power supply must be capable of delivering all the current the system requires without the voltage dropping. The current depends on factors such as how many modules are connected, but a modest system will typically use less than 250 mA.

Assembly Guide

This guide assumes you are familiar with assembling circuit boards, soldering and cleaning. If not, it is recommended you read some of the guides on the internet before continuing.

First check you have all the required components, as listed in the section "What You Need". Header pins P1, may need to be cut from longer strips.

Step 1

Fit and solder R1 (shown in red below).

Colour code for 470R resistor: Yellow, Violet, Brown
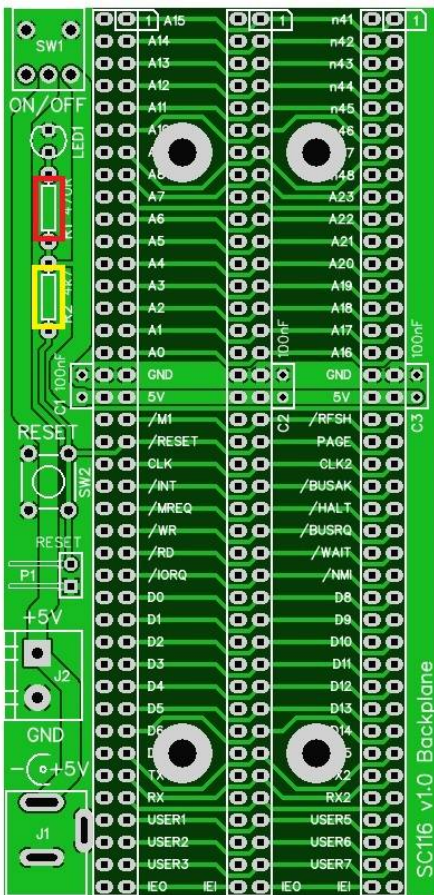

Fit and solder R2 (shown in yellow below).

Colour code for 4k7 resistor: Yellow, Violet, Red

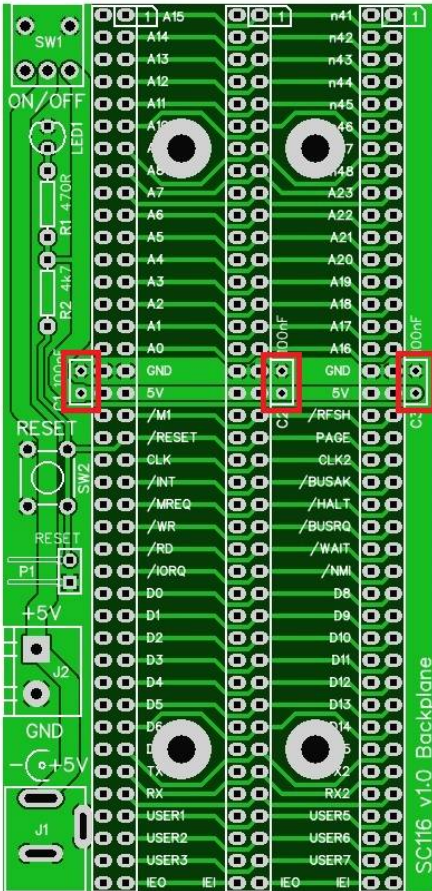These can be fitted either way round, as they are not polarity dependent.

Step 2

 Fit and solder capacitors C1 to C3.

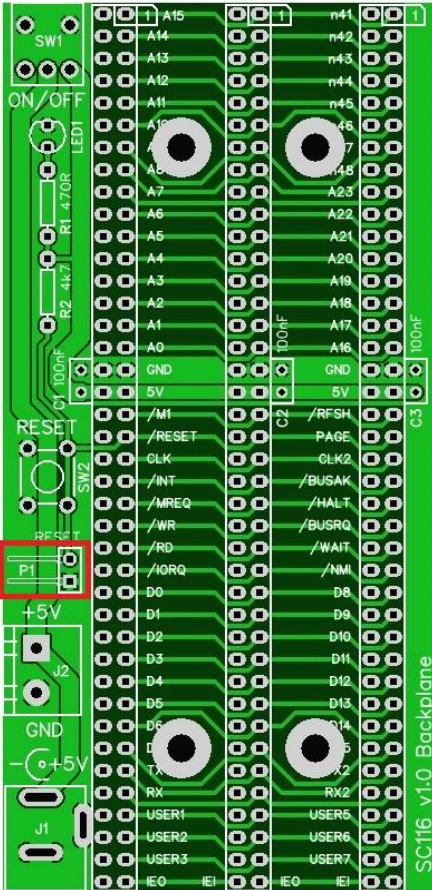These can be fitted either way round, as they are not polarity dependent.

Step 3

 Fit and solder P1.

This header allows an external reset switch to be connected to the backplane.

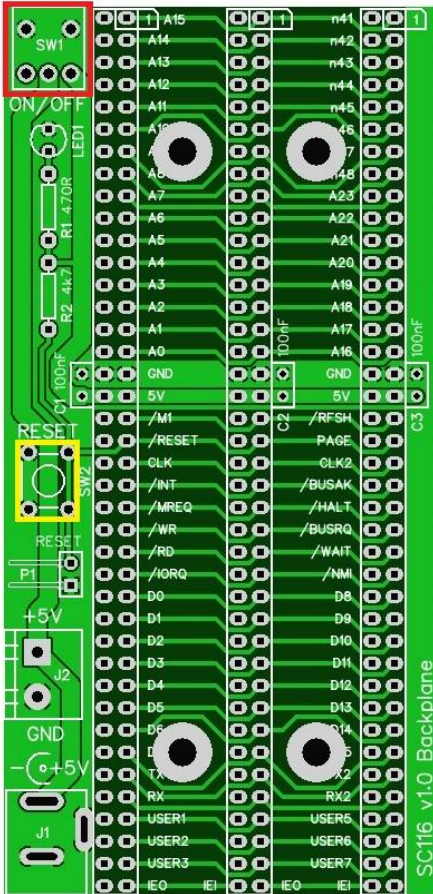Fitting this header is optional.

Step 4
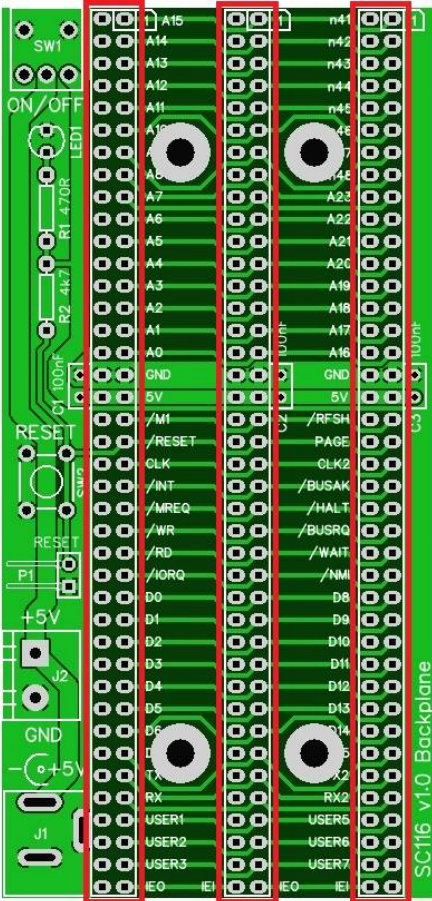

Fit and solder SW1 (shown in red below).

Fit and solder SW2 (shown in yellow below).

Step 5

Fit and solder K1 to K3.

Step 6

 Fit and solder LED1.

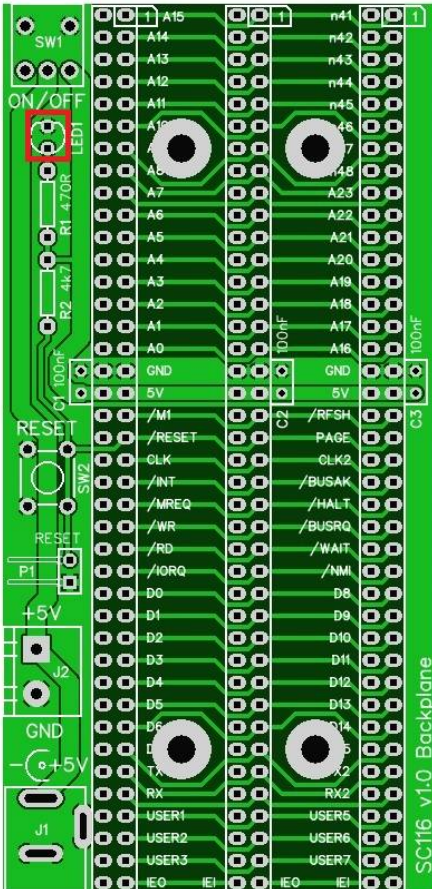It is important to fit this component the right way round. The cathode lead is usually shorter than the anode lead, and the cathode side is usually marked with a flat side on the plastic. The cathode is nearest the on/off switch (SW1).
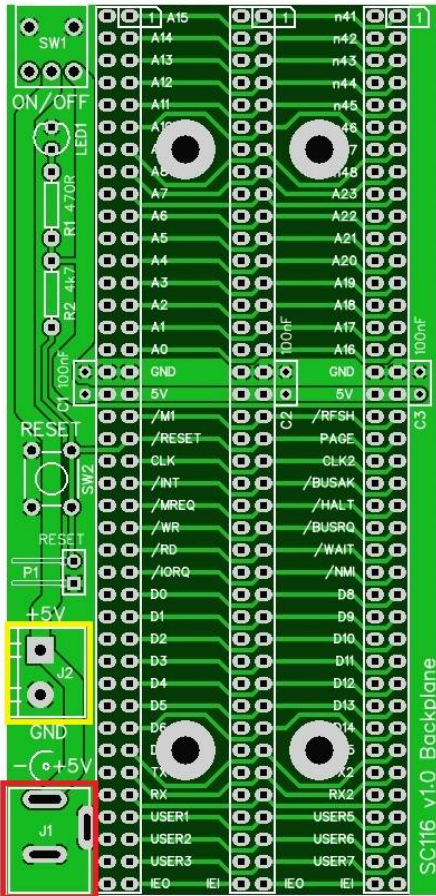
Step 7

Fit and solder J1 (shown in red below).

Fit and solder J2 (shown in yellow below).

J2 must be fitted with the wire access facing the edge of the board.

Step 8

Remove any solder 'splats' with a brush, such as an old toothbrush.

Visually inspect the soldering for dry joints and shorts.

Clean the flux off with suitable cleaning materials.

Visually inspect again.

Before fitting any RC2014 modules to the backplane, connect a regulated 5 volt DC power supply to either J1 or J2.
- Check the power LED lights when the ON/OFF switch is ON.
- Check the voltage on resistor R2, at the end nearest the reset switch, is at least 4.5 volts when the reset switch is not pressed, and drops to less than 0.4 volts when the reset switch is pressed.

If all is well, power down and plug in some RC2014 modules.

Purchasing the Printed Circuit Board

Currently the circuit board is available from Tindie and EasyEDA (in China), or more accurately from their production partner JLCPCB.

You can download Gerber files from EasyEDA and send them to your preferred manufacturer, but the following describes the ordering process through EasyEDA.

Browse to EasyEDA.com

Select the main menu item "Explore"

In the search box, enter "RC2014 SC116" or "sccousins"

Select, from the list shown, the project "SC116 v1.x Backplane with PSU"

The project's details should now be displayed.

Select "Open in Editor" (the button next to the circuit board illustration, not the one next to the schematic).

Select "Generate Fabrication File (Gerber)" to get a summary of the board details.

Select "Generate Gerber" to download the Gerber files or "Order at JLCPCB" to order the boards direct from JLCPCB. Selecting "Order at JLCPCB" requires you to log in (or create an account and log in).

Wait for the progress bar to complete.

You should now be presented with the image of each side of the board and the following options:

Layers	2	
Dimensions	102 x 50 mm	
PCB Qty	10	There is no saving selecting less than 10
PCB Thickness	1.6	
PCB Colour	Green	You may want to change this to Blue
Surface Finish	HASL	
Copper Weight	1 oz	
Gold Fingers	No	
Material Details	FR4-Standard Tg 140C	
Panel By JLCPCB	No	
Different Design	1	

Note, the price increases significantly if you select a colour other than green.

Select "Save to Cart"

Select "Checkout securely"

Enter your details and select your shipping options.

And finally complete the order.

History

2018-10-17   v1.0   First circuit boards
2019-03-05   e1.0.1   Revised this user guide
                          General improvements plus corrected some component
                          part numbers

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.

SC116 information

Information about this design can be found at www.scc.me.uk

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/