Small Computer Central

SC126, v1.0, Troubleshooting

This guide is for anyone who has an SC126 (https://smallcomputercentral.wordpress.com/sc126-z180-mother-board-rc2014/) that does not work.

Unless otherwise specified the following tests are performed with a low cost digital multimeter.

Results, below, are shown in a table which has a column for each of the following:

- Test – Description of the test
- My unit – Results on my SC126
- Min. – Minimum acceptable value
- Max. – Maximum acceptable value

Perform each check in the order described and, if possible, resolve any problem found before moving on to the next check.

Visual Inspection

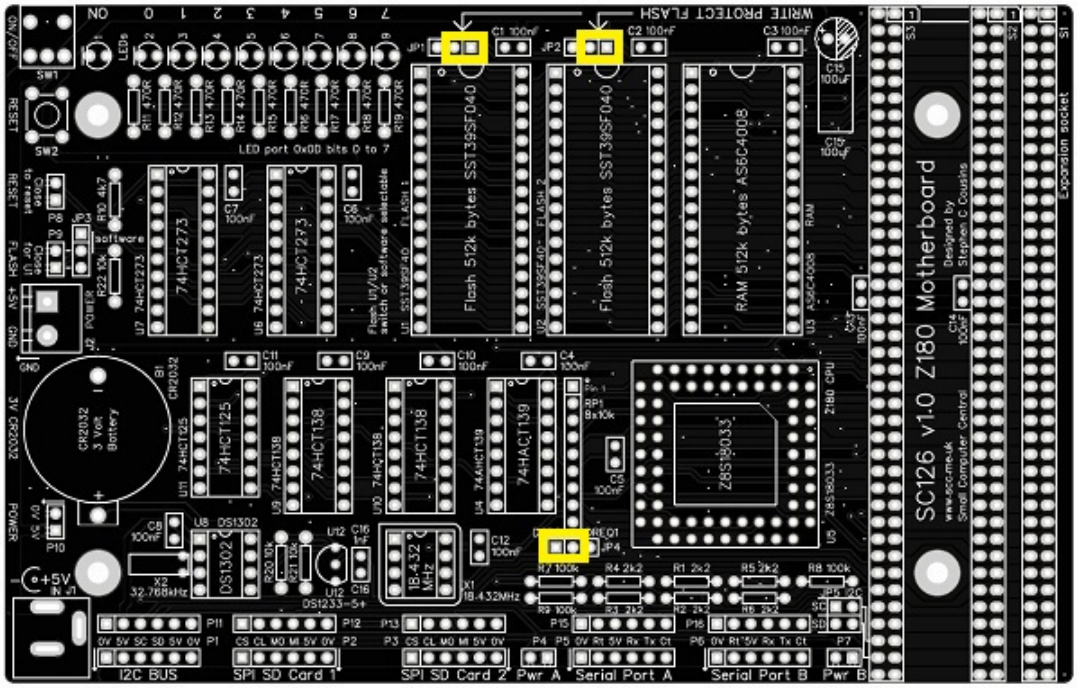
From my experience I think the most likely problem will be an assembly issue. These can often be found with visual inspection, so take your time and carefully do the following:

- Check components are in the correct locations and are fitted the correct way around.
- Look for any IC leg that is bent under the chip and not making contact with the socket.
- With a magnifying glass (or similar) inspect all solder joints looking for any that may have a short to other components or where the solder has not flowed nicely onto the pad and component lead.

Never underestimate the importance of visual inspection.

Jumpers

The following tests assume these jumper shunts are fitted.



Both write protection jumpers (JP1 and JP2) should have shunts fitted in the 'Write protect flash' positions. The jumper JP4 should have a shunt fitted in the DCD0 position.

Power supply

Ensure the power on/off toggle switch is in the ON position – toggle is away from the LEDs.

With the board not connected to a power source, use a multimeter to check there is not a short on the power lines. The meter reading will take a while to settle due to capacitance.

Test	*My unit*	*Min.*	*Max.*
Power supply resistance measured at screw terminal (J2)	9.8 kΩ	1 kΩ	100 kΩ

A value below the minimum would likely indicate a short circuit, such as a solder splash. A less likely cause would be a faulty component, such as a decoupling capacitor.

A value above the maximum would likely indicate a faulty toggle switch (SW1) or a broken track or solder joint near where the power is applied.

The following tests are carried out with a 5 volt power source connected to either the screw terminals (J2), the barrel socket (J1), the header pins (P10), or one of the serial port headers (P5 or P6). When using the serial port power source, fit a jumper shunt to P4 (serial port A) or P7 (serial port B). Ensure the power on/off toggle switch is in the ON position – toggle is away from the LEDs.

Test	*My unit*	*Min.*	*Max.*
Power supply voltage measured at screw terminal (J2)	4.97 V	4.75 V	5.25 V

If you have a means of measuring the power supply current, do so now.

Test	*My unit*	*Min.*	*Max.*
Power supply current running SCM (8 LEDs off)	50 mA	30 mA	100 mA
Power supply current running RomWBW (8 LEDs on)	100 mA	30 mA	150 mA

A value below the minimum suggested value might indicate a broken track such that power is not reaching all of the components. A value around the minimum suggested value could be caused by the oscillator not running so that there is very little activity on the board, and thus low current consumption.

A value above the maximum might be caused by a faulty component, a short circuit somewhere, or perhaps an IC inserted the wrong way around.

Power LED does not light up

Skip this section if the power LED (LED1) lights when power is applied. If it does not light, do the following:

Test	*My unit*	*Min.*	*Max.*
Power supply voltage at IC U7, pins 10 and 20	4.97 V	4.75 V	5.25 V

If the voltage is missing at IC U7 then check the toggle switch (SW1)

Test	*My unit*	*Min.*	*Max.*
Voltage from screw terminal (J2) GND to resistor R11 (near power LED) Test end of resistor furthest away from LEDs	4.97 V	4.75 V	5.25 V

If this voltage is below the minimum, the 5 volt supply is not reaching the resistor, so check the resistor's solder joints, the toggle switch (SW1), and look for a damaged track around R11.

Test	*My unit*	*Min.*	*Max.*
Voltage from screw terminal (J2) GND to resistor R11 (near power LED) Test end of resistor nearest the LEDs	1.89 V	1.5 V	2.0 V

If the voltage is not within the specified range, it is likely the LED is fitted the wrong way around or is faulty. Also, check solder joints and tracks around R11 and LED1.

Reset

The processor won't run if the reset signal is low.

Test	*My unit*	*Min.*	*Max.*
Voltage from U6 pin 10 (GND) to U6 pin 1 (/RESET)	4.9 V	4.0 V	5.25 V

Check this voltage drops to less than 0.5 volts when the reset button is pressed. When the reset button is released, the reset signal should go high within about 1 second.

If the reset signal stays low, there could be a problem around U12 (the voltage supervisor and reset chip), C16, or the reset button (SW2).

Clock

The processor won't run without a clock signal.

Test	*My unit*	*Min.*	*Max.*
Voltage from any ground point to X1 pin 5 (CLKX)	2.5 V	2.0 V	3.0 V

Self-test LED sequence

Both the Small Computer Monitor (SCM) and RomWBW use the 8 LEDs to display the results of self-test diagnostics following a reset.

SCM lights each LED in turn for a fraction of a second. Each LED is turned on and then off, such that there is only one LED on at a time. At the end of a successful test all 8 LEDs are turned off. This is described in detail here (https://smallcomputercentral.wordpress.com/firmware/firmware-scm-s6/).

RomWBW lights the LEDs in sequence, such that a successful test results in all 8 LEDs being turned on. This is described in detail here (https://smallcomputercentral.wordpress.com/sc126-z180-motherboard-rc2014/sc126-v1-0-user-guide/).

Try both sets of firmware (SCM and RomWBW) by selecting with jumper JP3. If neither firmware works, then it is unlikely the fault is one of the Flash chips.

More power tests

Check the 5 volt supply reaches the following places by measuring the voltage at the points indicated.

Test	*My unit*	*Min.*	*Max.*
IC U1 between pins 16 and 32	4.97 V	4.75 V	5.25 V
IC U2 between pins 16 and 32	4.97 V	4.75 V	5.25 V
IC U3 between pins 16 and 32	4.97 V	4.75 V	5.25 V
IC U4 between pins 8 and 16	4.97 V	4.75V	5.25 V
IC U5 between pins 36 and 34 This can be tricky so skip this measurement if you are concerned	4.97 V	4.75 V	5.25 V
IC U6 between pins 10 and 20	4.97 V	4.75 V	5.25 V
IC U7 between pins 10 and 20	4.97 V	4.75 V	5.25 V
IC U8 between pins 4 and 1	4.97 V	4.75 V	5.25 V
IC U9 between pins 8 and 16	4.97 V	4.75 V	5.25 V
IC U10 between pins 8 and 16	4.97 V	4.75 V	5.25 V

IC U11 between pins 7 and 14	4.97 V	4.75 V	5.25 V

Bus signals

With SCM selected with jumper JP3, check the voltage on the bus signals indicated in the tables below.

The voltages will depend on what the processor is doing, so on a faulty system they may not follow the pattern indicated by my test results. Also, a different version of the firmware will result in a different pattern of voltages.

If any of these signals are say less than 0.1 bolts or within 0.1 volts of the power supply voltage, it is likely there is a short between the signal and ground or the signal and 5 volts.

If any of these signals is outside the suggested range but not within 0.1 volts of ground or the power supply, then there could be a short between this signal and another signal, or it could just be the processor is running a tight loop and keeping the signal in one state nearly all the time.

If you have an oscilloscope, you will get a better idea of what is going on by looking at the signals at these locations, looking for floating signals or poorly shaped signals.

Test	***My unit***	***Min.***	***Max.***
IC U3 between pins 16 and 13 (D0)	2.6 V	1.2 V	3.5 V
IC U3 between pins 16 and 14 (D1)	2.2 V	1.2 V	3.5 V
IC U3 between pins 16 and 15 (D2)	2.3 V	1.2 V	3.5 V
IC U3 between pins 16 and 17 (D3)	2.2 V	1.2 V	3.5 V
IC U3 between pins 16 and 18 (D4)	1.9 V	1.2 V	3.5 V
IC U3 between pins 16 and 19 (D5)	1.5 V	1.2 V	3.5 V
IC U3 between pins 16 and 20 (D6)	2.4 V	1.2 V	3.5 V
IC U3 between pins 16 and 21 (D7)	1.8 V	1.2 V	3.5 V

Test	***My unit***	***Min.***	***Max.***
IC U3 between pins 16 and 12 (A0)	2.3 V	1.2 V	3.5 V
IC U3 between pins 16 and 11 (A1)	1.9 V	1.2 V	3.5 V
IC U3 between pins 16 and 10 (A2)	2.3 V	1.2 V	3.5 V
IC U3 between pins 16 and 9 (A3)	3.4 V	1.2 V	3.5 V
IC U3 between pins 16 and 8 (A4)	3.4 V	1.2 V	3.5 V
IC U3 between pins 16 and 7 (A5)	3.1 V	1.2 V	3.5 V
IC U3 between pins 16 and 6 (A6)	3.2 V	1.2 V	3.5 V
IC U3 between pins 16 and 5 (A7)	2.2 V	1.2 V	3.5 V

Test	***My unit***	***Min.***	***Max.***
IC U3 between pins 16 and 27 (A8)	2.7 V	1.2 V	3.5 V
IC U3 between pins 16 and 26 (A9)	2.3 V	1.2 V	3.5 V
IC U3 between pins 16 and 23 (A10)	3.5 V	1.2 V	3.5 V
IC U3 between pins 16 and 25 (A11)	2.6 V	1.2 V	3.5 V

IC U3 between pins 16 and 4 (A12)	2.6 V	1.2 V	3.5 V
IC U3 between pins 16 and 28 (A13)	2.0 V	1.2 V	3.5 V
IC U3 between pins 16 and 3 (A14)	2.0 V	1.2 V	3.5 V
IC U3 between pins 16 and 31 (A15)	2.0 V	1.2 V	3.5 V

Test	***My unit***	***Min.***	***Max.***
IC U3 between pins 16 and 24 (RD)	2.3 V	1.2 V	3.5 V
IC U3 between pins 16 and 29 (/WR)	4.5 V	4.0 V	5.25 V
IC U3 between pins 16 and 22 (CE)	3.5 V	1.2 V	3.5 V

U2 pin 29 (/WR) is high as SCM should now be sitting in a loop waiting for input from the serial port and not doing much, if any, writing.

If any of these signals looks wrong, try measuring the voltage when you press and release the reset button. You should see a change in voltage for about 1 second before the level settles. This indicates the SCM self-test code is running before the code settles into a loop waiting for serial input.

If the voltage levels do not appear to change during that first second, it is likely the processor is not running the SCM code in the expected way.