Small Computer Monitor

Installation

Monitor version 1.0 for the Z80 CPU

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Edition 1.0.0

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Overview

The Small Computer Monitor is a classic machine code monitor enabling debugging of programs and general tinkering with hardware and software. It can also act as a boot ROM, so no other software is required on the target computer system.

To install the Monitor you need to know the type of hardware you are using and the type of PROM containing Monitor program. Then look up, in the following pages, the correct jumper settings for this combination.

If you want to program your own PROM, then you need to know the hardware you are using, the type of PROM you have and which configuration of the Monitor you wish to use. The following tables give a summary of the popular combinations.

The Monitor requires a PROM of at least 8k bytes (8k by 8-bit, often called 64k bit memory). The Monitor on its own fits in 8k bytes, but can also contain software like BASIC and a CP/M loader, which requires a larger PROM.

In order to support a range of hardware and optional features, there are a number of different configurations of the Monitor. These are identified by a two character configuration code. The first character is usually a letter indicating the hardware family, such as “L” for LiNC80 and “R” for RC2014, and the second is usually a number indicating the variant within that family. The variants usually indicate what optional software is included in the PROM.

Optional software in the PROM is integrated with the Monitor and provides extra commands, such as BASIC and CPM. These two commands launch BASIC and CPM respectively. Systems that allow software to page different parts (or banks) of the ROM into the memory map, such as the LiNC80, enable additional monitor functions to be added without making changes to the Monitor code or even recompiling it.

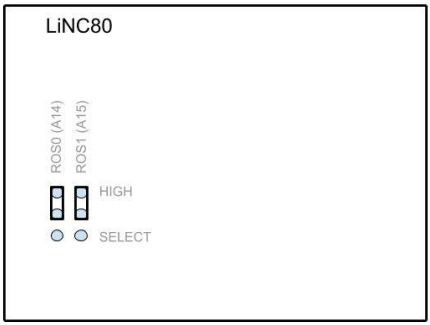
Installation Options

The following configurations are described in this document.

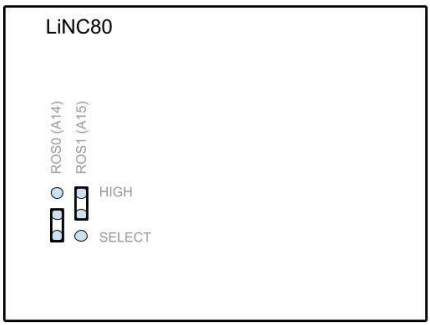
LiNC80	Config	Contains	PROMs
SBC1	L1 (16k)	SCMonitor BASIC (47k free) CP/M loader	27C128
SBC1	L1 (32k)	SCMonitor BASIC (47k free) CP/M loader GSL monitor/loader	27C256 27C512 28C256

RC2014	Config	Contains	PROMs
RC2014 Mini	R1 (8k)	SCMonitor (only)	27C64 27C128 27C256 27C512 28C64 28C256
8k ROM board	R1 (8k)	SCMonitor (only)	27C64 28C64
Switchable ROM board	R1 (8k)	SCMonitor (only)	27C64 27C512
Pageable ROM board and 32k/64k RAM board	R1 (8k)	SCMonitor (only)	27C64 27C128 27C512 28C256
Pageable ROM board and 64k RAM board	R2 (16k)	SCMonitor BASIC (47k free)	27C128 27C256 27C512 28C256
Pageable ROM board and 64k RAM board	R3 (32k)	SCMonitor BASIC (31k free) CP/M loader	27C256 27C512 28C256

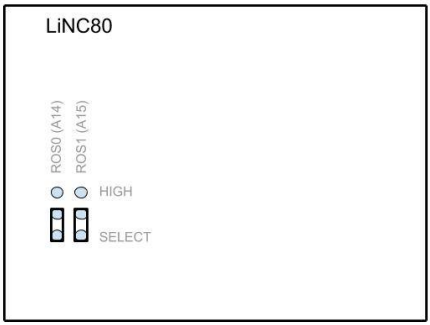
LiNC80, 16k EPROM 27C128, Monitor L1

Monitor configuration L1	16k EPROM 27C128
SCMonitor BASIC (47k free) CP/M loader	
16k page size (ROM) 1 page available	

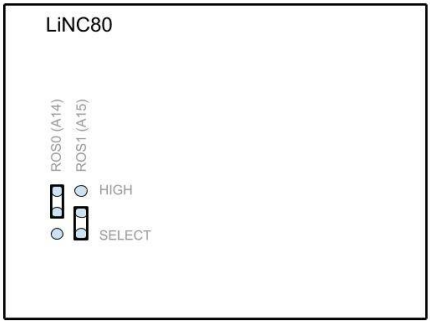
LiNC80, 32k EPROM 27C256, Monitor L1

Monitor configuration L1	32k EPROM 27C256
SCMonitor BASIC (47k free) CP/M loader GSL monitor (optional)	
16k page size (ROM) 2 pages available Shown with Monitor in first ROM page	

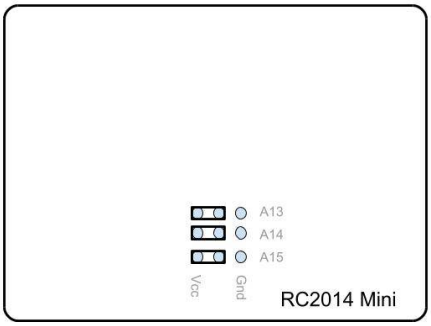
LiNC80, 64k EPROM 27C512, Monitor L1

Monitor configuration L1	64k EPROM 27C512
SCMonitor BASIC (47k free) CP/M loader GSL monitor (optional)	
16k page size (ROM) 4 pages available Shown with Monitor in first ROM page	

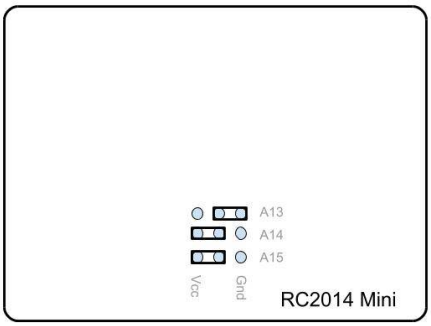
LiNC80, 32k EEPROM 28C256, Monitor L1

Monitor configuration L1	32k EEPROM 28C256
SCMonitor BASIC (47k free) CP/M loader GSL monitor (optional)	
16k page size (ROM) 2 pages available Shown with Monitor in first ROM page	

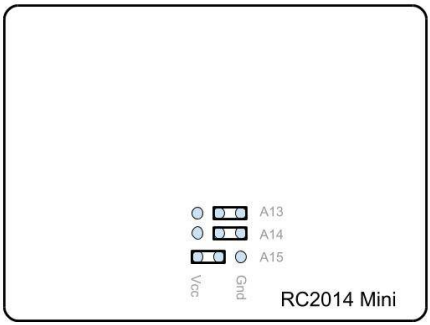
RC2014 Mini, 8k EPROM 27C64, Monitor R1

Monitor configuration R1	8k EPROM 27C64
SCMonitor (only)	
8k page size (ROM) 1 pages available	

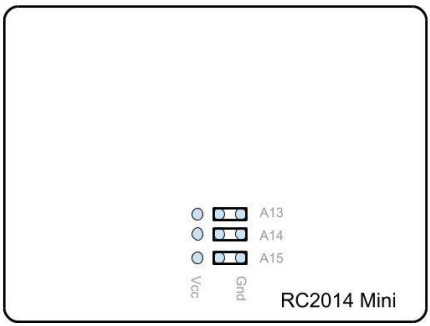
RC2014 Mini, 16k EPROM 27C128, Monitor R1

Monitor configuration R1	16k EPROM 27C128
SCMonitor (only)	
8k page size (ROM) 2 pages available Shown with Monitor in first ROM page	

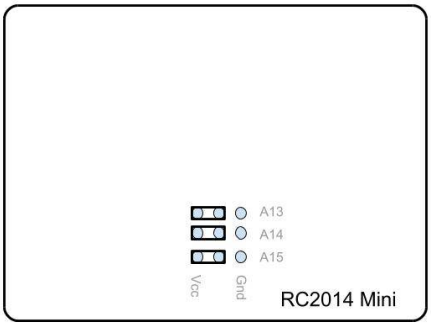
RC2014 Mini, 32k EPROM 27C256, Monitor R1

Monitor configuration R1	32k EPROM 27C256
SCMonitor (only)	
8k page size (ROM) 4 pages available Shown with Monitor in first ROM page	

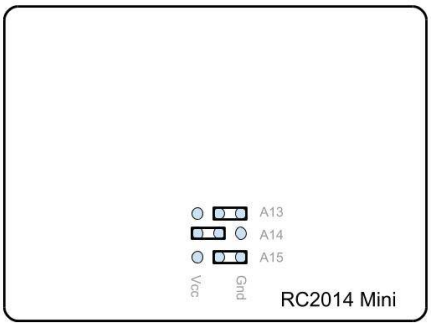
RC2014 Mini, 64k EPROM 27C512, Monitor R1

Monitor configuration R1	64k EPROM 27C512
SCMonitor (only)	
8k page size (ROM) 8 pages available Shown with Monitor in first ROM page	

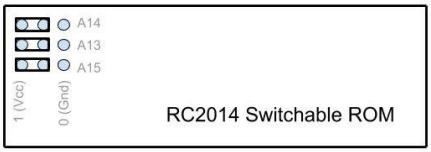
RC2014 Mini, 8k EEPROM 28C64, Monitor R1

Monitor configuration R1	8k EEPROM 28C64
SCMonitor (only)	
8k page size (ROM) 1 page available	

RC2014 Mini, 32k EEPROM 28C256, Monitor R1

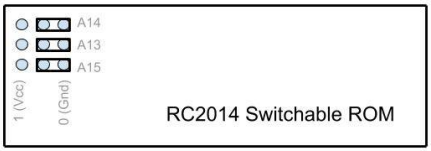
Monitor configuration R1	32k EEPROM 28C256
SCMonitor (only)	
8k page size (ROM) 4 pages available Shown with Monitor in first ROM page	

RC2014 Classic, 8k EPROM 27C64, Monitor R1

Monitor configuration R1	8k EPROM 27C64
SCMonitor (only)	
8k page size (ROM) 1 page available	

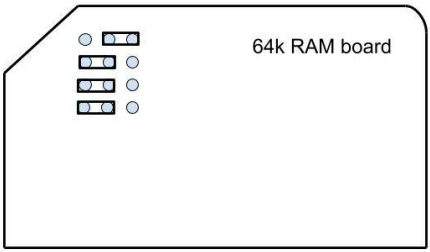
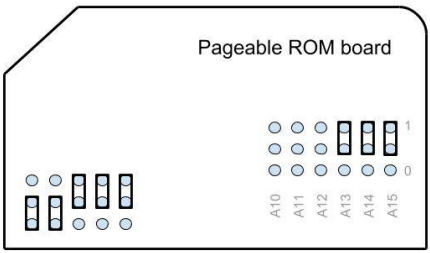
This configuration of Monitor and EPROM can also be used in the original 8k ROM board.

RC2014 Classic, 64k EPROM 27C512, Monitor R1

Monitor configuration R1	64k EPROM 27C512
SCMonitor (only)	
8k page size (ROM) 8 pages available Shown with Monitor in first ROM page	

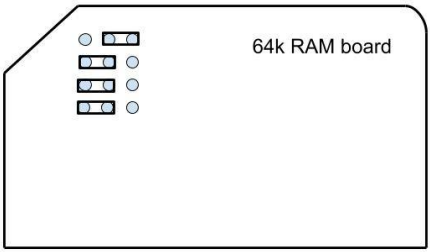
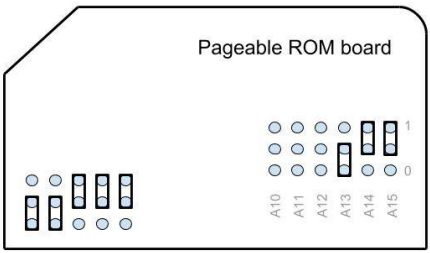
This configuration of Monitor and EPROM can also be used in the original 8k ROM board.

RC2014, 8k EPROM 27C64, Monitor R1

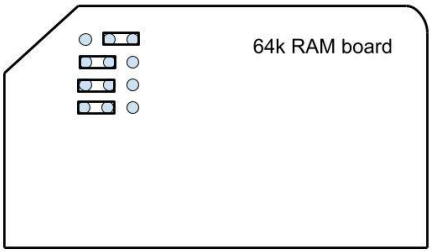
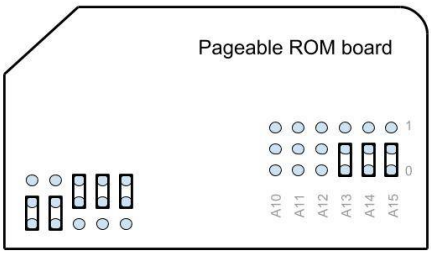
RC2014 configuration R1	8k EPROM 27C64
SCMonitor only	
8k page size (ROM) 1 page available	

This configuration of Monitor and jumpers is also suitable for the 28C64 EEPROM.

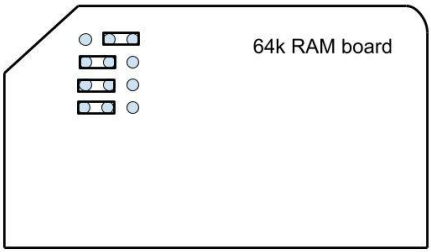
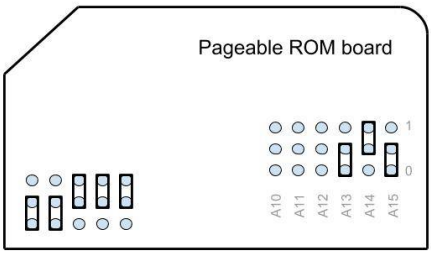
RC2014, 16k EPROM 27C128, Monitor R1

RC2014 configuration R1	16k EPROM 27C128
SCMonitor only	
8k page size (ROM) 2 pages available Shown with Monitor in first ROM page	

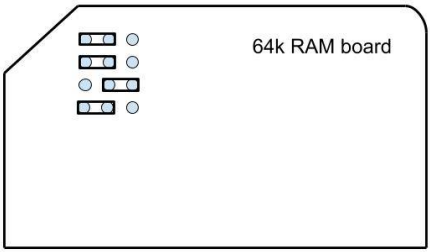
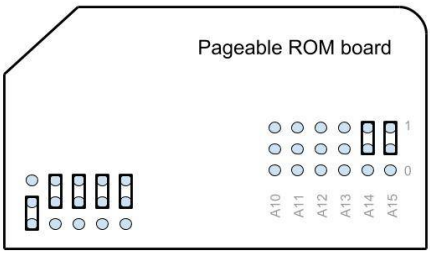
RC2014, 64k EPROM 27C512, Monitor R1

RC2014 configuration R1	64k EPROM 27C512
SCMonitor only	
8k page size (ROM) 8 pages available Shown with Monitor in first ROM page	

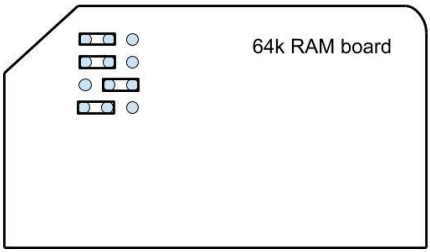
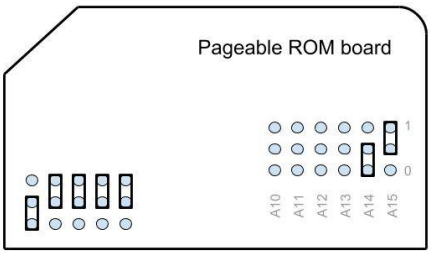
RC2014, 32k EEPROM 28C256, Monitor R1

RC2014 configuration R1	32k EEPROM 28C256
SCMonitor only	
8k page size (ROM) 4 pages available Shown with Monitor in first ROM page	

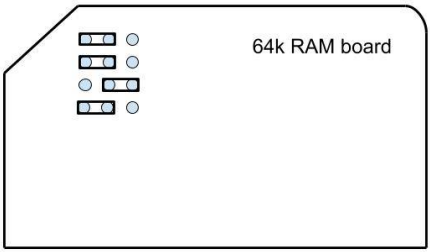
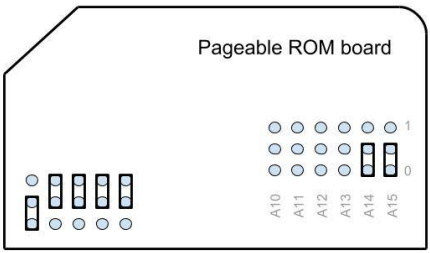
RC2014, 16k EPROM 27C128, Monitor R2

RC2014 configuration R2	16k EPROM 27C128
Small Computer Monitor BASIC (47k free)	
16k page size (ROM) 1 page available	

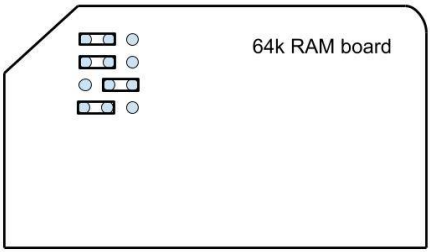
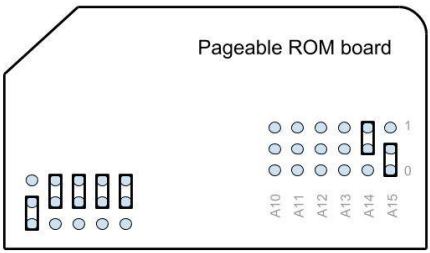
RC2014, 32k EPROM 27C256, Monitor R2

RC2014 configuration R2	32k EPROM 27C256
Small Computer Monitor BASIC (47k free)	
16k page size (ROM) 2 pages available Shown with Monitor in first ROM page	

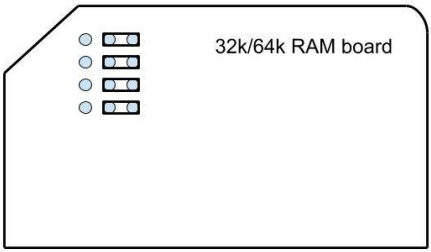
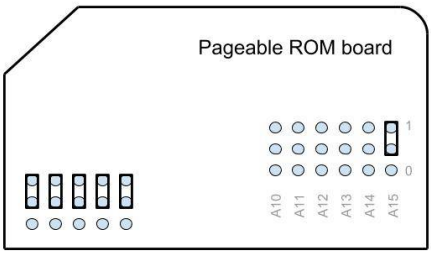
RC2014, 64k EPROM 27C512, Monitor R2

RC2014 configuration R2	64k EPROM 27C512
Small Computer Monitor BASIC (47k free)	
16k page size (ROM) 4 pages available Shown with Monitor in first ROM page	

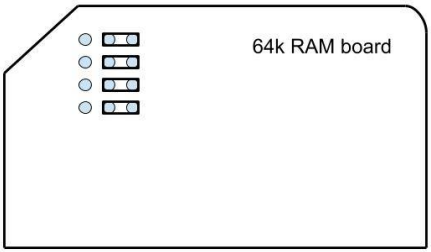
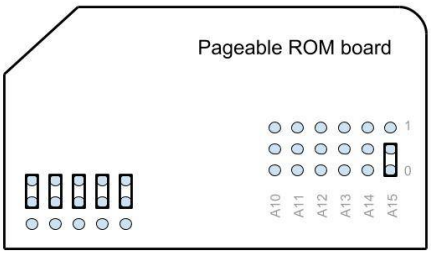
RC2014, 32k EEPROM 28C256, Monitor R2

RC2014 configuration R2	32k EEPROM 28C256
Small Computer Monitor BASIC (47k free)	
16k page size (ROM) 2 pages available Shown with Monitor in first ROM page	

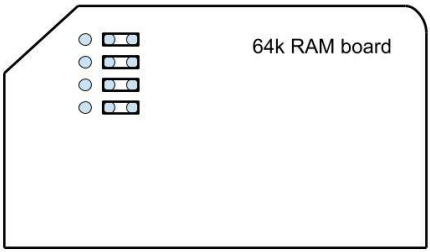
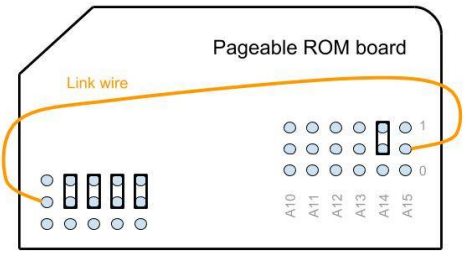
RC2014, 32k EPROM 27C256, Monitor R3

RC2014 configuration R3	32k EPROM 27C256
Small Computer Monitor BASIC (31k free) CP/M loader	
32k page size (ROM) 1 page available Requires paging signal between RAM and ROM boards.	

RC2014, 64k EPROM 27C512, Monitor R3

RC2014 configuration R3	64k EPROM 27C512
Small Computer Monitor BASIC (31k free) CP/M loader	
32k page size (ROM) 2 pages available Shown with Monitor in first ROM page Requires paging signal between RAM and ROM boards.	

RC2014, 32k EEPROM 28C256, Monitor R3

RC2014 configuration R3	32k EEPROM 28C256
Small Computer Monitor BASIC (31k free) CP/M loader	
32k page size (ROM) 2 pages available Shown with Monitor in first ROM page Requires paging signal between RAM and ROM boards.	

Fault Finding

If you do not see the monitor's sign on message on the terminal when you switch the system on, then here are some things to try:

Press the system's reset button.

Check the power supply is providing 4.75 to 5.25 volts, measured on the circuit board with the system turned on. Everything should be fine with a supply voltage of 4.5 to 5.5 volts, but better to play safe.

Check all links and jumpers, check no chips have bent legs and thus not making contact with their socket, carefully inspect all soldering, check all the chips are inserted the right way round, check all the components are in the right place. Check your serial connection looks right and that the terminal is correctly set. Then cry!

Don't forget to follow any troubleshooting guide provided by the manufacturer.

LiNC80

Double check the jumpers for ROM signals A14 and A15, particularly if you are using a chip like the 28C256 which has unusual pin-outs for these signals. Also double check the serial jumpers as the clock source determines the initial baud rate.

RC2014

If your RC2014 was not previously tested with the supplied BASIC ROM, then if possible check it does work with the BASIC ROM. If that is not possible then you'll need to go through all the usual fault finding processes, described here.

If your RC2014 was known to be working with the supplied BASIC ROM, then verify the Small Computer Monitor ROM contains the correct code and check the links related to addressing the ROM (especially if the chip has a different capacity to the one containing BASIC). Other than that you would appear to have an odd problem as the Monitor ROM should, in theory, work if the RC2014 standard BASIC ROM works.

It should be noted that there are a number of different serial modules available for the RC2014 and they are not all compatible. Currently the Small Computer Monitor only works with official RC2014 serial modules or modules totally compatible with these, and also SIO/2 modules following Grant Searle's register addressing order.

Parts and Suppliers

The following is a list of parts and suppliers used during development of the Small Computer Monitor.

LiNC80 official modules

Information about the LiNC80 and its accessories, and links to the store page where kits can be purchased can be found at http://linc.no/go/linc80.

RC2014 official modules

Information at www.rc2014.co.uk
Parts purchased through Tindie:
https://www.tindie.com/stores/Semachthemonkey/?ref=offsite_badges&utm_source=sellers_Semachthemonkey&utm_medium=badges&utm_campaign=badge_medium

Chip programmer

WINGONEER TL866CS Universal USB MiniPro EEPROM FLASH BIOS Programmer AVR GAL PIC SPI
Amazon ASIN: B071H5XGR7
https://www.amazon.co.uk/gp/product/B071H5XGR7/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1

EEPROM 8k x 8 bit

Microchip Technology AT28C64B-15PU Parallel EEPROM Memory, 64kbit, 150ns, 4.5 → 5.5 V PDIP 28-Pin
RS part number: 127-6572
http://uk.rs-online.com/web/p/eeprom-memory-chips/1276572/

EEPROM 32k x 8 bit

Microchip Technology AT28C256-15PU Parallel EEPROM Memory, 256kbit, 150ns, 4.5 → 5.5 V PDIP 28-Pin
RS part number: 127-6570
https://uk.rs-online.com/web/p/eeprom-memory-chips/1276570/

FTDI cable

TTL-232R-5V - USB to Serial Converter Cable, 5V, 6Way, 1.8m
Farnell order code: 2419945

http://uk.farnell.com/ftdi/ttl-232r-5v/usb-to-serial-converter-cable/dp/2419945?ost=2419945&iscrfnonsku=false&ddkey=http%3Aen-GB%2FElement14_United_Kingdom%2Fsearch

FTDI 'cable'

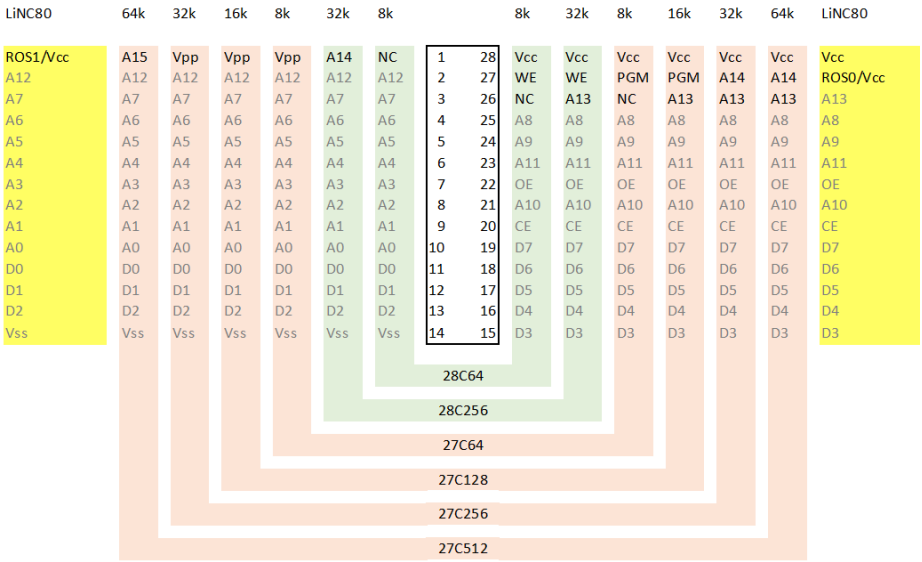
HALJIA FT232RL FTDI USB to TTL Serial Converter Adapter Module Mini USB 3.3V 5.5V Board for Arduino
Amazon ASIN: B06XDH2VK9
https://www.amazon.co.uk/gp/product/B06XDH2VK9/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1

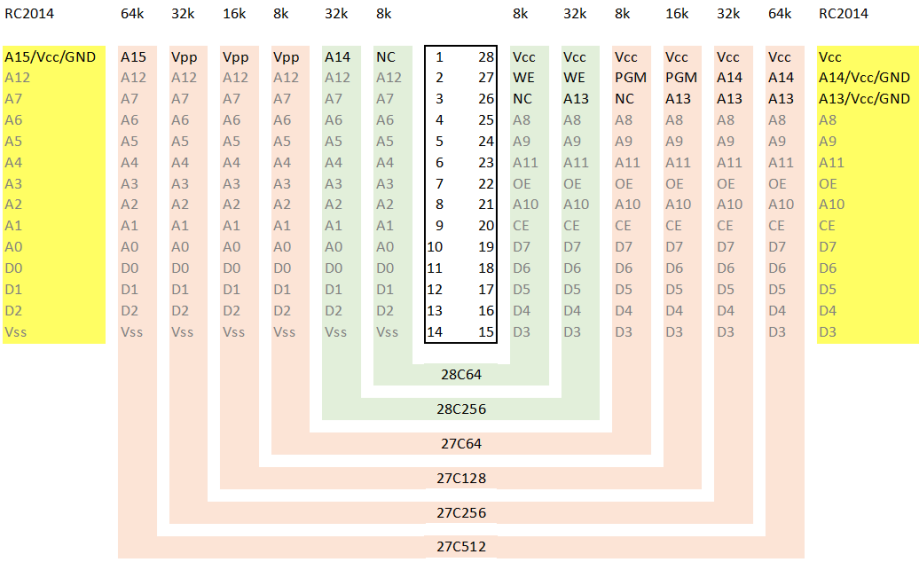
USB-RS232 cable

UGREEN 20210 USB Serial Cable, USB to RS232 DB9 9 pin Converter Cable
Amazon ASIN: B00QUZY4UG
https://www.amazon.co.uk/gp/product/B00QUZY4UG/ref=oh_aui_search_detailpage?ie=UTF8&psc=1
Note, you still need a null modem lead between this and the LiNC80 or RC2014.

PROM Pin-outs

Common PROM pin-outs are shown below, together with LiNC80 and RC2014 jumper options.





Contact Information

If you wish to contact me regarding the Small Computer Monitor please use the contact page at www.scc.me.uk.

Stephen C Cousins, Chelmsford, Essex, United Kingdom.

LiNC80

Issues related to the LiNC80 can be posted on the google group “LiNC80”.
Information about the LiNC80 and its accessories, and links to the store page where kits can be purchased can be found at http://linc.no/go/linc80

RC2014

Issues related to the RC2014 can be posted on the google group “RC2014-Z80”.
Information about the RC2014 can be found at www.rc2014.co.uk
Kits are available from www.tindie.com