# HU-050SW Voltage Ammeter PWM Signal Generator DIY Kit

## I. Introduction:

HU-050SW is a a multifunctional voltmeter Ammeter DIY Kit. It is an instrument that integrates multiple functions and is very suitable for laboratory or testing scenarios.It is easy to use, has a beautiful design, and is perfect for home or office use.

It is a fun DIY electronic product that allows you to better understand the circuit and learn how to solder.

## II. Function:

1>.Measure and display the measured voltage value(DC 0V-30V/0.04V)

2>.Measure and display the measured current value(0A-2A/0.01A)

3>.Display current environmental temperature value(0-100℃)

4>.Display measured temperature value by external NTC sensor(0-100℃ & NOT included)

5>.Measure the measured logic level: High level, Low level, High impedance state

6>.Measuring circuit ON/OFF status: short circuit with buzzer alarm

7>.Measure the frequency and duty cycle of the input PWM signal(1Hz~31.2KHz 0%~100%)

8>.Output 1Hz~31.2KHz 0%~100% adjustable PWM signal as signal generator(3.3V/5V switchable)

9>.Output 3.3V and 5V voltage value

## III. Feature:

1>.Integrating multiple functions into one

2>.Three power supply methods

3>.Electronic document image and text installation manual

4>.Acrylic transparent shell

5>.DIY Hand Soldering

## IV. Parameter:

1>.Work voltage: DC 5V

2>.Work current: <30mA

3>.Power interface: Micro USB/DC-005/XH2.54-2P

4>.Input/Output PWM frequency: 1Hz~31.2KHz

5>.Input/Output PWM duty cycle: 0%~100%

6>.Output frequency voltage: 3.3V or 5V switchable

7>.Measured voltage: DC 0V-30V/0.04V

8>.Measured current: 0A-2A/0.01A

9>.Measured temperature: 0-100℃

9>.Switch display type: Black button

10>.Power switch: Yes

11>.Display screen: Red

12>.Power indicator: Yes

13>.Work Temperature:-40℃~85℃

14>.Work Humidity:5%~95%RH

15>.Size(Installed):98*75*21mm

## V. Use Methods:

1>.Input 5V work voltage from any one of power interface Micro USB/DC-005/XH2.54-2P. It is not recommended to use multiple power interfaces at the same time.

2>.Switch SW1 power ON/OFF Toggle Switch to ON status to turn ON power.

3>.Calibration: Keep press SW2 black button until the display screen flashes once. Note: Do not connect the load during calibration and just only need to calibrate once.

4>.The display screen defaults to displaying the measured voltage at the first line and current values at the second line. They will display 000 if the measured device is not connected.

5>.Click SW2 button to switch functions tested.

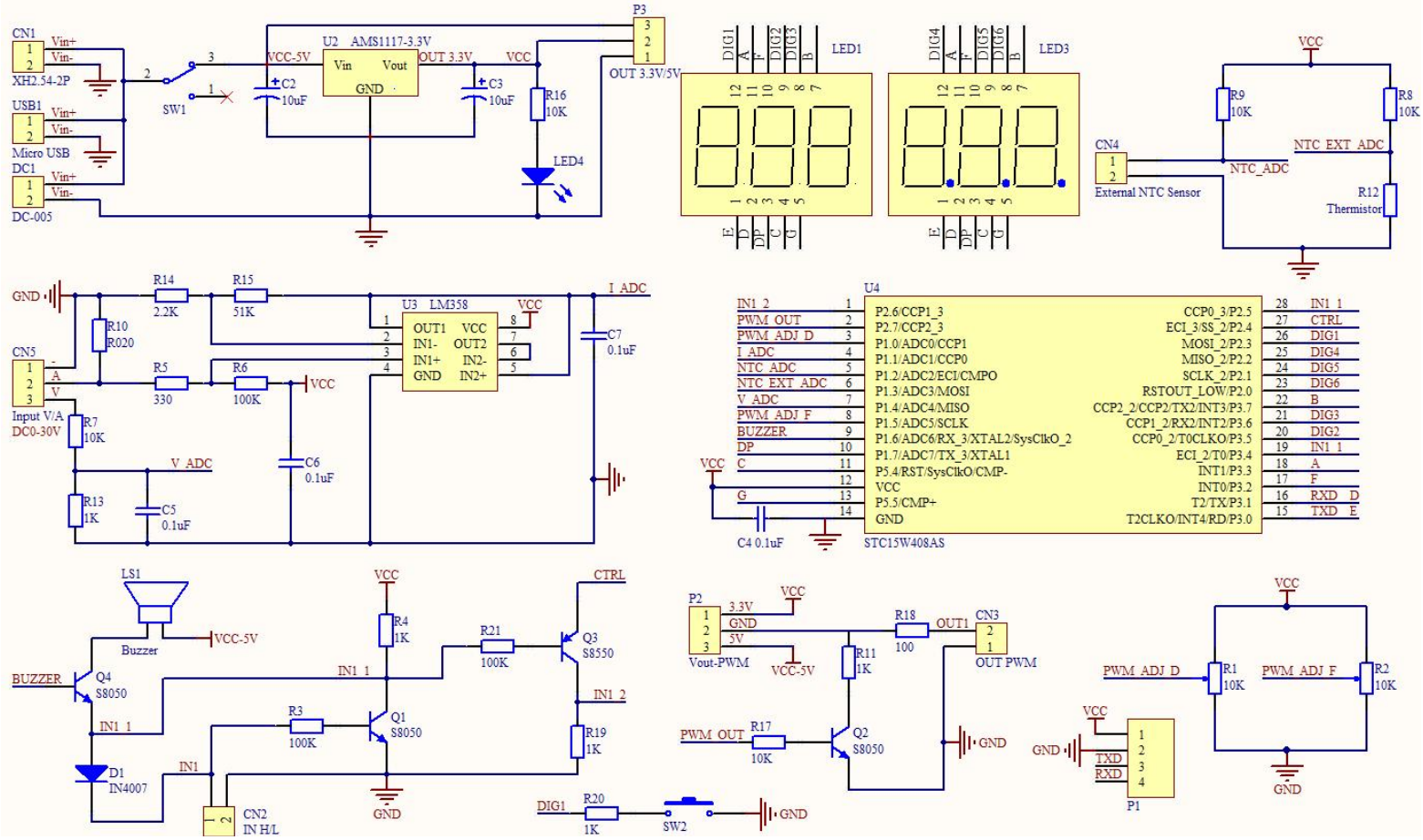
6>.Refer to the wiring diagram in the appendix to connect the tested equipment.

## VI. Component Listing:

| NO. | Component Name | PCB Marker | Parameter | QTY |
|---|---|---|---|---|
| 1 | Electrolytic Capacitor | C2, C3 | 10uF | 2 |
| 2 | Ceramic Capacitor | C4-C7 | 0.1uF 104 | 4 |
| 3 | White XH2.54-2P Socket | CN1, CN4 | 2.54mm | 2 |
| 4 | KF301-3P Terminal Connector | CN5 | 5.08mm | 1 |
| 5 | KF301-2P Terminal Connector | CN2, CN3 | 5.08mm | 2 |
| 6 | IN4007 Diode | D1 | DO-41 | 1 |
| 7 | DC-005 Power Socket | DC1 | | 1 |
| 8 | Red 3-Digit Digital Tube | LED1, LED3 | | 2 |
| 9 | 3mm Red LED | LED4 | | 1 |
| 10 | Active Buzzer | LS1 | | 1 |
| 11 | 3Pin Male Pin | P2, P3 | 2.54mm | 2 |
| 12 | S8050 Transistor | Q1, Q2, Q4 | TO-92 | 3 |
| 13 | S8550 Transistor | Q3 | TO-92 | 1 |
| 14 | Adjustable Potentiometer | R1, R2 | 10Kohm 103 | 2 |
| 15 | Metal Film Resistor | R4, R11, R13,R19, R20 | 1Kohm | 5 |
| 16 | Metal Film Resistor | R7-R9, R16, R17 | 10Kohm | 5 |
| 17 | Metal Film Resistor | R5 | 330ohm | 1 |
| 18 | Metal Film Resistor | R3,R6,R21 | 100Kohm | 3 |
| 19 | Metal Film Resistor | R18 | 100ohm | 1 |
| 20 | SMD Resistor | R10 | 0.02ohm R020 | 2 |
| 21 | Thermistor | R12 | | 1 |
| 22 | Metal Film Resistor | R14 | 2.2Kohm | 1 |
| 23 | Metal Film Resistor | R15 | 51Kohm | 1 |
| 24 | SS12F23 Toggle Switch | SW1 | 5Pin | 1 |
| 25 | Black Button | SW2 | | 1 |
| 26 | Black Button Cap | SW2 | | 1 |
| 27 | AMS1117-3.3V Voltage Regulator | U2 | SOT-223 | 1 |
| 28 | LM358P | U3 | DIP-8 | 1 |

| | | | | |
|---|---|---|---|---|
| 29 | IC Socket | U3 | DIP-8 | 1 |
| 30 | STC15W408AS | U4 | DIP-28 | 1 |
| 31 | IC Socket | U4 | DIP-28 | 1 |
| 32 | Micro USB Socket | USB1 | 2Pin | 1 |
| 33 | USB Power Wire | | 50cm | 1 |
| 34 | Green Jumper Cap | | | 1 |
| 35 | Red Crocodile Clip | | | 1 |
| 36 | Black Crocodile Clip | | | 1 |
| 37 | 12mm Red/Black Wire | | | 1 |
| 38 | Acrylic Plate | | Transparent | 6 |
| 39 | M3*9mm Copper Pillar | | | 4 |
| 40 | M3*5+6mm Copper Pillar Screw | | | 4 |
| 41 | M3*5mm Screw | | | 8 |
| 42 | PCB | | | 1 |
| Note:Users can complete the installation according to the PCB silk screen and component list. | | | | |

# VII. Schematic Diagram:




# VIII. Application:

1>.Training welding skills
2>.Student school
3>.DIY production
4>.Project Design

5>.Electronic competition
6>.Gift giving
7>.Crafts collection
8>.Home decoration
9>.Souvenir collection
10>.Graduation design
11>.Holiday gifts

## IX. Installation Tips:

1>.User needs to prepare the welding tool at first.
1.1>.Soldering iron (<50 Watt)
1.2>.Rosin core ("radio") solder
1.3>.Wire cutters
1.4>.Wire strippers
1.5>.Screwdriver
2>.Please be patient until the installation is complete.
3>.The package is DIY kit.It need finish install by user.
4>.The soldering iron can't touch the components for a long time(1.0 second), otherwise it will damage the components.
5>.Pay attention to the positive and negative of the components.
6>.Strictly prohibit short circuit.
7>.User must install the LED according to the specified rules.Otherwise some LED will not light.
8>.Install complex components preferentially.
9>.Make sure all components are in right direction and right place.
10>.It is strongly recommended to read the installation manual before starting installation!!!
11>.Please wear anti-static gloves or anti-static wristbands when installing electronic components.

## X. Installation Steps(Please be patient install!!!):

1>.Step 1: Install 1pcs SMD components SOT-223 AMS1117-3.3V Voltage Regulator at U2. Verify and confirm the installation direction of AMS1117. The rectangular silk screen on the PCB coincides with the crystal oscillator on the AMS1117 to locate the installation direction.
2>.Step 2: Randomly choose a pad on the PCB, and then melt the solder on this pad.
3>.Step 3: Fix AMS1117: Use a soldering iron to melt tin on the pad just now and hold AMS1117 with tweezers in the other hand to place/press on U1 to prevent movement. Take care to match and align each pads. Then remove soldering iron. Then remove tweezers after solder tin cooling and solidification.
4>.Step 4: Connect others pads on AMS1117 to pads on PCB by tin and soldering iron.
5>.Step 5: Install 1pcs 0.02ohm R020 SMD Resistor at R10 by the same methods.
6>.Step 6: Install 5pcs 1Kohm Metal Film Resistor at R4,R11,R13,R19,R20.
7>.Step 7: Install 5pcs 10Kohm Metal Film Resistor at R7,R8,R9,R16,R17.

8>.Step 8: Install 1pcs 330ohm Metal Film Resistor at R5.

9>.Step 9: Install 3pcs 100Kohm Metal Film Resistor at R3,R6,R21.

10>.Step 10: Install 1pcs 100ohm Metal Film Resistor at R18.

11>.Step 11: Install 1pcs 2.2Kohm Metal Film Resistor at R14.

12>.Step 12: Install 1pcs Thermistor at R12 as showing. It is recommended that the sensor probe be at least 5mm away from the edge of the PCB.

13>.Step 13: Install 1pcs 51Kohm Metal Film Resistor at R15.

14>.Step 14: Install 1pcs DO-41 1N4007 Diode at D1. Pay attention to the installation direction. There is a white mark on 1N4007 and a white mark on PCB which are used to confirm the installation direction.

15>.Step 15: Install 1pcs 2Pin Micro USB Socket at USB1.

16>.Step 16: Install 1pcs DIP-28 IC Socket at U4.There is a gap mark on one end of the IC Socket and there is a gap mark on PCB silk screen where the IC Socket can place on.These two marks are corresponding to each other and are used to specify the installation direction of the IC Socket.

17>.Step 17: Install 1pcs DIP-8 IC Socket at U3 by the same methods

18>.Step 18: Install 2pcs White XH2.54-2P Socket at CN1,CN4. Pay attention to the notch facing inward.

19>.Step 19: Install 1pcs 3mm Red LED at LED4. The Longer pin is positive pole and connect to the ‘ + ’ pad.

20>.Step 20: Install 4pcs 0.1uF 104 Ceramic Capacitor at C4,C5,C6,C7.

21>.Step 21: Install 1pcs SS12F23 Toggle Switch at SW1.

22>.Step 22: Install 2pcs 3Pin Male Pin at P2,P3.

23>.Step 23: Install 3pcs TO-92 S8050 Transistor at Q1,Q2,Q4. Pay attention to the installation direction. The arc on the PCB corresponds to the arc of the components.

24>.Step 24: Install 1pcs TO-92 S8050 Transistor at Q3. Pay attention to the installation direction. The arc on the PCB corresponds to the arc of the components.

25>.Step 25 Install 2pcs 10uF Electrolytic Capacitor at C2,C3. The Longer pin is positive pole and connect to the ‘ + ’ pad.

26>.Step 26: Install 1pcs Active Buzzer at LS1. The ‘ + ’ pin connect to the ‘ + ’ pad.

27>.Step 27: Install 2pcs KF301-2P Terminal Connector at CN2,CN3 and 1pcs KF301-3P Terminal Connector at CN5. Note: The wire insertion port faces outward.

28>.Step 28: Install 1pcs DC-005 Power Socket at DC1.

29>.Step 29: Install 1pcs Black Button at SW2.

30>.Step 30: Install 2pcs 10Kohm 103 Adjustable Potentiometer at R1,R2. Note: Pay attention to the installation direction with the knob in the upper left corner.

31>.Step 31: Install 2pcs Red 3-Digit Digital Tube at LED1,LED3.Pay attention to the installation direction of the decimal point.

32>.Step 32: Install 1pcs DIP-28 IC STC15W408AS at U4. There is a gap mark on one end of the IC and there is a gap mark on DIP-28 IC Socket where the IC can place on.These two marks are corresponding to each other and are used to specify the installation direction of the IC.

33>.Step 33: Install 1pcs DIP-8 IC LM358P at U3 by the same methods.

34>.Step 34: Remove the jacket of the crocodile clip and connect the wires. Note: Try to use more solder tin at the welding points.

35>.Step 35: Reinstall the removed red and black insulation jacket , paying

attention to the red installation on the red wire.

36>.Step 36: Fix 4pcs M3*9mm Copper Pillar on PCB by 4pcs M3*5+6mm Copper Pillar Screw.

37>.Step 37: Tear off the protective film on the surface of the acrylic shell.

38>.Step 38: Pace power interface side acrylic board on the bottom acrylic board as showing.

39>.Step 39: Fix PCB on the bottom acrylic board by 4pcs M3*5mm Screw. Pay attention to aligning the power interface on the side.

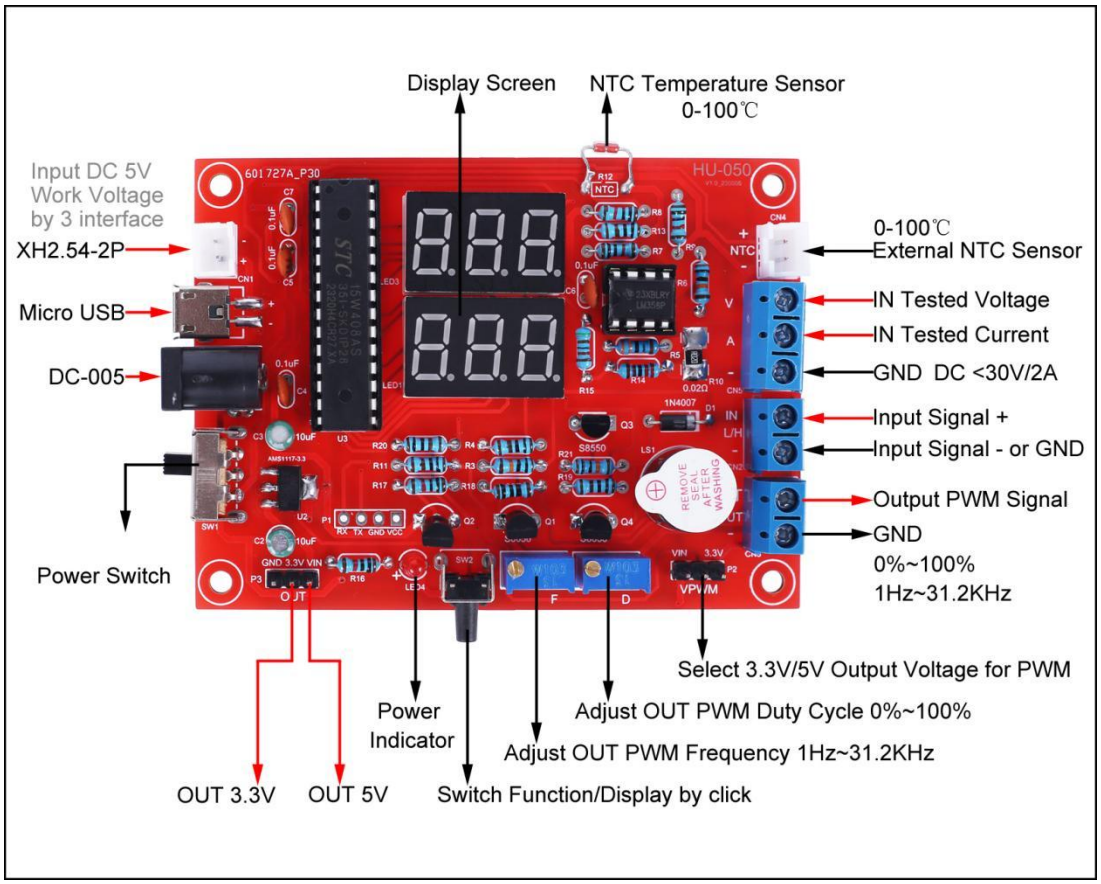
40>.Step 40: Place another side acrylic board with temperature sensor hole.

41>.Step 41: Place another side acrylic board with button hole.

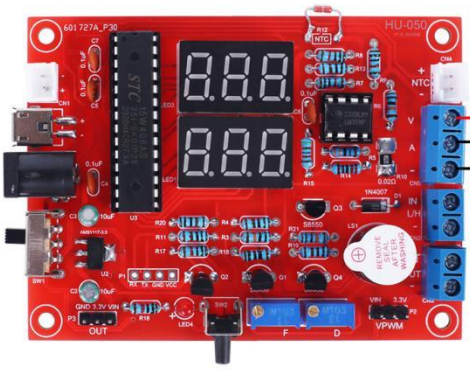
42>.Step 42: Place the last side acrylic board.

43>.Step 43: Fix the last acrylic board 4pcs M3*5mm Screw.

## XI. Install shown steps:



## Measure Voltage and Current Values



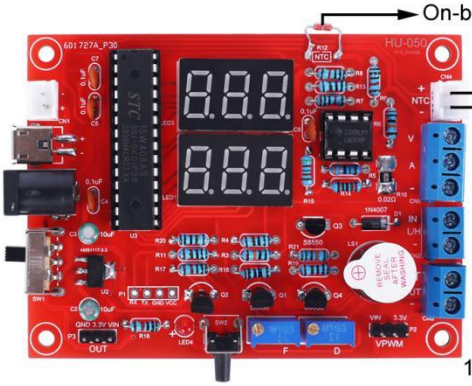

Display Screen :

0.00 Volt : V

0.00 Amps: A

1.The 1st screen display measured voltage.
Its range is DC 0V~30V. Accuracy 0.04V.
2.The 2nd sreen display measured current.
Its range is 0A~2A. Accuracy 0.01A

## Measure Temperature in Celsius



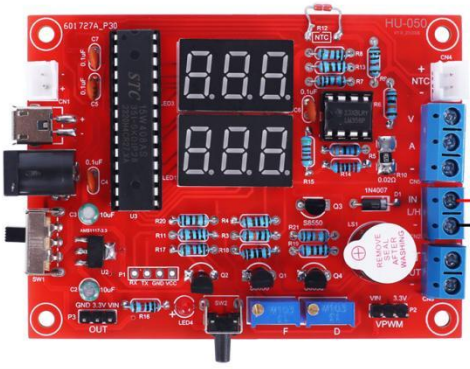

Display Screen :

00C Ambient Temperature

00C External Temperature

1.Measured temperature's range is 0~100℃. Accuracy 1℃.

## Measure Logic Level Signal




Display Screen :

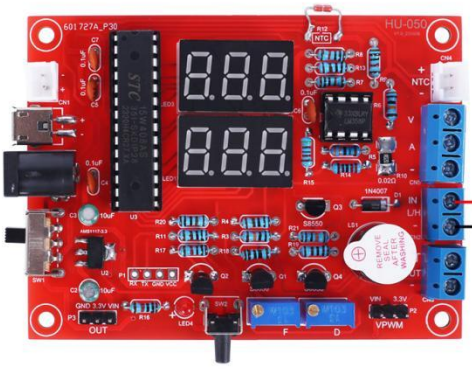
L-H --- High impedance state

L-H -L- Low Level

L-H -H- High Level

1.Display the logical status of the measured input signal.

## Measuring Circuit ON/OFF Status



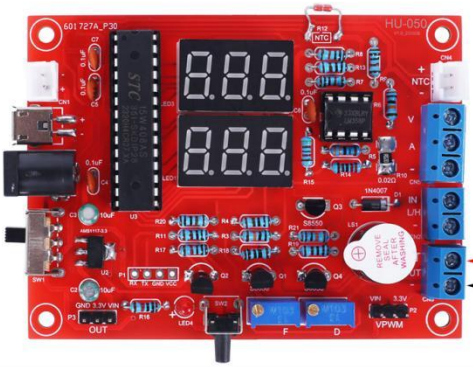

Display Screen :

- - -

- - -

1.Buzzer continuously alarms when the tested circuit is short circuited or turn ON.

## Measure Input PWM Frequency & Duty Cycle



Display Screen :

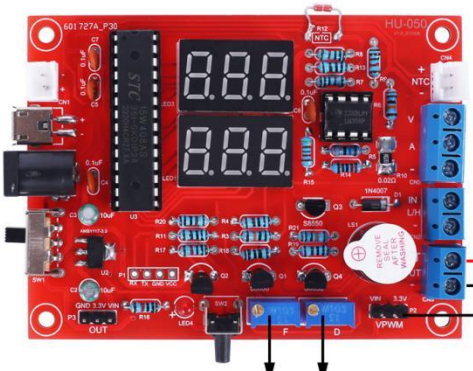
0.00 Freq:KHz
00 DutyCycle:%

000 Freq:KHz
00 DutyCycle:%

Input Signal

1.The 1st screen display measured frequency. Its range is 1Hz~31.2KHz.
2.The 2nd sreen display measured duty cycle.Its range is 0%~100%.

## Output PWM Signal



Display Screen :

0.00 Freq:KHz
00 DutyCycle:%

000 Freq:KHz
00 DutyCycle:%

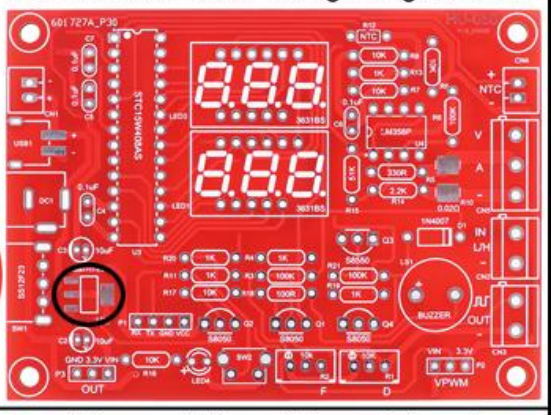
Output Signal

1.The 1st screen display output frequency.Its range is 1Hz~31.2KHz.
2.The 2nd sreen display output duty cycle.Its range is 0%~100%.

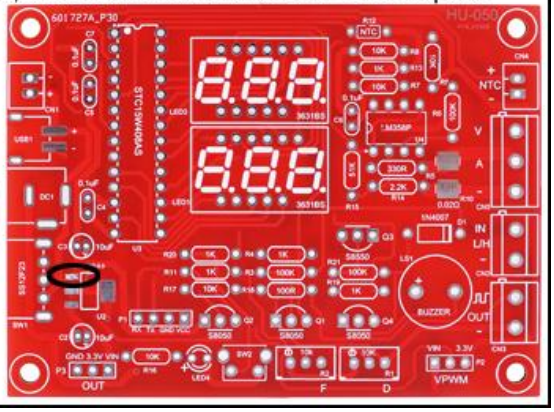
Adjust Frequency  Adjust Duty Cycle  Switch 3.3V/5.5V OUT for PWM

Step 1: Install 1pcs SMD components SOT-223 AMS1117-3.3V Voltage Regulator at U2. Verify and confirm the installation direction of AMS1117. The rectangular silk screen on the PCB coincides with the crystal oscillator on the AMS1117 to locate the installation direction.

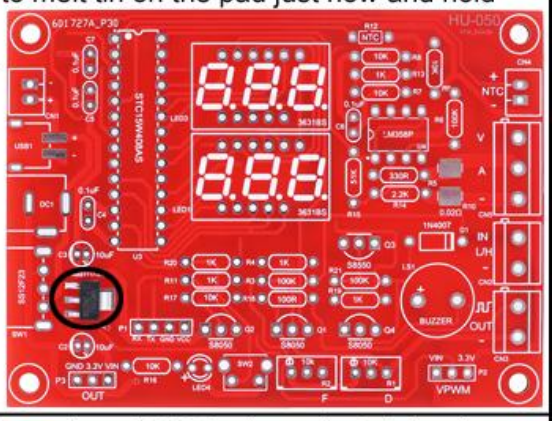




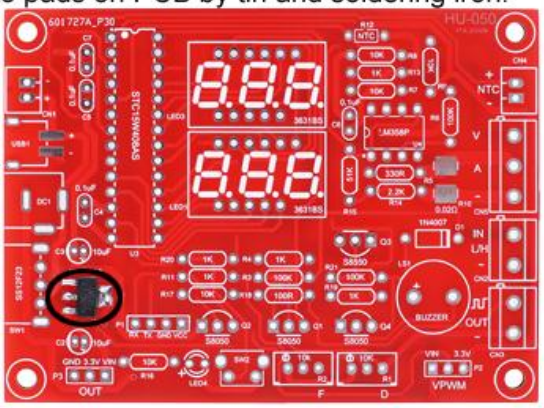
Step 2: Randomly choose a pad on the PCB, and then melt the solder on this pad.

Step 3: Fix AMS1117: Use a soldering iron to melt tin on the pad just now and hold AMS1117 with tweezers in the other hand to place/press on U1 to prevent movement. Take care to match and align each pads. Then remove soldering iron. Then remove tweezers after solder tin cooling and solidification.

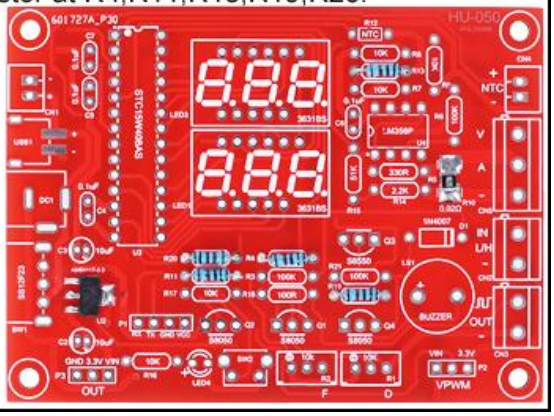


Step 4: Connect others pads on AMS1117 to pads on PCB by tin and soldering iron.

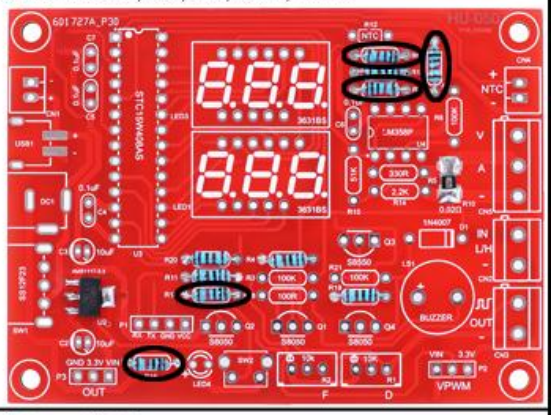


Step 5: Install 1pcs 0.02ohm R020 SMD Resistor at R10 by the same methods.

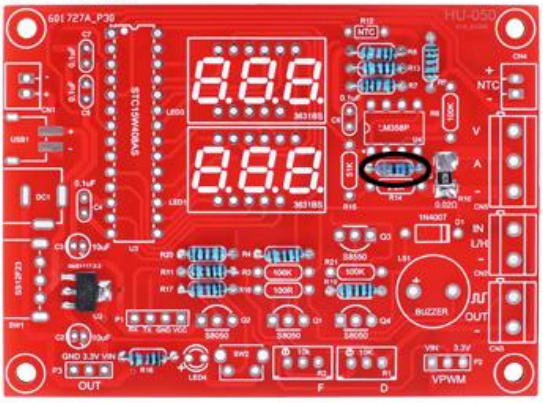

Step 6: Install 5pcs 1Kohm Metal Film Resistor at R4,R11,R13,R19,R20.



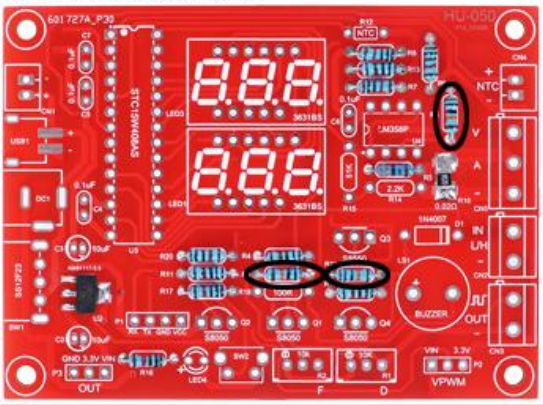
Step 7: Install 5pcs 10Kohm Metal Film Resistor at R7,R8,R9,R16,R17.



Step 8: Install 1pcs 330ohm Metal Film Resistor at R5.

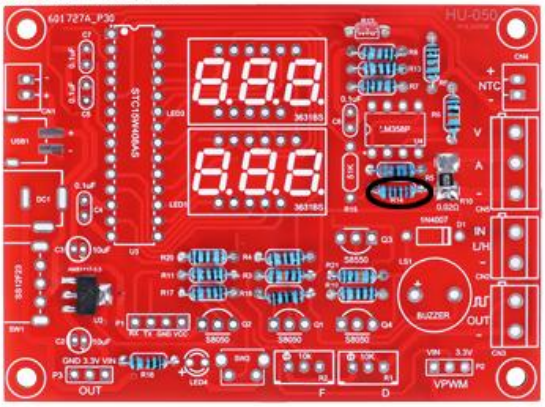


Step 9: Install 3pcs 100Kohm Metal Film Resistor at R3,R6,R21.

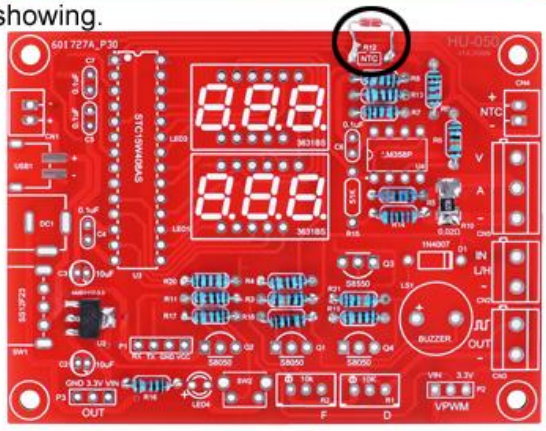


Step 10: Install 1pcs 100ohm Metal Film Resistor at R18.

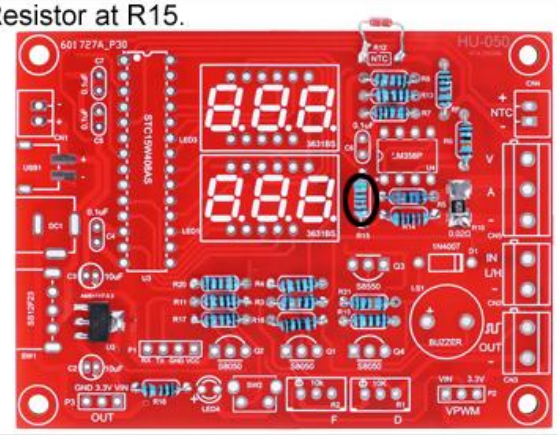
Step 11: Install 1pcs 2.2Kohm Metal Film Resistor at R14.

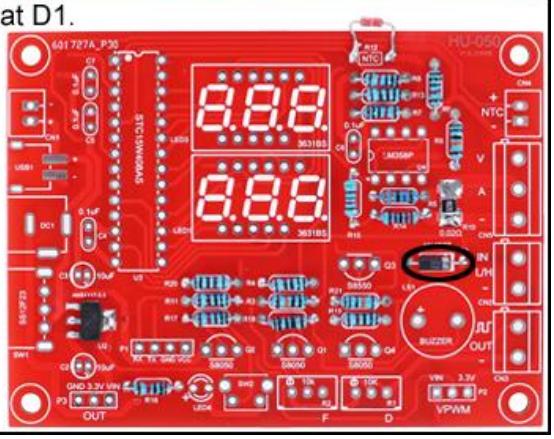
Step 12: Install 1pcs Thermistor at R12 as showing.
It is recommended that the sensor probe be at least 5mm away from the edge of the PCB.

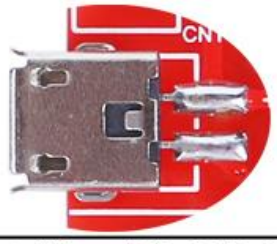
Step 13: Install 1pcs 51Kohm Metal Film Resistor at R15.

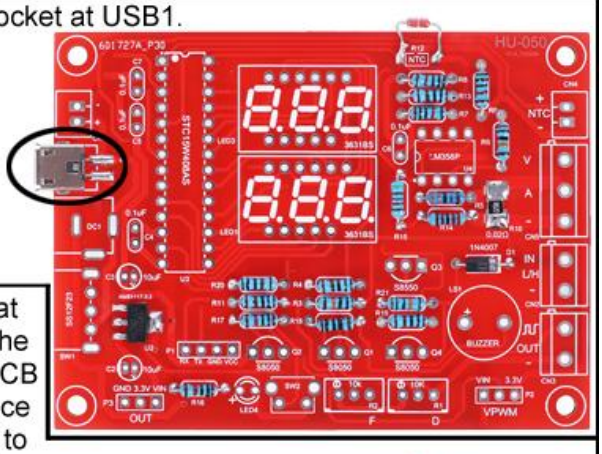


Step 14: Install 1pcs DO-41 1N4007 Diode at D1.
Pay attention to the installation direction. There is a white mark on 1N4007 and a white mark on PCB which are used to confirm the installation direction.

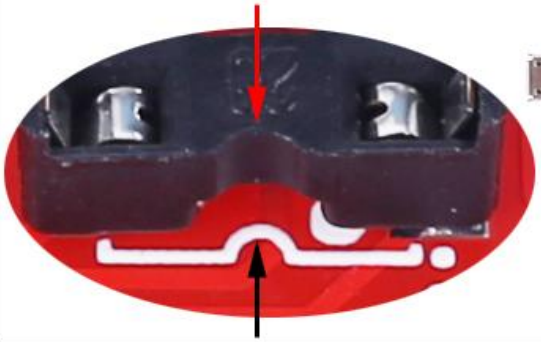


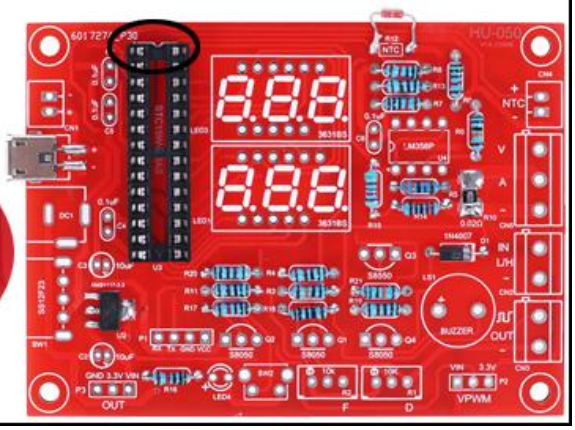
Step 15: Install 1pcs 2Pin Micro USB Socket at USB1.



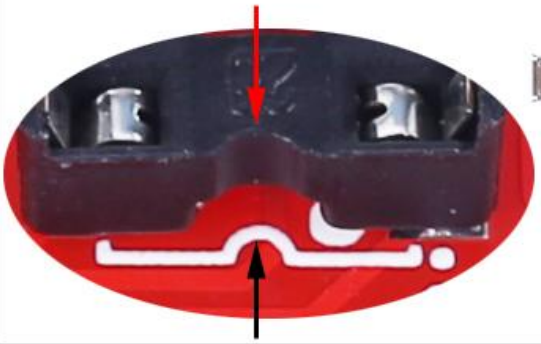


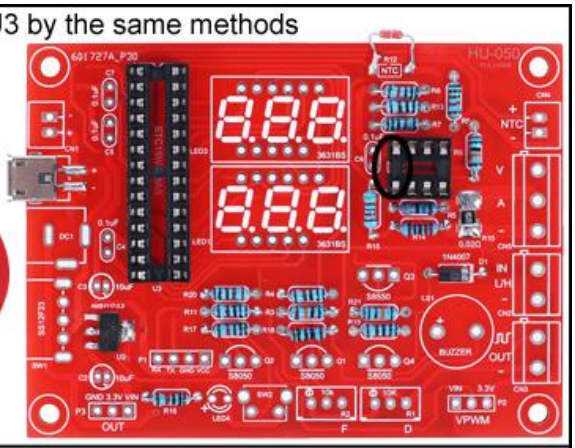
Step 16: Install 1pcs DIP-28 IC Socket at U4.There is a gap mark on one end of the IC Socket and there is a gap mark on PCB silk screen where the IC Socket can place on.These two marks are corresponding to each other and are used to specify the installation direction of the IC Socket.



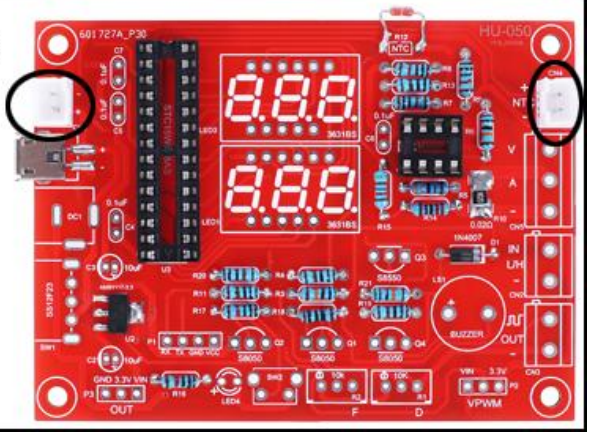


Step 17: Install 1pcs DIP-8 IC Socket at U3 by the same methods

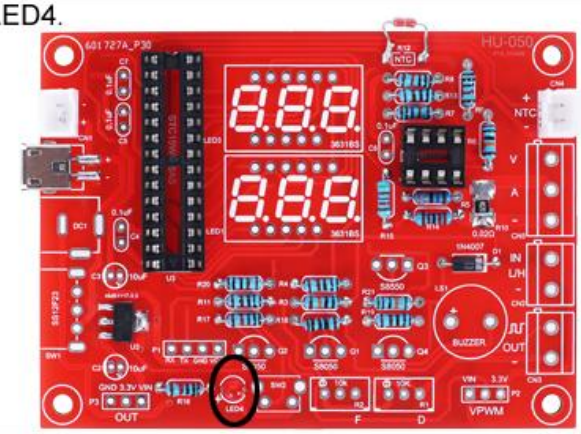




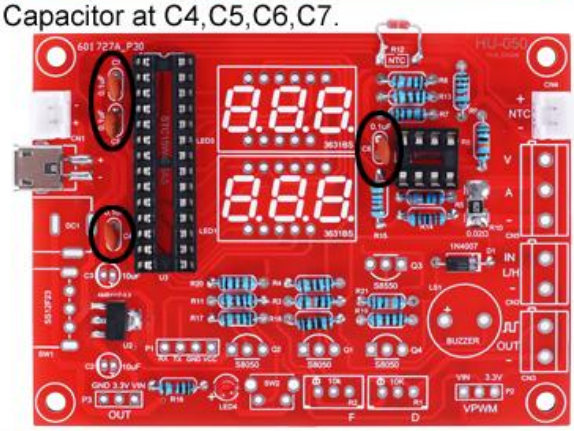
Step 18: Install 2pcs White XH2.54-2P Socket at CN1,CN4. Pay attention to the notch facing inward.



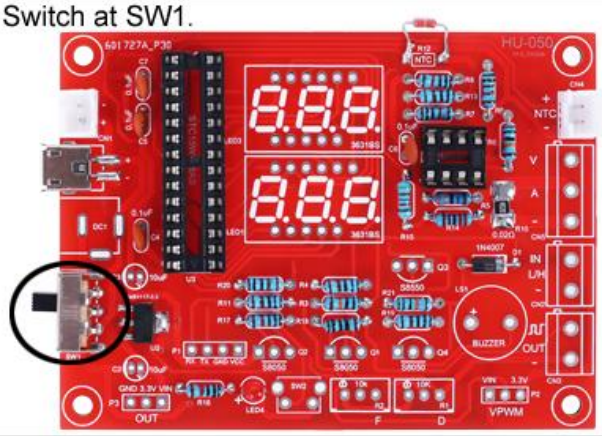
Step 19: Install 1pcs 3mm Red LED at LED4.
The Longer pin is positive pole and connect to the ' + ' pad.

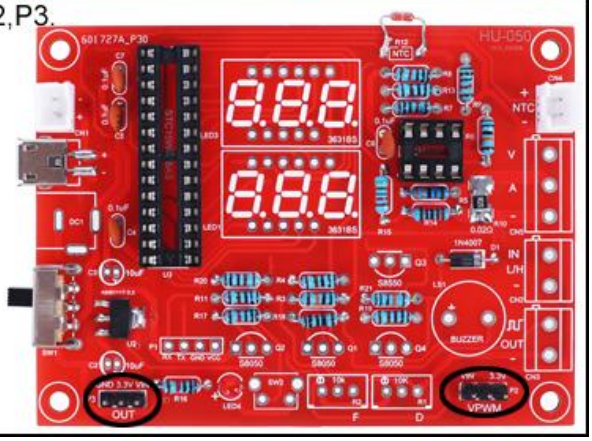
Step 20: Install 4pcs 0.1uF 104 Ceramic Capacitor at C4,C5,C6,C7.



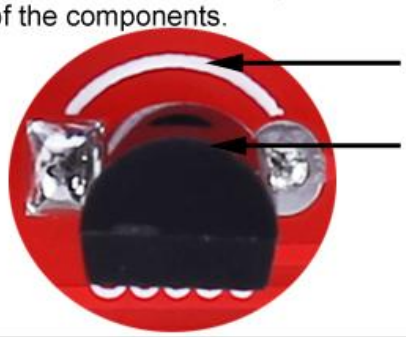
Step 21: Install 1pcs SS12F23 Toggle Switch at SW1.

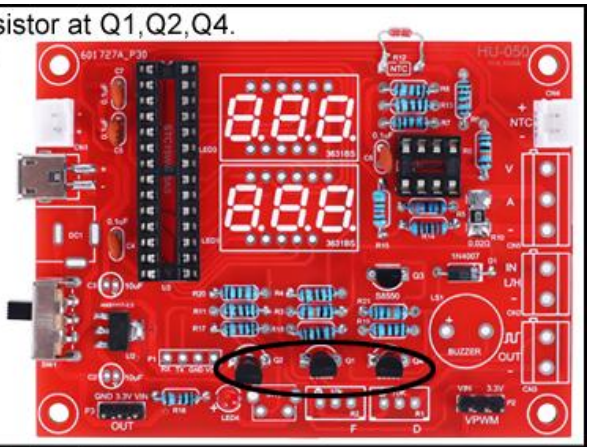



Step 22: Install 2pcs 3Pin Male Pin at P2,P3.

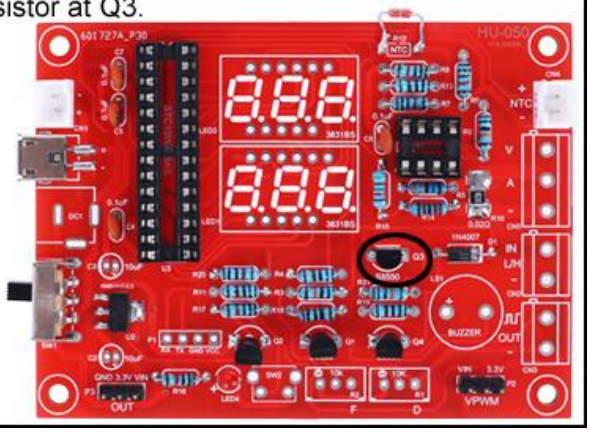



Step 23: Install 3pcs TO-92 S8050 Transistor at Q1,Q2,Q4.
Pay attention to the installation direction.
The arc on the PCB corresponds to the arc of the components.

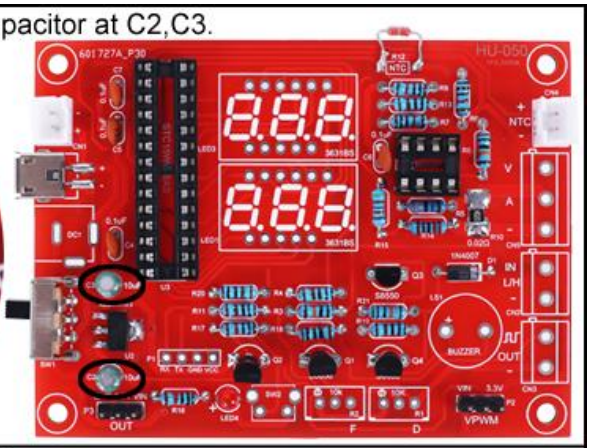




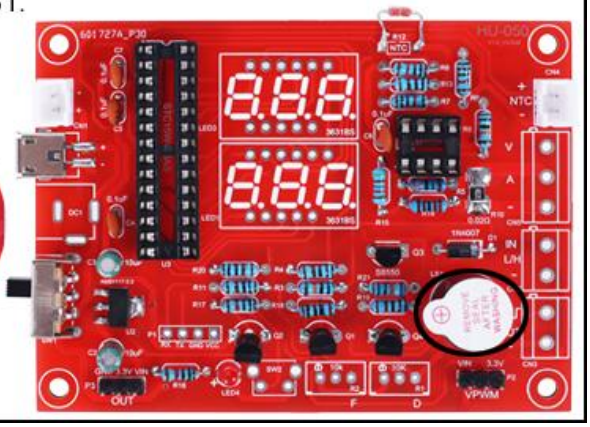
Step 24: Install 1pcs TO-92 S8050 Transistor at Q3.
Pay attention to the installation direction.
The arc on the PCB corresponds to the arc of the components.



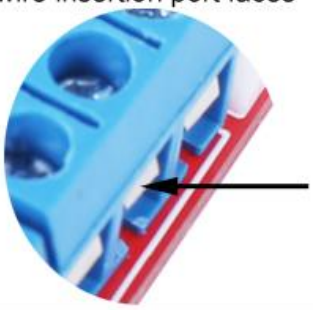
Step 25 Install 2pcs 10uF Electrolytic Capacitor at C2,C3.
The Longer pin is positive pole and connect to the ' + ' pad.

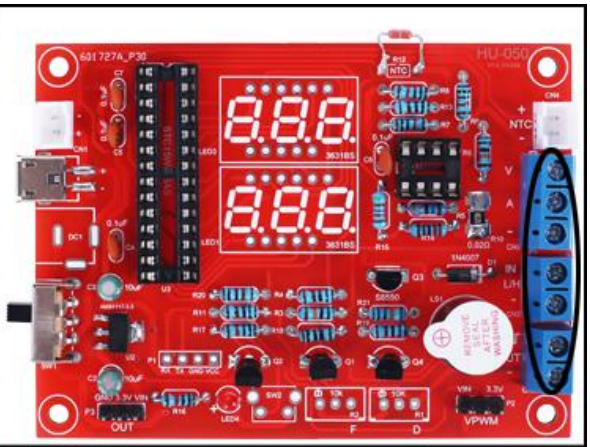



Step 26: Install 1pcs Active Buzzer at LS1.
The ' + ' pin connect to the ' + ' pad.

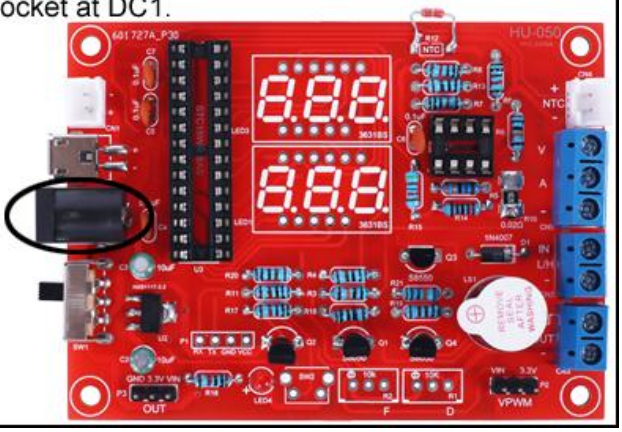



Step 27: Install 2pcs KF301-2P Terminal Connector at CN2,CN3 and 1pcs KF301-3P Terminal Connector at CN5.
Note: The wire insertion port faces outward.

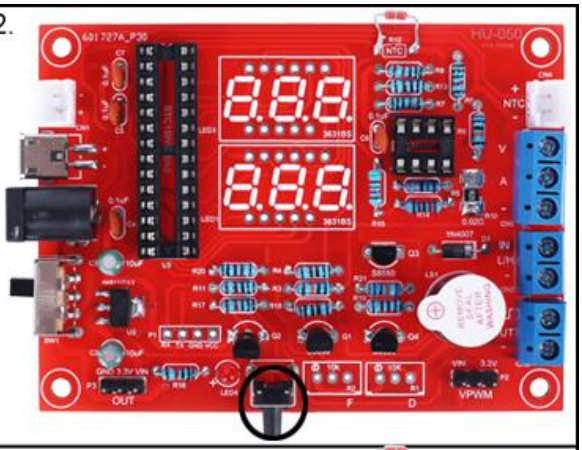




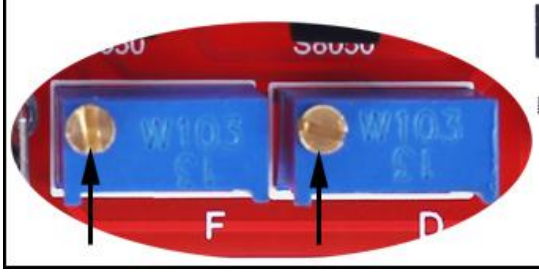
Step 28: Install 1pcs DC-005 Power Socket at DC1.

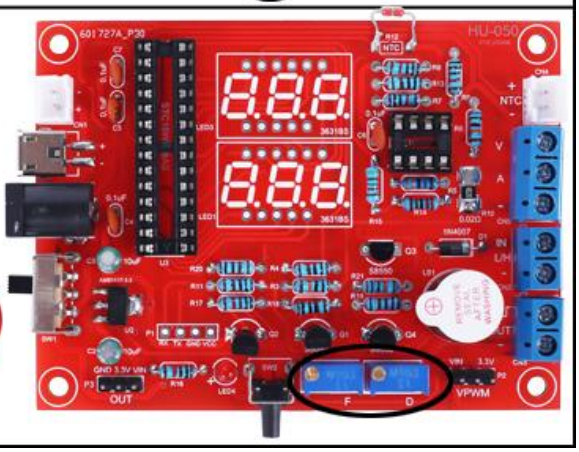


Step 29: Install 1pcs Black Button at SW2.

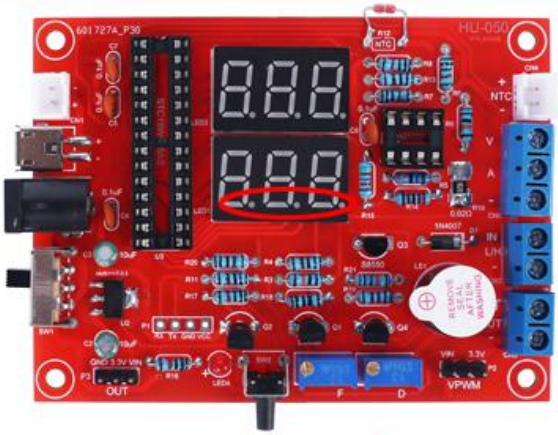



Step 30: Install 2pcs 10K 103 Adjustable Potentiometer at R1,R2.
Note: Pay attention to the installation direction with the knob in the upper left corner.

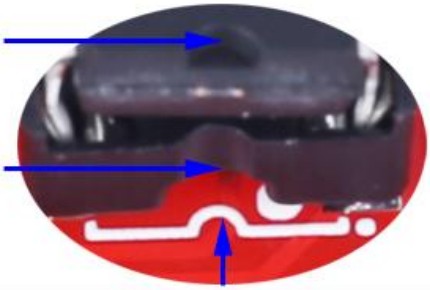


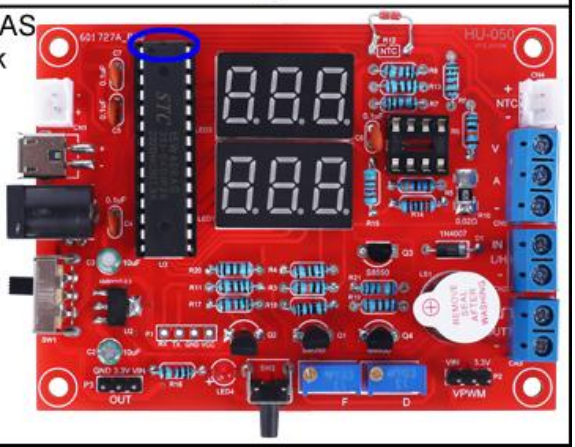



Step 31: Install 2pcs Red 3-Digit Digital Tube at LED1,LED3.Pay attention to the installation direction of the decimal point.

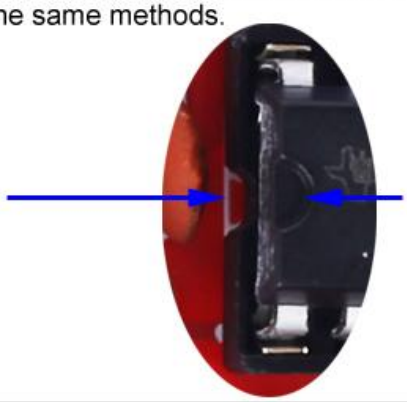


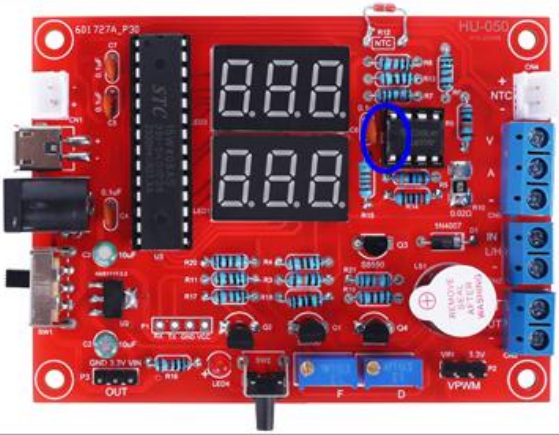
Step 32: Install 1pcs DIP-28 STC15W408AS at U4. Align gap mark on IC and gap mark on DIP-28 IC Socket. They are used to specify the installation direction.



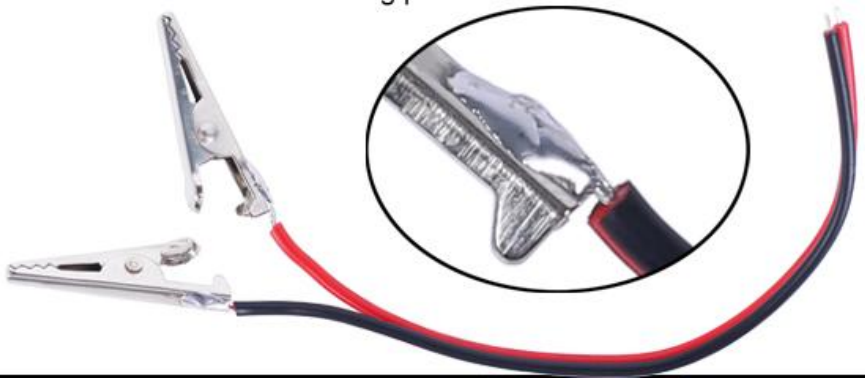


Step 33: Install 1pcs DIP-8 IC LM358P at U3 by the same methods.

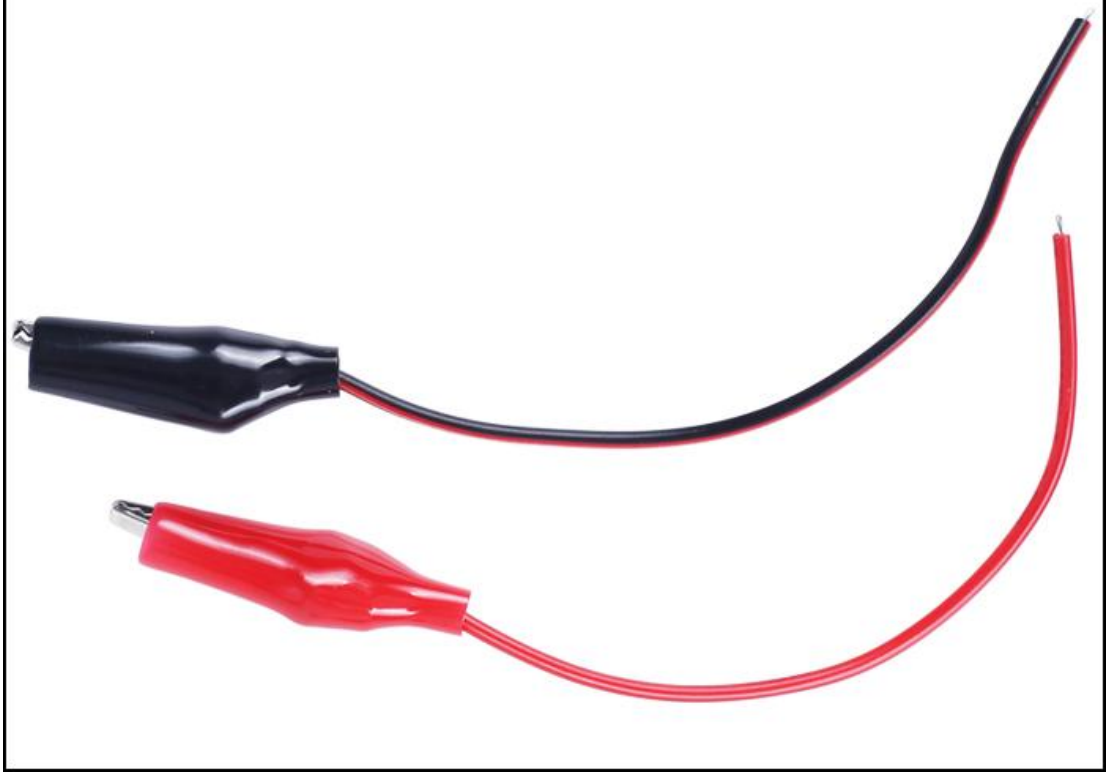




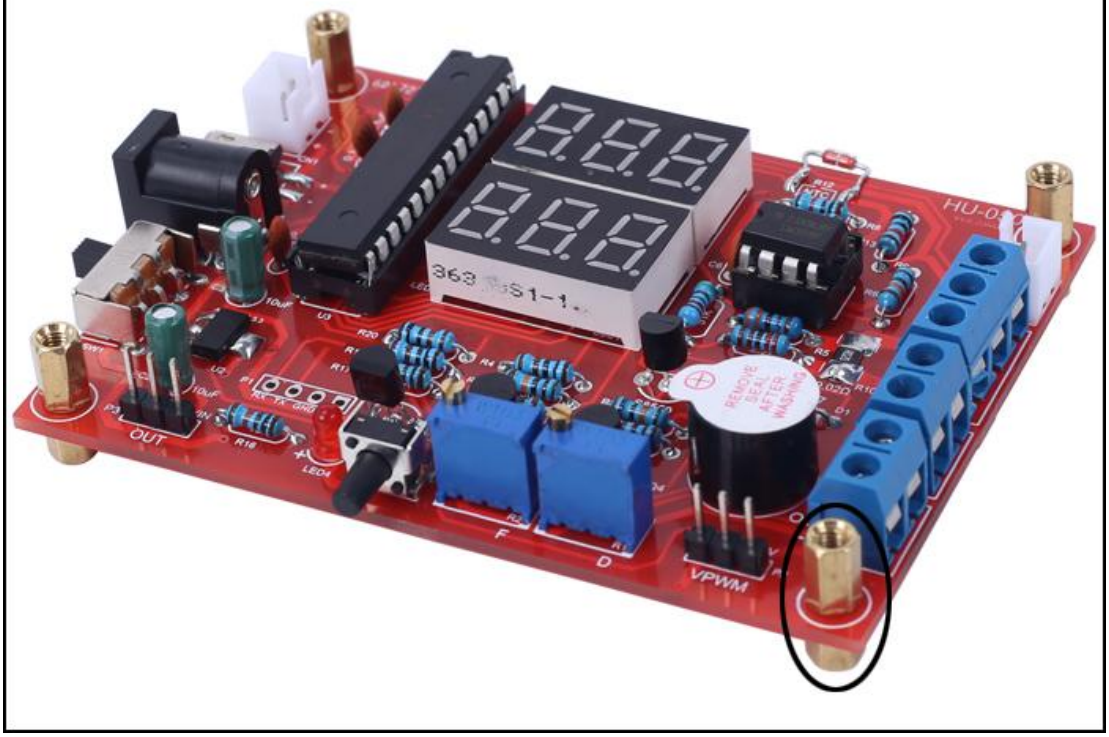
Step 34: Remove the jacket of the crocodile clip and connect the wires.
Note: Try to use more solder tin at the welding points.



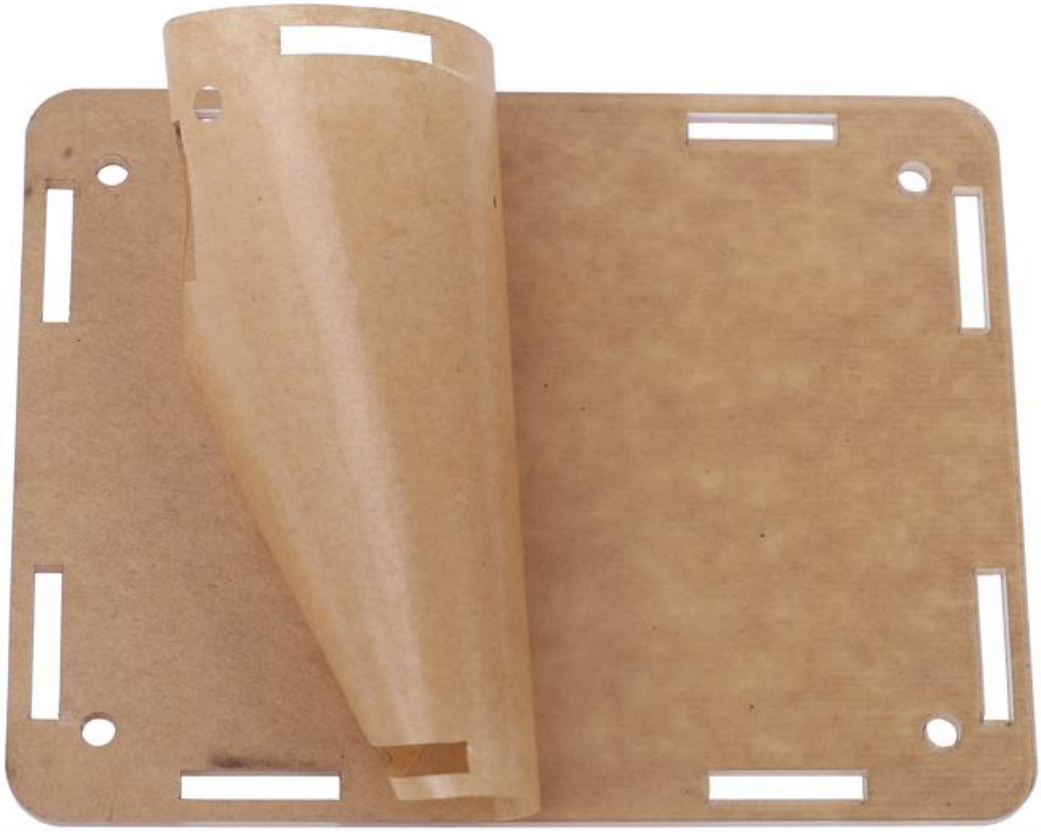
Step 35: Reinstall the removed red and black insulation jacket , paying attention to the red installation on the red wire.



Step 36: Fix 4pcs M3*9mm Copper Pillar on PCB by 4pcs M3*5+6mm Copper Pillar Screw.

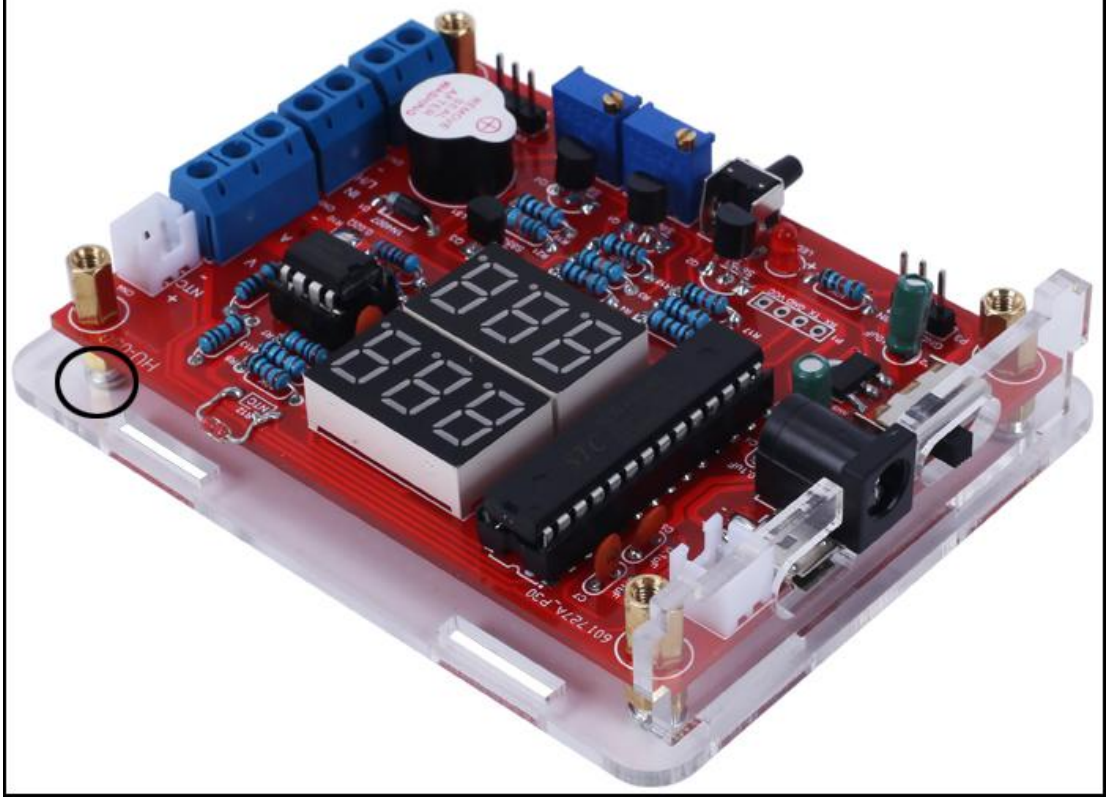


Step 37: Tear off the protective film on the surface of the acrylic shell.

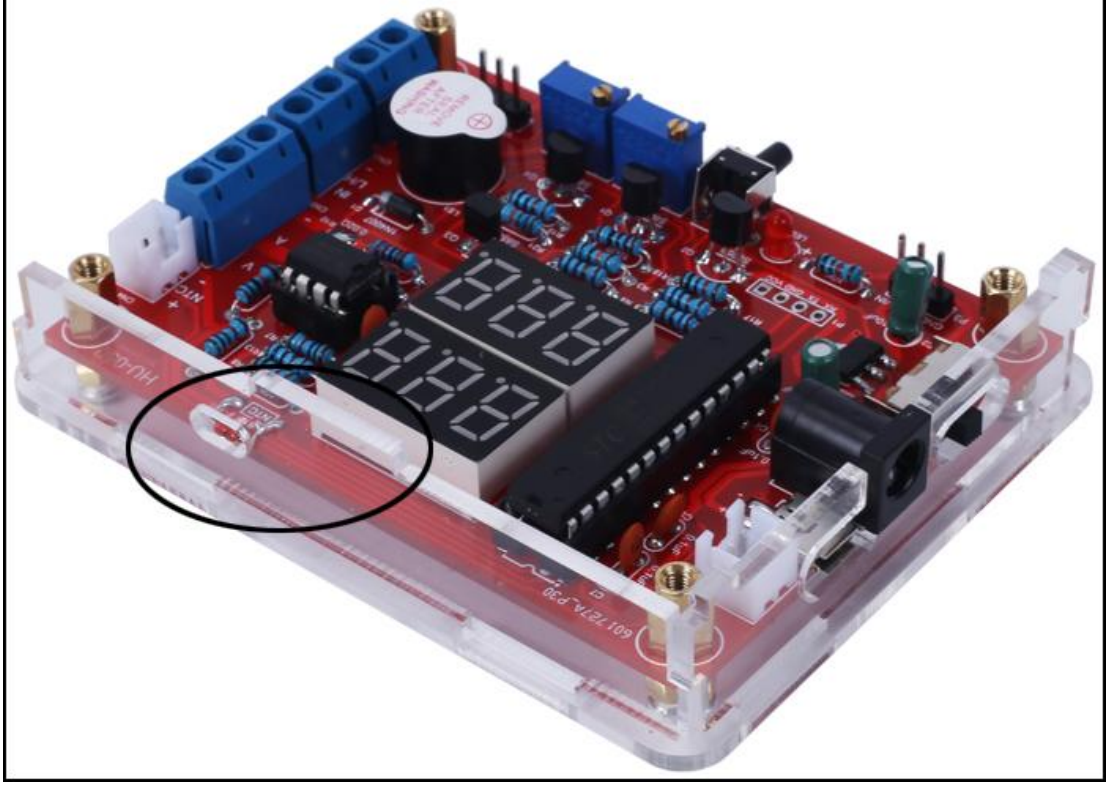


Step 38: Pace power interface side acrylic board on the bottom acrylic board as show.

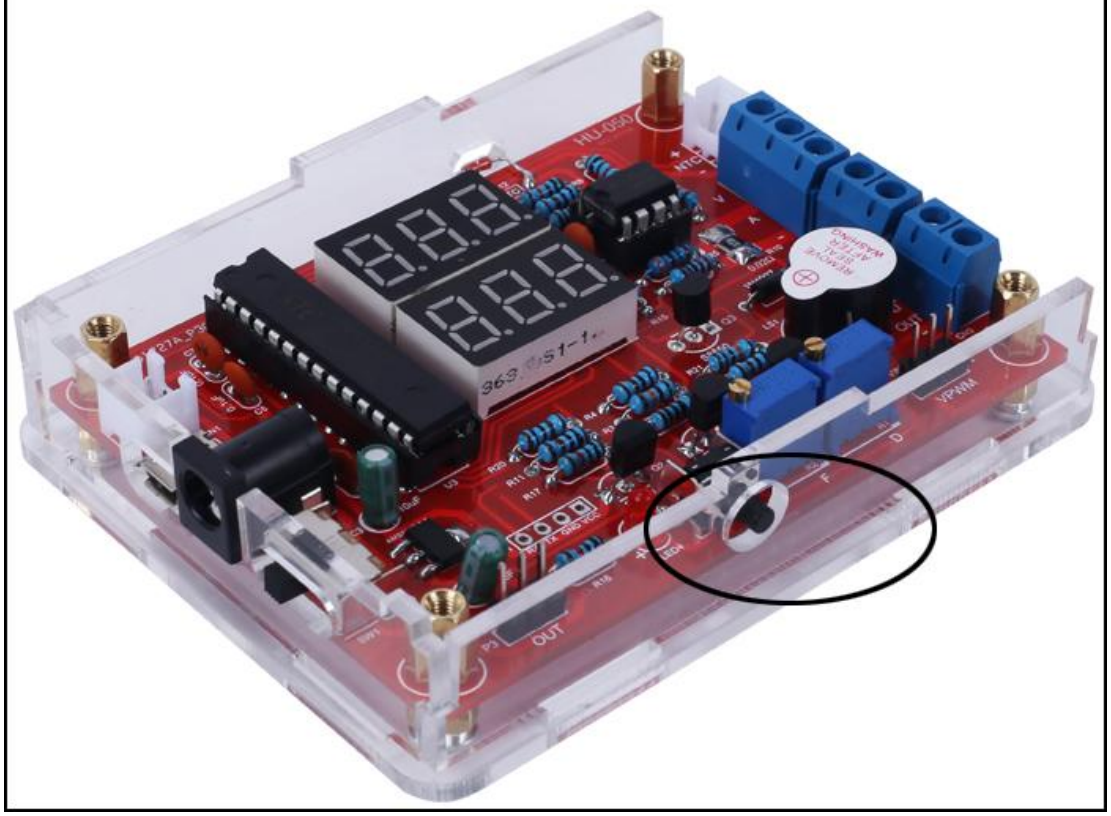
Step 39: Fix PCB on the bottom acrylic board by 4pcs M3*5mm Screw.
Pay attention to aligning the power interface on the side.



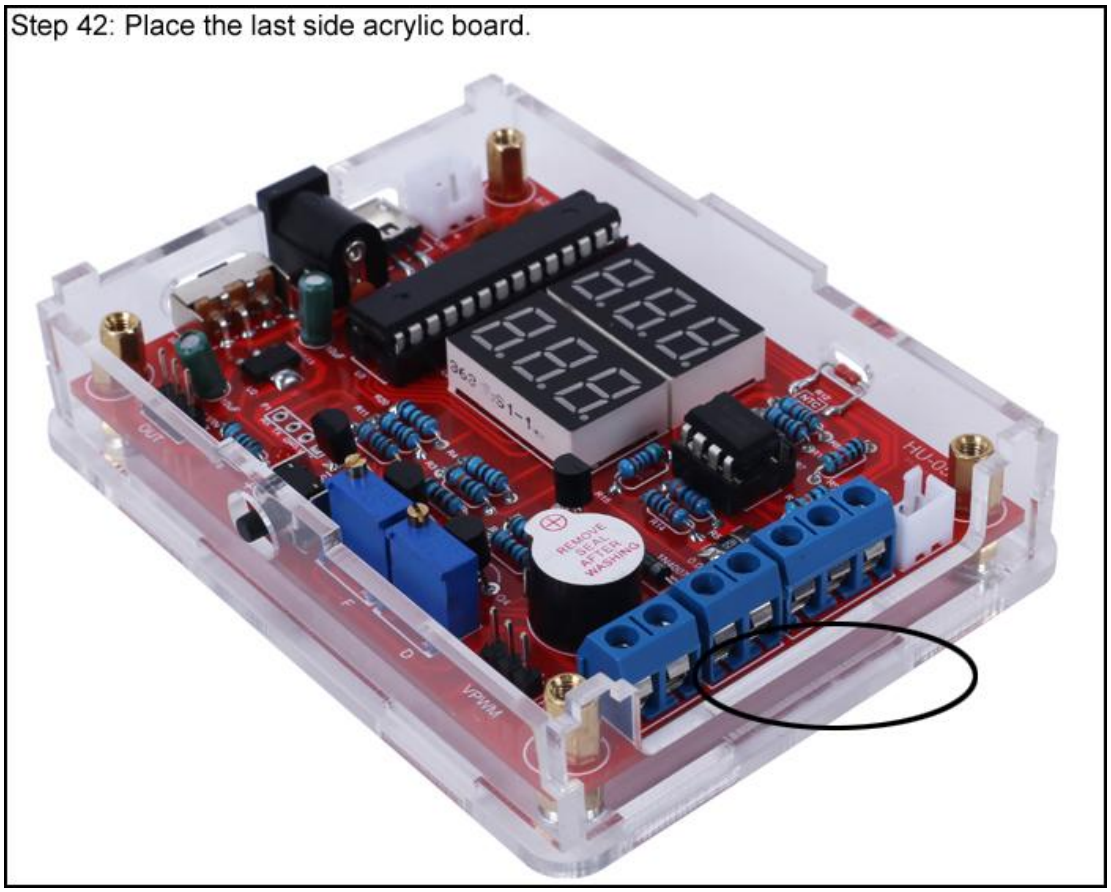
Step 40: Place another side acrylic board with temperature sensor hole.



Step 41: Place another side acrylic board with button hole.



Step 42: Place the last side acrylic board.



Step 43: Fix the last acrylic board 4pcs M3*5mm Screw.