# Troubleshooting

**Appliable model: 062**

**General Notes:**

1) Whenever a kit assembled does not work its power supply should be first checked. The +5V power supply should be within +5V +/- 2% range and there are no apparent overheat components (the heatsink of 7805 could warm up to 40 – 50℃ and that is normal).
2) If any overheat or smoke is seen power off the unit immediately and carefully check soldering, component placement, and their values.
3) It is assumed that users have digital multimeter available when carrying out troubleshooting.
4) Unless otherwise stated voltages are measured with volt meter's negative probe connected to GND (7805's heatsink) and positive probe connected the point to be checked.
5) Always power off oscilloscope before carrying out connection check.

Fig. 1 shows typical voltages measured at various check points for a normal 062 oscilloscope.

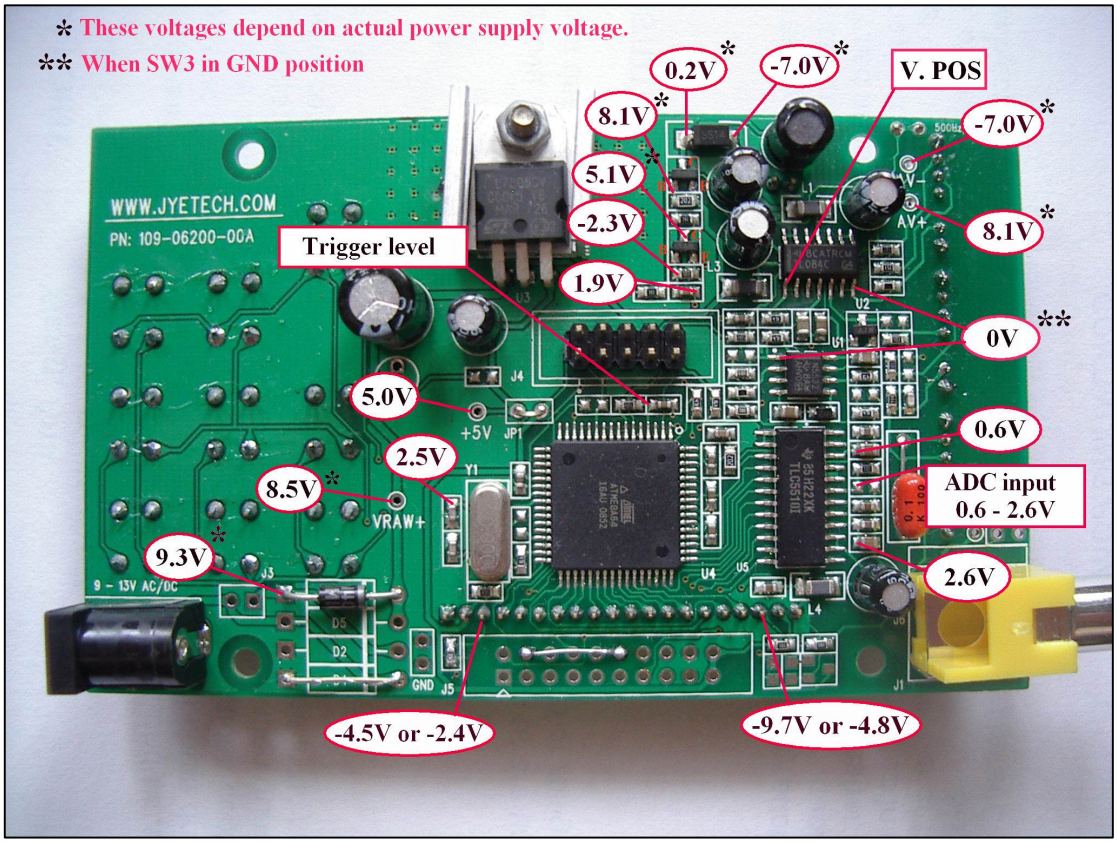


Fig. 1

## 1. LCD backlight does not light up

The LCD backlight is simply powered by +5V through a 0 ohm resistor R23. If it doesn't work following items should be checked.

1) Check if +5V power supply is normal.
2) Check soldering of pin 19 & 20 of LCD module.
3) Check soldering of R23.
4) If normal +5V is measured between pin 19 & 20 of LCD module and the LCD backlight doesn't light up then it is possibly an LCD module internal problem.

## 2. LCD lights up but nothing seen on screen

For this problem there are four possible causes.

**A. LCD contrast is incorrect**

LCD contrast is determined by voltage at pin 3 (VO). This voltage depends on VEE at pin 18 and divider of R27 and R29. For normal display VO should be -4.5V or -2.4V depending on type of LCD module used. ( Two types, TG12864D-04 and LY12864-16, of LCD module from different manufaturers are used. LCD modules with signal names shown at the front are TG12864D-04. Otherwise, they are LY12864-16. ) For TG12864D-04 VO should be -4.5V. For LY12864-16 it should be -2.4V. Check VO with a volt meter. If the voltage is incorrect display may not be seen even the rest of scope is working.

If VO is incorrect first check VEE. VEE is generated by a built-in negative voltage generator inside LCD module. For TG12864D-04 VEE is approximately -9.7V. For LY12864-16 it is about -4.8V. If this voltage is found wrong possible causes include:

1) Pin 18 of LCD module is shorted to something else.
2) Pin 18 is opened.
3) Bad negative voltage generator inside LCD.

If VEE is ok then check soldering of R27 and R29 and their values. R27 should be 5.6K for TG12864D-04 and 3.3K for LY12864-16. R29 should be 10K for both types.

**B. MCU (Atmega64) does not work properly**

To verify MCU state check voltage at its pin 5 (measuring at C17 is easier). This voltage should be about 1.9V.

There is another way to verify if MCU is working or not. Each time at booting up MCU emits certain ASCII string at its UART0 output pin (pin 3 of U4). First it outputs using 9600bps (controlled by bootloader) then using 38400bps (controlled by main firmware). In both case the data format are 8-N-1. By connecting to PC serial port via a serial level converter these outputs can be easily captured.

If MCU is not running correctly then possible causes are

1) MCU is not programmed.
2) Bad soldering at some critical pins like those for power supply and oscilator.
3) Oscillator not running. Oscillator can be roughly checked with a digital voltmeter. Measure voltage at pin 23 (probing at C24). If 2.5V is read then oscillator is working. (For a kit with programmed MCU bad oscillator is unlikely because it is verified at programming. Successful completion of programming requires a good oscillotor.)
4) Bad chip.

**C. Bad connections between MCU and LCD**

There are 14 signals (see signal labels with prefix “LCD_” in schematic) connecting LCD to MCU. Their connections can be checked with a ohm meter. It is recommended that sharp meter probes be used and check from pin to pin instead of pad to pad. Try to identify possible opens (false soldering) and shorts (bridged MCU pins, etc).

**D. Bad LCD module**

## 3. Display and buttons work but no trace seen

If display and buttons are working that means the digital portion is OK. The problem is in analog portion that includes analog power supply (AV+, AV-), analog channel (opamps), and ADC (TLC5510).

**A. Check AV+**

AV+ should be the same as or slightly lower than VRAW+. If it is significantly lower then it is possible that somewhre are shorted. If it is 0V L3 may be open.

**B. Check AV-**

AV- should be -6V or lower if you use a power supply of +9V or higher. If AV- is close to 0V then you would not be able to see any traces. For AV- problem please check:

1) Is D7 placed correct? - D7 should be placed with its striped end pointing 7805 (see Fig. 1). If D7 is placed wrong Q1 is likely burnt. Q1, if burnt, can be replaced with any general purpose PNP transistor (even a through-hole one). Q1 and Q2 polariy are shown in Fig. 1.
2) Is L2 open? - Please check it with multimeter. It should read about 3 ohms.
3) Any possible short/open of components around Q1 and Q2?

**C. Check analog channel**

If AV+ and AV- are normal then analog channel should be checked. Put SW3 in GND position and follow steps below.

1) Measure voltage at pin 7 of U2. It should be 0V. If it is not check if R5 is opened or DN1 is shorted.

2) Measure voltage at pin 1 of U1. It should also be 0V. If it is not check R6, R11, and SW2.

3) Measure voltages at pin 7 of U1 and pin 1 of U2. They should be approximately the same when voltage at U1 pin 1 is 0V. If this is not the case check R2, R3, R8, R12, and D1. Voltage at U2 pin 1 determins V.POS. It is generated by MCU and can be varied from panel (please see Operating Instructions).

**D. Check ADC**

Keep SW3 in GND position and change V.POS from panel (this adjusts voltage at pin 1 of U2) so that voltage at pin 7 of U1 falls in the range of 0.6V – 2.6V. When the voltage in this range trace should be seen on screen (remember to put scope trigger in AUTO mode when doing this checking). If not then problem lies in ADC chip, TLC5510.

1) First measure voltage at pin 19 of U5. It should be equal to that of U1 pin 7. If not R24 may be opened.

2) Check voltages at pin 16 (17) and pin 22 (23) of U5. They should be about 2.6V and 0.6V, respectively. If they are far from these values the chip is possibly bad.

3) Power the unit off and check connections between U5 and MCU with a ohmmeter. These connections include the 8 data lines (pin 3 - 10 of U5) and clock line (pin 12 of U5). Again sharp meter probes should be used and checks be made from pin to pin. This is try to uncover any bad soldering (possible opens/shorts).

## 4. Scope does not trig

Trigs are produced by comparing trig source signal to trigger level. Trigger level is generated at C16 by MCU through the RC filter of R21/C16 and is fed to U4 pin 4, the non-invert input of built-in comparator of ATMega64. Trig source signal is brought to the invert input of the comparator. For internal trig this signal is from analog output at U1 pin 7 going through R30 to U4 pin 57. For external trig it is from J5 pin 12 directly to U4 pin 58.

When trigger does not work the following items can be checked.

**A. Trigger level**

Measure voltage at C16 while varying V.POS setting from panel. This voltage should change accordingly. For internal trig the range of this voltage is from 0.6V – 2.6V and for external trig it is 0V – 5V. If this voltage is ok check connection between C16 and pin 4 of U4.

**B. Trig sources**

For internal trig check connection from U1 pin 7 to U4 pin 57 and soldering of R30. For external trig check connection from pin 12 of J5 to pin 58 of U4.