Small Computer Central

SC718 – RCBus Z80 CTC Module

SC718 is a Z80 CTC (Counter Timer Channels) module designed for the RCBus. It is provides a 4 channel timer, counter, frequency generator and Z80 mode 2 interrupt generator.

- SC718 – Assembly guide
- SC718 – Compatibility
- SC718 – Parts list
- SC718 – Printed circuit board
- SC718 – User guide
- SC700 series information (https://smallcomputercentral.com/rcbus/sc700-series/)
- SC700 series support (https://smallcomputercentral.com/support/)

Downloads

- SC718, v1.0, Kit contents sheet (PDF) (https://smallcomputercentral.com/wp-content/uploads/2023/05/sc718-kit-contents_v1.0.0_2023-05-21.pdf)
- SC718, v1.0, Schematic (PDF) (https://smallcomputercentral.com/wp-content/uploads/2023/05/sc718_v1.0.0_2023-05-07_17-05_schematic.pdf)
- SC718, v1.0, PCB design files (OSHWLab) (https://oshwlab.com/sccousins/sc718-v1-0-z80-ctc)
- SC718, v1.0, Gerber files (ZIP) (https://drive.google.com/file/d/1iMV7XFi3brl9GPoKNNAv8AMYV5CrytWN/view?usp=drive_link)

Errata

- PCB SC718 v1.0.0 has the wrong part number label for U2. Fixed in PCB v1.0.1

Suppliers

Kits	*Website*	*From*	*Currency*
Small Computers Direct	SCDirect (https://small-computers-direct.square.site/s/search?q=sc718)	UK	GBP
Stephen C Cousins	Tindie (https://www.tindie.com/search/?q=sc718)	UK	USD
Small Computer Central	Lectronz (https://lectronz.com/products/search?q=sc718)	UK	Euro/USD
PCBs	*Website*	*From*	*Currency*
Small Computers Direct	(https://small-computers-direct.square.site/s/search?q=sc733)SCDirect (https://small-computers-direct.square.site/s/search?q=sc718)	UK	GBP
Stephen C Cousins	Tindie (https://www.tindie.com/products/tindiescx/picknmix-boards-for-rcbus-80pin/)	UK	USD
Small Computer Central	Lectronz (https://lectronz.com/products/pick-n-mix-boards-for-rcbus-80pin)	UK	Euro/USD
Assembled and Tested	*Website*	*From*	*Currency*
Not available			
Components			
See parts list			

Small Computers Direct does not collect VAT for EU countries
Tindie does not collect VAT for EU countries
Lectronz does collect EU VAT for orders up to 150 EUR
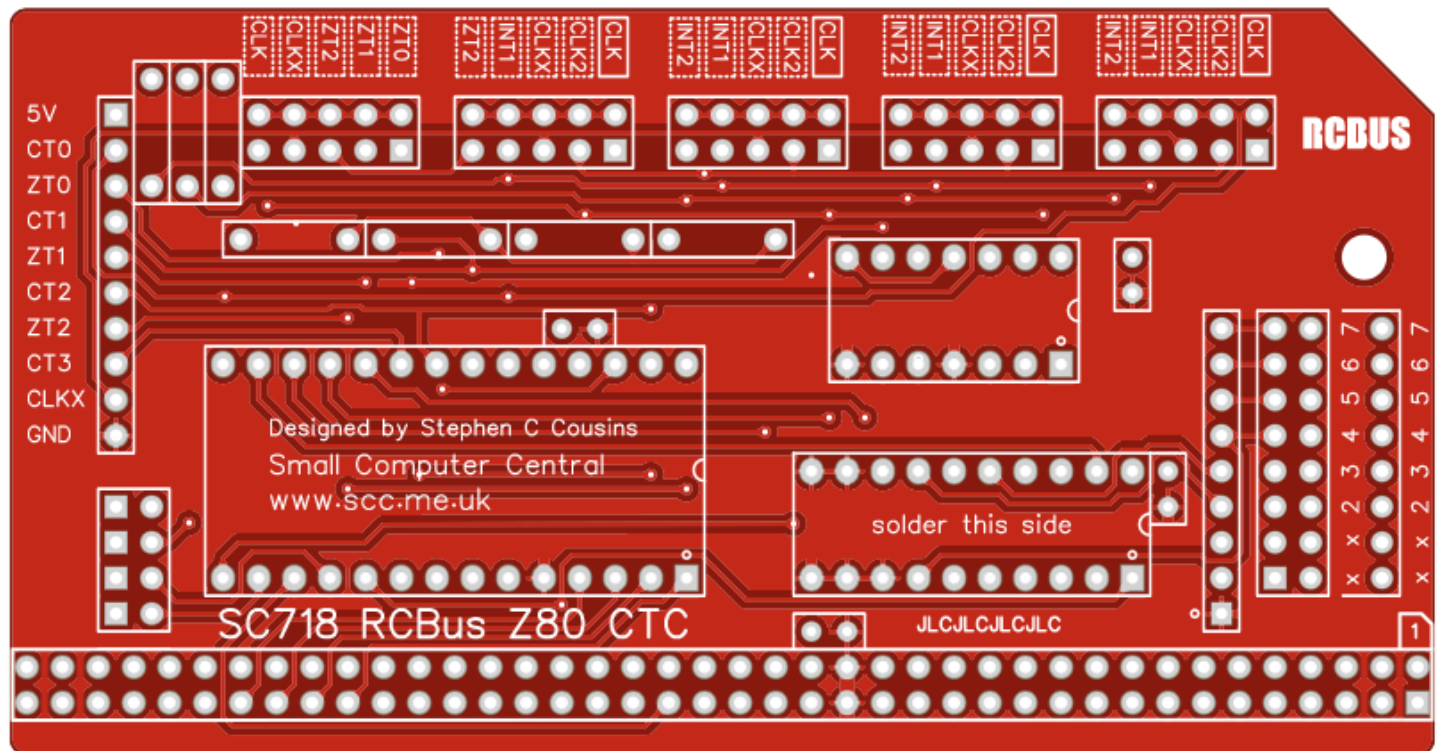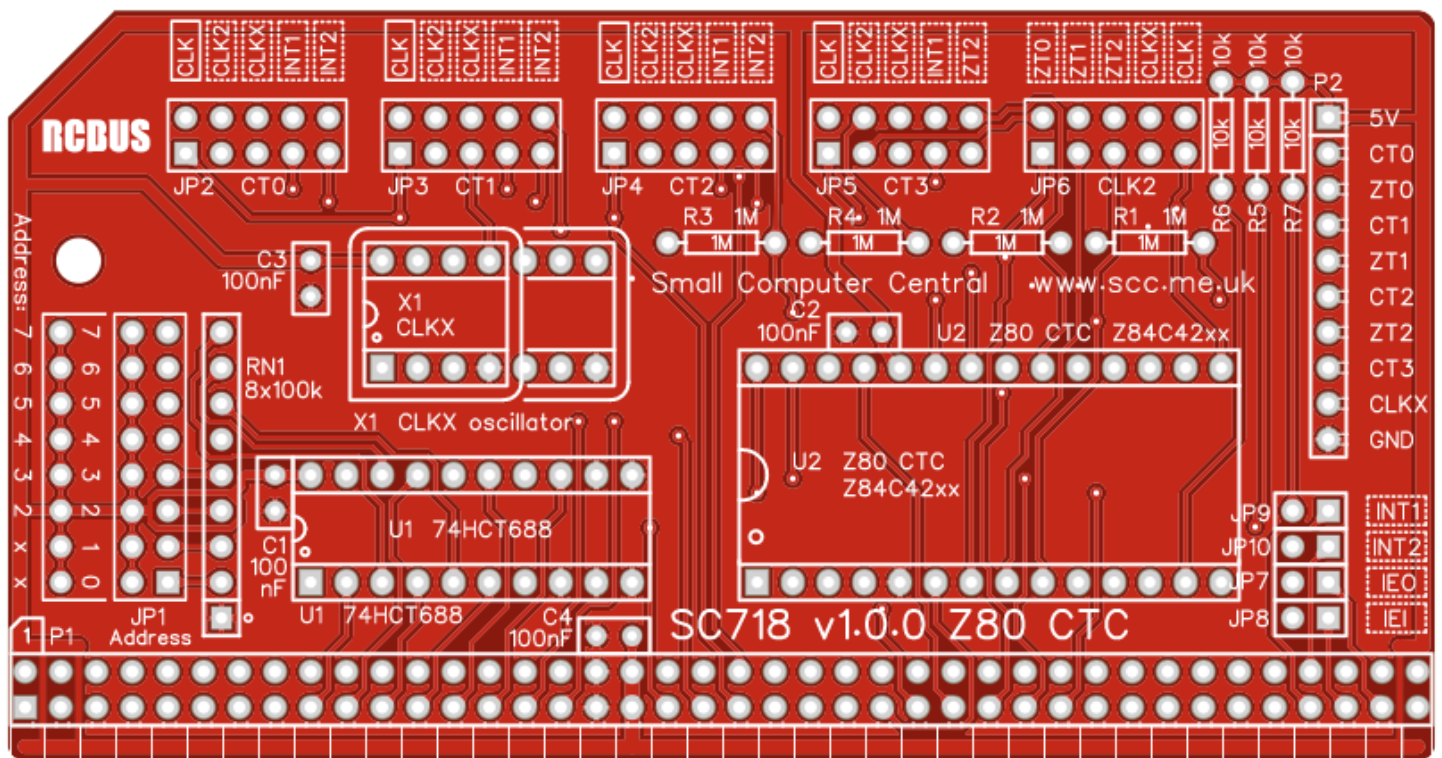
Parts List

Reference	*Qty*	*Component*
PCB	1	SC718, v1.0, PCB
C1 to C4	4	Capacitor, ceramic, 100 nF

JP1	1	Header, male, 2 row x 8 pin, angled
JP2+3+4+5+6	1	Header, male, 2 row x 29 pin, straight *2 (some pins need to be removed)
JP7+8+9+10	1	Header, male, 2 row x 4 pin, angled, or Header, male, 2 row x 4 pin, straight *1
Jumpers	15	Jumper shunts
P1	1	Header, male, 2 row x 40 pin, angled
P2	1	Header, male, 1 row x 10 pin, angled
R1 to R4	4	Resistor, 1M, 0.25W
R5 to R7	3	Resistor, 10k, 0.25W
RN1	1	Resistor network, 8x100k, SIL, 9-pin
Screw (for spacer)	1	Machine screw, 6mm, M3
Spacer	1	Spacer, 10mm, M3, nylon
U1	1	74HCT688
U2	1	Z80 CTC Z84C3008, or Z80 CTC Z84C3010
X1	1	Oscillator (optional) Not included in the kit
IC socket 20-pin U1	1	Socket, DIP, 20-pin
IC socket 28-pin U2	2	Socket, DIP, 28-pin

Component details and sourcing (https://smallcomputercentral.com/components/)

1. If you don't need to connect flying leads (eg. Dupont wire) to IEI and IEO you could use straight pins rather than angled pins. You only need flying leads on these pins if you want to create an interrupt daisy chain and the backplane does not support this feature. Backplanes designed to meet the full requirements of the RCBus v1.0 provide for this with jumpers.
2. You could fit angled header pins if you want easy access to these jumper settings but they obscure the labels and protrude beyond the edge of the PCB.

Printed Circuit Board

User Guide

SC718 is a Z80 CTC (Counter Timer Channels) module designed for the RCBus. It is provides a 4 channel timer, counter, frequency generator and Z80 mode 2 interrupt generator.

The device address is set with jumpers. All of the I/O pins are available on header pins on the back edge of the PCB on on the RCBus.

The input source for each channel is selected with a jumper. Input sources include the RCBus CLK and CLK2 signals, the onboard oscillator, and the RCBus INT1 and INT2 signals.

The CTC can generate clock signals at programmable frequencies, such as baud rate clocks. A jumper allows the CTC to generate a clock on the RCBus CLK2 pins.

The CTC can generate Z80 mode 2 interrupts for non-Z80 family devices. The RCBus-Z80 provides two interrupt pins for non-Z80 devices. Jumpers allow these interrupts to be connected to the CTC which can be programmed to detect appropriate edges and generate interrupts.

A periodic timer interrupt can be generated by any of the channels. A jumper allows the output of channel 2 to be connected to the input of channel 3, thus providing a 16-bit timer. Alternatively, channel 3 can count timer ticks from timer 2 providing a means of detecting missed interrupts.

The Z80 interrupt daisy chain can be implemented on a backplane conforming to the RCBus-Z80 specification or it can be implemented via Dupont style wires connected the the IEI and IEO header pins.

Details about programming a Z80 CTC can be found in the Z80 CTC datasheet (PDF) (https://drive.google.com/file/d/1ZCt1S1F0NASjZ3dQNydnT6eiGw-Io9a6/view?usp=sharing).

Input/output port functions

I/O Address	Read	Write
Configurable *1 base address	Read Z80 CTC	Write Z80 CTC
base + 0	CTC 0	CTC 0
base + 1	CTC 1	CTC 1
base + 2	CTC 2	CTC 2
base + 3	CTC 3	CTC 3

1. The RCBus I/O base address should be set to match the software you are using. Typically, this is 0x88 (binary 1000 1000).

Jumper options

Jumper	Function
JP 1	Set module's RCBus I/O base address The suggested address is 0x88 (binary 1000 1000)
JP 2	CTC channel 0 input source (CT0) JP2.1 – RCBus clock signal (CLK) JP2.2 – RCBus clock 2 signal (CLK2) JP2.3 – Onboard oscillator output (X1) JP2.4 – RCBus interrupt 1 signal (/INT1) JP2.5 – RCBus interrupt 2 signal (/INT2) The default is RCBus clock signal (CLK)
JP 3	CTC channel 1 input source (CT1) JP3.1 – RCBus clock signal (CLK) JP3.2 – RCBus clock 2 signal (CLK2) JP3.3 – Onboard oscillator output (X1) JP3.4 – RCBus interrupt 1 signal (/INT1) JP3.5 – RCBus interrupt 2 signal (/INT2) The default is RCBus clock signal (CLK)

JP 4	CTC channel 2 input source (CT2) JP4.1 – RCBus clock signal (CLK) JP4.2 – RCBus clock 2 signal (CLK2) JP4.3 – Onboard oscillator output (X1) JP4.4 – RCBus interrupt 1 signal (/INT1) JP4.5 – RCBus interrupt 2 signal (/INT2) The default is RCBus clock signal (CLK)
JP 5	CTC channel 3 input source (CT3) JP5.1 – RCBus clock signal (CLK) JP5.2 – RRCBus clock 2 signal (CLK2) JP5.3 – Onboard oscillator output (X1) JP5.4 – RCBus interrupt 1 signal (/INT1) JP5.5 – CTC 2 output (ZT2) The default is RCBus clock signal (CLK)
JP 6	Signal output to RCBus clock 2 signal (CLK2) JP6.1 – CTC channel 0 output (ZT0) JP6.2 – CTC channel 1 output (ZT1) JP6.3 – CTC channel 2 output (ZT2) JP6.4 – Onboard oscillator output (X1) JP6.5 – RCBus clock signal (CLK) The default is jumper shunt not fitted
JP 7	Connects RCBus IEO signal to module The default is jumper shunt not fitted
JP 8	Connects RCBuss IEI signal to module The default is jumper shunt not fitted
JP 9	Connects RCBus INT signal to module The default is jumper shunt not fitted
JP 10	Connects RCBus INT2 signal to module The default is jumper shunt not fitted

Assembly Guide

Below is the suggested order of assembly. A general guide to assembling circuit boards can be found here (https://smallcomputercentral.com/assembly-guide/).

1. Resistors R1 to R7
   These can be fitted either way around
2. Decoupling capacitors C1 to C4
   These can be fitted either way around
3. Sockets for U1 and U2
   Fit such that the notch in the socket matches the curve in the outline on the PCB silkscreen
4. Header pins P2
5. Bus header P1
   Make sure the pins are parallel to the PCB so that the board is vertical when it is fitted into a backplane socket
6. Resistor network RP1
   This must be fitted the correct way around whereby the dot on the component matches the dot on the PCB

silkscreen

7. Header pins JP1
8. Header pins JP2+JP3+JP4+JP5+JP6

   This can be fitted as one strip if pin pairs 6, 12, 18 and 24 are pulled out of the plastic with a pair of pliers
   See parts list for options
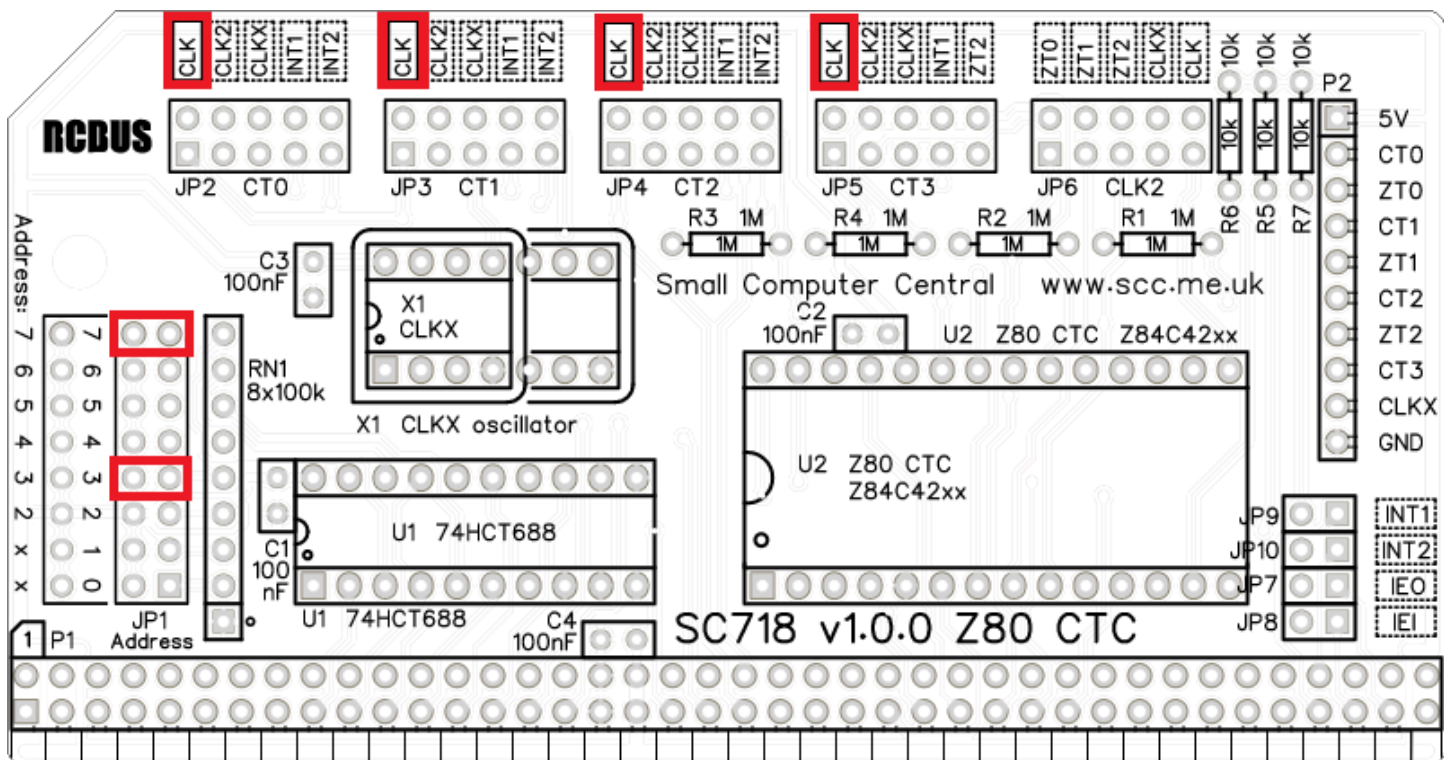9. Header pins JP7+JP8+JP9+JP10

   See parts list for options
10. Insert the integrated circuits into their sockets

    Make sure the notch in the component is at the end indicated by the notch in the socket and the curve on the
    PCB silkscreen
11. Fit the nylon spacer in the mounting hole

Fit jumper shunts in the positions shown below. All other jumpers are optional and should only be fitted if the
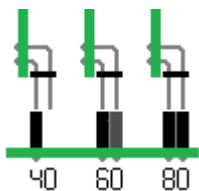feature is required.

Compatibility

This module conforms to the RCBus specification v1.0 (https://smallcomputercentral.com/rcbus/) for RCBus-
2014 and RCBus-Z80.

The RCBus specification includes RCBus-2014 (both RC2014 standard 40-pin bus and RC2014 enhanced 60-
pin bus) and also the full 80-pin RCBus. The 80-pin RCBus provides support for advanced Z80 features, such
as the interrupt daisy-chain, as well as support for other processor families.

The table below indicates electrical compatibility with each backplane type (40, 60 and 80 pin)

Backplane	?	Compatibility notes
RCBus 80-pin	✔	Fully supported
RCBus 60-pin (RC2014 enhanced)	✔	Limitations: Optional mode 2 interrupt chain requires wires between modules
RCBus 40-pin (RC2014 standard)	✔	Limitations: Optional mode 2 interrupt chain requires wires between modules Some optional signals are not available (CLK2, /INT2)

Notes

- This product is designed for hobby use and is not suitable for industrial, commercial, or safety-critical applications.
- The product contains small parts and is not suitable for young children.