# Contents

- OVERVIEW
- SAFETY INFORMATION
- Tools
- Assembly steps
- Troubleshooting
- FAQ
- Schematic, parts list and layout
OVERVIEW

The construction manual explains how to assemble the Microcontroller kit at home. No need special tools. The bare PCB is ready to put electronic parts and solder them with a pen type soldering iron. Testing is simple with the DC volt meter or logic probe. The preprogrammed chips are 89S52 microcontroller with 8-kB monitor program and the PLD decoder.

For young students, it could take approx. 2 hours to complete it. Building the 8051 Microcontroller kit is fun. Enjoy your time.

SAFETY INFORMATION

- Soldering place should be good ventilation or open space will be suitable for your students.
- The soldering iron is rather hot, be careful during assemble the kit.
- Cutting the leg of electronic parts is danger. Have the safety glass is recommended.
- The voltage regulator 7805 is hot when using with >12VDC supply.
- Wash your hand when finish.

Tools


2. Italian wire cutter
3. Soldering wire: Ultracore 0.8mm TIN/LEAD 60/40

4. Tray from cookie box or from kitchen. We can put all components into the tray and prepare them to assemble.

5. AC adapter with +9VDC output. Center pin positive (+).
ASSEMBLY STEPS

Mark the check box for each steps that completed.

☐ 1. Check the PCB, no wire or conductive parts on both sides.
Remember do not touch the PCB pad with finger. Pick it at the board border. The board comes with presoldered transient voltage suppressor, D11.
2. The transient voltage suppressor, D11 is located close to U11, GAL16V8D. It is a voltage clipper to clip the spike voltage at +5V.

3. Put the XTAL, 11.0592MHz to the PCB with small paper inserted to prevent the XTAL case short to a small VIA. Solder it.

5. Finished soldering point should be shine and look good.
6. Put diode D9 and D13, cut the legs of D13 and use them for TP1 and TP2.

7. Put LED D12, SQUARE pad is for Anode pin (longer leg). Solder it ONLY one LEG, not both legs. It could not in position!
8. Push the LED with finger while solder the leg, adjust until the LED is nice position. Solder the other leg and cut the leg.

9. Do the same for 8-bit debugging LED and CY LED.
10. Finish ALL LEDs using the same procedure.

12. Put R-PACK R10 and R6, the DOT indicates PIN 1.

13. Put U7, 7805 by bending the legs. And R4, solder it.
14. Put tact switch, press it until click!

15. Check all tact switches are locked, no one spring out.
16. Push it if some may spring out. Then solder them.

17. Put all electrolytic capacitors, 10uF +16V. Pin + is longer leg put to square pad.
18. Put all multilayer capacitors, 100nF. Pins has no polarity.

19. Put C10, 470uF electrolytic capacitor. Longer leg is + to square pad.
20. The negative pin of C10 has sign indicator as shown below.

21. Put Q2, BC557 and Q3, KIA7042. Both have the same case TO92. Do not swap them, ensure correct location for each one. Then solder them.
22. Put socket for Microcontroller (40 pins), SRAM (28 pins) and PLD (20 pins). Solder them.

24. Put the 7-segment LED. Solder only one pin for each LED. Adjust the position the same method as LED soldering. Check both are in line then solder them.

25. Put U1, U3, U10, U11, 74HC573 and U4, MAX232. All have no socket. Placing must be correct position! Ensure PIN1 is correct. Again solder only one pin for each chip. Verify correct position then solder them.
26. Put U12, 74HC541 and the rest parts, solder them. Put the keypad sticker.

27. Put the microcontroller, SRAM and PLD chips. Test the board power with AC adapter that provides approx. +9VDC. The power LED should lit.
28. The RESET text will show 8051.

29. Press key PC, the location 9000 with its content will be displayed.
30. You built it, the 8051 digital computer in your hand. Very easy.
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>No display, no power LED</td>
<td>1. no power from AC adapter 2. wrong polarity jack 3. wrong direction of protection diode, D13</td>
<td>1. Check AC outlet 2. correct the jack polarity, use new adapter 3. correct diode direction</td>
</tr>
<tr>
<td>No display, power LED lit</td>
<td>1. wrong IC chip insertion 2. oscillator is not running 3. CPU is not reset</td>
<td>1. correct chip position 2. check XTAL soldering, C6 and C5 must be 30pF. Use logic probe check at pin 18 of 89S52, it must be pulse signal. 3. Use logic probe check pin 9 of the microcontroller, press RESET key will make it logic “high”.</td>
</tr>
<tr>
<td>No display on GPIO1 LED</td>
<td>1. wrong direction of D9 2. wrong direction of LED</td>
<td>1. correct the direction 2. correct Cathode/Anode pins</td>
</tr>
<tr>
<td>No beep when press key</td>
<td>1. no speaker 2. wrong position of Q2 3. Wrong transistor Q2</td>
<td>1. solder the speaker 2. correct the position of Q2 3. Use PNP, not NPN transistor</td>
</tr>
<tr>
<td>None stop long beep</td>
<td>3. Wrong transistor Q2</td>
<td></td>
</tr>
<tr>
<td>Heat up at voltage regulator, U7 7805</td>
<td>1. DC input is too high.</td>
<td>1. Lower input DC voltage to +7 to 9V</td>
</tr>
<tr>
<td>No display on LCD</td>
<td>1. wrong insertion position 2. not yet adjust contrast POT, R4</td>
<td>1. correct the position 2. Adjust contrast until black line appeared.</td>
</tr>
<tr>
<td>No back-light on LCD</td>
<td>1. no R2 installed 2. R2 is higher resistant 3. LCD module has no back-light 4. back-light pin is not the same as schematic</td>
<td>1. install R2 2. use 5-10 Ohms for R2 3. use LCD module with back-light 4. use LCD module with correct back-light pin</td>
</tr>
<tr>
<td>RS232 Terminal</td>
<td>1. terminal is not set</td>
<td>1. set terminal for 9600</td>
</tr>
<tr>
<td>Connecting problem</td>
<td>Correct format</td>
<td>Bit/s, 8-data bit, no parity, one stop bit, no flow control.</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td>2. RS232 cable is not cross cable.</td>
<td>2. check the cable, it must be cross cable.</td>
<td></td>
</tr>
<tr>
<td>3. Notebook has no Rs232 port</td>
<td>3. Use the USB to RS232 converter</td>
<td></td>
</tr>
</tbody>
</table>

| P1.7 LED is not blink with TEST function | 1. wrong insertion of D10 | 1. correct the polarity |

| Some key has no response | 1. not yet solder it | 1. check and solder it |
**FAQ**

Q1: Can I use my soldering iron? I got 30W pen type.

A1: Yes, you can use your own soldering iron even with 30W is fine. My suggestion the Hakko presto 25W has been my tool so far more than 10 Yrs. It has a very good TiP. The TiP is shine with lead, so thermal contact is very good. It makes easier soldering.

Q2: My soldering wire is not 0.8mm size and not sure the TiN/LEAD ration.

A2: I suggest to use 0.8mm size with TiN/LEAD ratio 60/40.

Q3: I have no digital multimeter. How can I check the +5V output from 7805 regulator.

A3: You can use needle multimeter as well. The needle would show approx. 4.8V-5V is fine.

Q4: Why need approx. >7VDC for the power supply? Can I use 6V?

A4: The dropping voltage across 7805 is approx. 2V in order to provide +5V output. If we use lower, says 6V the output voltage will be lower than +5V!

Q5: My AC adapter output is +15V, can I use it?

A4: Yes, you can use it, but the power dissipation at the 7805 will be approx. 80mA*(+15V-5V) or 0.8W! If we use +7V, it will be 0.2W.

Q6: Why you said the low frequency transformer is good for young students?

A6: The low frequency transformer has separate turn, primary and secondary turns. The power is transferred by magnetic field. So it is a kind of galvanic isolation between high voltage and low voltage. It is quite safe.

Q7: Can I reprogram the microcontroller chip with my monitor program?

A7: Yes, you may learn the user's manual that provides monitor source code in c language. You can modify it, recompile then reprogram the chip.

Q8: Why need brownout reset chip, KIA7042?

A8: The CPU that has no brownout reset will not be able to restart properly. You can test the kit with adjustable power supply. Slowly increase the voltage from 0 to +9V. If no brownout reset chip, you will see what will happening. This feature makes the kit is very reliable.

Q9: What is the important issue for assembly the kit?

A9: 95% that causes circuit not functioning are from soldering! Each parts must have good electrical contact.
PARTS LIST

Semiconductors

U2 HM62256B, 32kB SRAM
U4 MAX232A
U5 AT89S52 microcontroller
U6 GAL16V8D
U7 LM7805/TO
U9,U8 LTC-4727JR, 7-segment
U12 74HC541
U1,U3,U10,U11 74HC573
Q2 BC557 or BC327
Q3 KIA7042
D1,D2,D4,D5,D6,D7,D8,D15 LED
D3 LED 3mm
D9 1N5236A
D10 Debug 3mm LED
D11 TVS5V
D12 POWER LED
D13 1N4007

Resistors (all resistors are 1/8W +/-5%)

R1,R4 10K
R9,R2 10 or 5
R3 330, or 680
R5 2k or 1k
R10,R6 10k RESISTOR SIP 9
R7 4.7k

Capacitors

C1,C7 10uF 10V
C2,C3,C4 10uF
C5,C6 30pF disceramic
C8 100uF or 10uF 16V
C9 10uF 16V
C10 470uF 25V
C12,C13,C14,C15,C16 0.1uF
C17,C18 0.1uF multilayer
C12 10uF 10V electrolytic
C19,C18 100nF disc ceramic

Additional parts

JP1 HEADER 20X2
JR1 CONN RECT 16
J1 DC input JACK

S1 11.0592MHz Xtal
S1,3,4,5,6,7,8,9, S10,S11,S12,S13,S14,S15,
S16,S17,S18,S19,S20,S21,
S22,S23,S24,S25,S26
S27 INTERRUPT0
S28 INTERRUPT1

All switches are 12mm TACT switch

TP1 +5V
TP2 GND
VB1 SUB-D 9, Male (cross cable)

PCB double side plate through hole
LED cover Clear RED color acrylic plastic
Keyboard sticker printable SVG file
PLD equation

/** *************** INPUT PINS **********************/
PIN 2    =     RD;
PIN 3    =     WR;
PIN 4    =     RESETL;
PIN 5    =     A8;
PIN 6    =     A9;
PIN 7    =     A10;
PIN 8    =     A15;
PIN 9    =     PSEN;
PIN 1    =     A0;
PIN 11    =    A1;

/** *************** OUTPUT PINS **********************/
PIN 12   =   RAMCE;
PIN 13   =   RESETH;
PIN 14   =   GPIO1;
PIN 15   =   RAMOE;
PIN 16   =   LCD_E;
PIN 17   =   PORT0;
PIN 18   =   PORT1;
PIN 19   =   PORT2;

RAMCE = !A15;
RAMOE = !A15 # (RD & PSEN);
RESETH = !RESETL;
!GPIO1 = WR # A15 # A10 # A9 # !A8 # A1 # A0;
!LCD_E = (RD & WR) # A15 # A10 # A9 # A8;
PORT0 = RD # A15 # A10 # !A9 # A8 # A1 # A0;
!PORT1 = WR # A15 # A10 # !A9 # A8 # A1 # !A0;
!PORT2 = WR # A15 # A10 # !A9 # A8 # !A1 # A0;

PLD CHIP GAL16V8D