LC Meter V7 (DPDT Calibration / 3-Steps-Layers PCB Model)

Assembly and Instruction Manual　V1.0　@2025

1. Introduction

- A high—precision LC meter combining the historic Franklin oscillator circuit with modern microcontroller technology.
- Features manual calibration via a DPDT switch, offering simplicity and reliability over automatic relays.
- Utilizes a 3-steps−layers sandwich structure where the PCBs themselves form the enclosure, emphasizing functional beauty.

Comment:
This manual calibration method enhances operational reliability and deepens the understanding of the circuit.

2. Operating Principle

- Calculates L/C values based on changes in the oscillation frequency of the LC resonant circuit.
- Process:
  1. Measure the base oscillation frequency (F_1)
  2. Connect a known reference capacitor, measure frequency (F_2) for calibration
  3. Connect the unknown component, measure frequency (F_3), and calculate the value

Comment:
Calibration removes the effect of stray capacitance by a difference, allowing for highly accurate measurements.

3. Assembly

3.1 PCB Assembly

- Solder components starting with the shortest ones (resistors, diodes).
- The reference capacitor (C_3) is heat-sensitive; minimize soldering time.
- Verify resistor values and capacitor polarity during assembly.
- There are 3 kinds of errors on PCB, so you shall take countermeasure as below mistake prevention..
- You shall tune R3 o TP4066 module for safety charging as lower than 0.5C duty.

Comment:
Using a multimeter and/or parts checker to verify

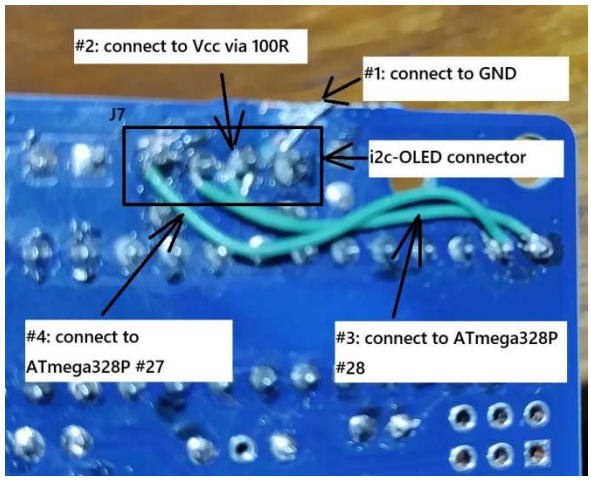
the resisters/capacitors values is recommended.

3.2 Mistake prevention & charge current tuning

3.2.1 i2c-OLED pin assignment

Correct #1:GND, #2:VCC, #3:SCL, #4;SDA

You shall cut 7 traces and jump 4 wires.



3.2.3 R6/R7

Wrong order on schematic diagram

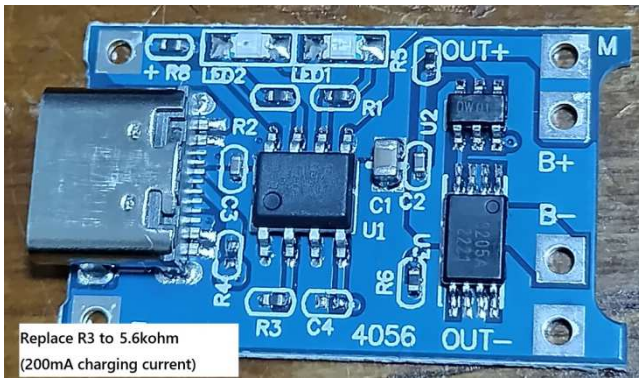
Correct R7:10k, R6:100R

3.2.3

ICSP is wrong order: It can not be used.

3.2.4 TP4066 charging current must be tuned under 0.5C

You shall replace R3 to 5k or more.



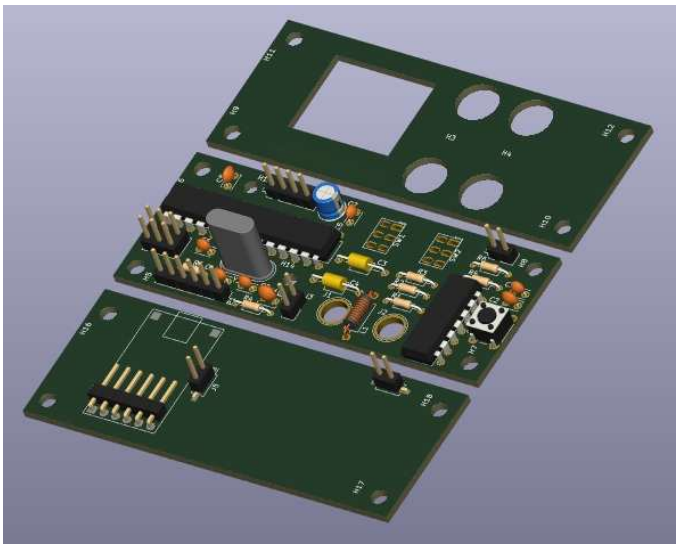
3.3 3-Steps-Layer Structure Assembly

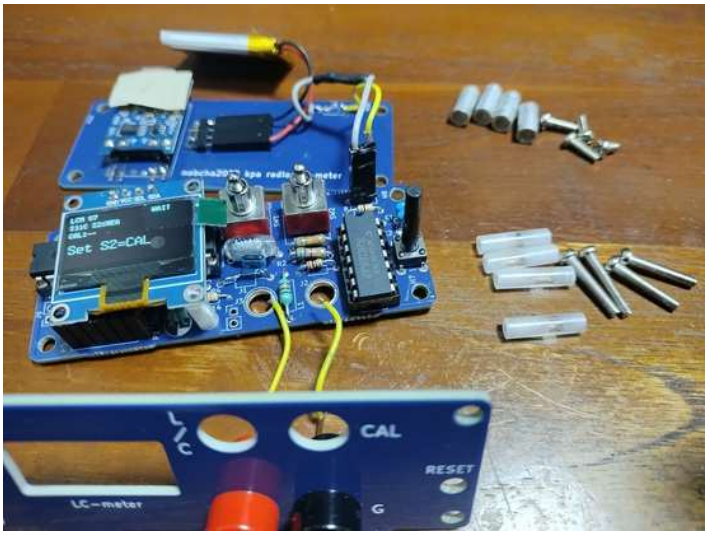
- Three-layer structure: Top PCB (front panel), Main PCB, Bottom PCB (battery).
- Adjust spacer length according to the height of switches and OLED.

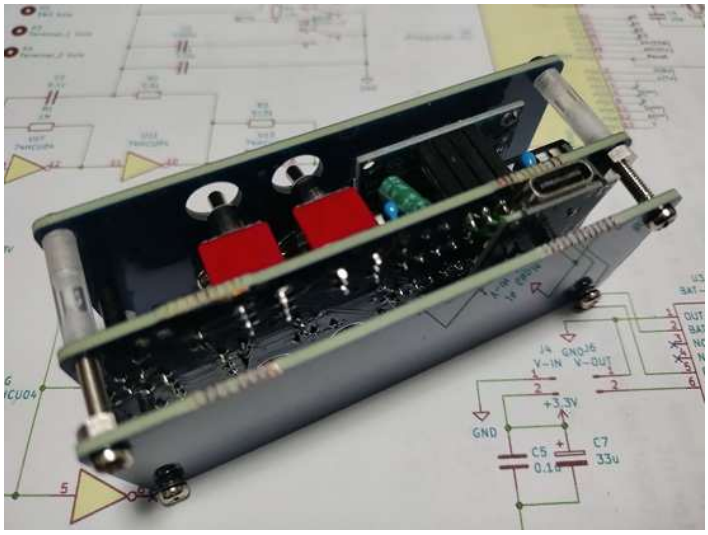
- Perform a trial assembly before final assembly.

Comment:
Trial assembly is crucial to avoid damaging PCBs or components.

To confirm the end of assembly, you shall use diagnostic code by setting SW2 on when resetting.







4. Firmware

- Download the DPDT-compatible sketch from GitHub.
- Ensure the ATmega328P is pre-loaded with the Arduino UNO boot loader.
- Check the sketch comments for switch pin assignments.
- To set SW2 be turning on, you shall operate the diagnostic code.

Comment:
Chips without a boot loader can be programmed via ICSP with the other Arduino machine.

The Arduino sketch is available on GitHub and is responsible for counting, calculating, and displaying the frequency.

5. How to Use (DPDT Switch Operation)

1. **Mode Selection (SW1):** Select L (inductor) or C (capacitor) (use C for calibration).
2. **Calibration (SW2):**
   - Leave measurement terminals open.
   - Flip SW2 to [CAL], wait for display to stabilize, then return to [MEASURE].
3. **Measurement:** Select the correct mode, connect the component, and read the value.

Comment:
Regular calibration helps maintain accuracy.

When power is turned on (RESET switch on) with SW2 ON, a diagnostic program will start. The diagnostic program will display the frequency and SW status of the unit.

This is useful for troubleshooting during assembly or for confirming malfunctions.

6. Application Example

- Ideal for verifying coil inductance during the construction of antenna tuners like the ATU-100.
- Adjust winding count and spacing to match design values before installation.

Comment:
Accurate inductance values are key to maximizing tuner performance.

7. Parts list

ID	Code	Foot print	Pcs	Name/value	Example
1	C1,C2,C5,C6,C8,C10	C_Disc_D3.0mm_W2.0mm_P2.50mm	6	0.1u	Ceramic Disc Capacitors
2	C3	C_Axial_L3.8mm_D2.6mm_P10.00mm_Horizontal	1	1000p/High precision 5%	102J coaxial metalized film
3	C4	C_Axial_L3.8mm_D2.6mm_P10.00mm_Horizontal	1	470p	471 film
4	C7,C12	CP_Radial_D5.0mm_P2.50mm	2	33u/10V	33u/10V Aluminum capacitor

5	C9,C11	C_Disc_D3.0mm_W2.0mm_P2.50mm	2	22p	Ceramic Disc Capacitors
6	H1,H2,H3,H4	MountingHole_8.4mm_M8	3	SW1,2,T1,2 hole	
7	H14,H13	MountingHole_2.7mm_M2.5	2	MountingHole3	M2.6 screw, Stand off
8	H5,H6,H7,H8,H15,H11,H17,H10,H9,H16,H18,H12	MountingHole_3.2mm_M3	12	MountingHole3.2	M2.6 screw, Stand off
9	J1	TestPoint_Plated_Hole_D5.0mm	1	Terminal_1	Bnana jack
10	J2	TestPoint_Plated_Hole_D5.0mm	1	Terminal_2	Bnana jack
11	J3	PinHeader_1x02_P2.54mm_Vertical	1	TEST	
12	J4	PinHeader_1x02_P2.54mm_Vertical	1	V-IN	
13	J5	PinHeader_2x01_P2.54mm_Vertical_SMD	1	BAT	Wire soldered
14	J6	PinHeader_2x01_P2.54mm_Vertical_SMD	1	V-OUT	Wire soldered
15	J7	PinHeader_1x04_P2.54mm_Vertical	1	Conn_i2c LCD	
16	J8	PinHeader_2x03_P2.54mm_Vertical	1	ICSP	
17	P1	PinHeader_1x06_P2.54mm_Vertical	1	COM	
18	L1	L_Axial_L6.6mm_D2.7mm_P10.16mm_Horizontal_Vishay_IM-2	1	22uH	Inductor
19	R1	R_Axial_DIN0204_L3.6mm_D1.6mm_P7.62mm_Horizontal	1	1M	1/6W carbon
20	R2	R_Axial_DIN0204_L3.6mm_D1.6mm_P7.62mm_Horizontal	1	5.6k	1/6W carbon
21	R3	R_Axial_DIN0204_L3.6mm_D1.6mm_P7.62mm_Horizontal	1	510k	1/6W carbon
22	R4,R5	R_Axial_DIN0204_L3.6mm_D1.6mm_P7.62mm_Horizontal	2	10k	1/6W carbon
23	R6	R_Axial_DIN0204_L3.6mm_D1.6mm_P5.08mm_Horizontal	1	100R	1/6W carbon
24	R7	R_Axial_DIN0204_L3.6mm_D1.6mm_P7.62mm_Horizontal	1	10k	1/6W carbon
25	SW1	SW_6P_for_PCB	1	SW_DPDT	620-BX
26	SW2	SW_6P_for_PCB	1	SW_DPDT	620-BX
27	SW3	SW_PUSH_6mm_H4.3mm	1	RESET	_
28	U1	DIP-14_W7.62mm	1	74HCU04	IC socket
29	U2	DIP-28_W7.62mm	1	ATmega328P-PU	IC socket
30	U3	PinHeader_1x06_P2.54mm_Horizontal	1	BAT-CHA	TP4066 module
31	BAT	LIPO battery	1		
32	Y1	Crystal_HC49-U-3Pin_Vertical	1	16MHz	_
33	PCB	Panel,Circuit,Bottom PCB combined	1		

7. Operating examples

1pF mica capacitor

33ｎF（333）

T37-2 10t troidul coil 0.5uH

4.7uH

10mH

BLOG: https://nobcha23.hatenablog.com/

GITHUB: https://github.com/Nobcha/ARD_LCM_MANUAL