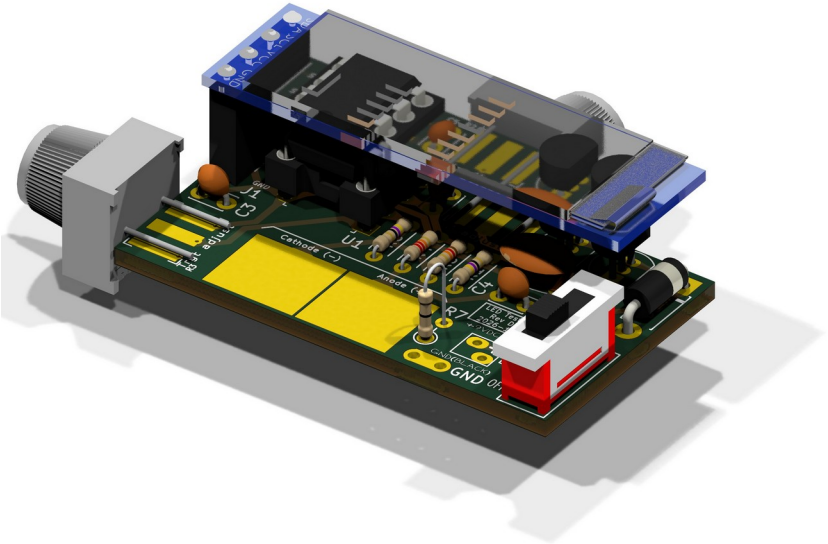
KIT ASSEMBLY MANUAL

LED TESTER

Constant-Current LED Tester with Display

Version 2.1 · OLED 128×32 · Rev D



Somerled Design

somerled.design

Welcome

Thank you for choosing the Somerled Design **LED Tester** kit. In an evening or two you will build a small bench instrument that lights any ordinary LED safely at a current you choose. Its display shows the LED's **forward voltage** and **current**, and works out the **series resistor** you would need to run that LED, at that current, from your own supply voltage.

This manual is written in the tradition of the classic kit manuals many of us grew up with. Every step has a check box, ( ). When you finish a step, mark the box. If you are interrupted, you will know exactly where to pick up again. Read each step all the way through before you do it, and do the steps in order.

Do not hurry. Kit building is meant to be enjoyed, and careful work the first time is much faster than finding a mistake later.

What the kit does

An LED must never be connected straight to a battery. It needs its **current** limited. The LED Tester uses an **LM317L** adjustable regulator wired as a **constant-current source**. Whatever LED you touch to the test pads, the tester pushes a steady current through it, set by trimmer R2. An **ATtiny85** microcontroller measures the LED and drives a 0.91 in **128×32 OLED** display.

- Turn **R2** to set the LED current, from about **2.3 mA to 27 mA**.
- Read the LED's **forward voltage** and **current** on the display. No meter is needed.
- Turn **R3** to dial in the **supply voltage** your project will use (0 to 9.5 V).
- The display then shows the nearest standard (E24) **resistor** for that LED, current and supply.

The power switch

Unlike the simple v1 tester, this one has a microcontroller and a display that draw current all the time it is on. Slide switch **SW1** turns the tester on and off. Switch it **OFF** when you have finished, or the battery will run down.

About this manual

The pictures are 3D renderings of the circuit board made from the actual design files. Each group of steps shows the board with only the parts installed so far. Your parts may look slightly different from the pictures (body colours, markings and shapes vary between makers), but the values and placements will be the same.

An interactive placement guide (iBOM) for this kit is on the support page, **shop.somerled.design/support/**. It shows where every part goes on the board.

Tools You Will Need

( )	Tool	Notes
( )	Soldering iron	25–40 W pencil iron, or a temperature-controlled station set to about 650–700 °F (340–370 °C). Fine conical or small chisel tip.
( )	Solder	Rosin-core electronics solder, 0.020–0.031 in (0.5–0.8 mm) diameter. Never use acid-core solder.
( )	Iron stand and tip cleaner	A damp sponge or brass wool.
( )	Diagonal cutters	Small flush cutters for trimming leads.
( )	Long-nose pliers	For bending leads.
( )	Safety glasses	Clipped leads fly. Solder can spit.
( )	Good light and a magnifier	For inspecting solder joints.
( )	Optional	Multimeter, for checking parts and troubleshooting. Desoldering braid or a solder sucker, in case you need to correct a mistake.

CAUTION: Work in a ventilated area, keep your fingers away from the hot tip, and wash your hands after handling solder. Most kit solder contains lead.

Static electricity

The microcontroller U1 and the display module can be damaged by static electricity, the same kind of spark you feel from a doorknob in dry weather. You may not feel a discharge that is large enough to harm them.

- Leave U1 in its protective tube or foam until the step that installs it.
- Before you pick up U1 or the display, touch a large grounded metal object (a metal desk frame, or the screw on a grounded outlet cover) to discharge yourself. An anti-static wrist strap is even better.
- Work on a bare wooden or laminate surface, not on carpet or plastic sheeting. Avoid wool sweaters.
- Hold U1 by the ends of its body and the display by its edges. Do not touch the pins.

Soldering

A good solder joint is the single most important thing in a kit. Almost every kit that does not work on the first try has a poor solder joint somewhere. Take the time to learn the method below and you will have few problems.

How to make a good solder joint

( ) Keep the tip clean and **tinned**: wipe it on the sponge and melt a little fresh solder onto it.

( ) Touch the tip so it heats **both** the component lead **and** the copper pad at the same time.

( ) After one or two seconds, feed solder into the joint, **not onto the iron tip**. The solder should flow smoothly around the lead and over the pad.

( ) Remove the solder first, then the iron. Do not move the part while the solder cools (a few seconds).

( ) Trim the lead just above the top of the solder joint with diagonal cutters. Hold the lead end so it does not fly.

What to look for

Good joint	Poor joint
Smooth, shiny (or satin with lead-free) and shaped like a small volcano or tent around the lead.	Dull, grainy, lumpy, or a ball of solder sitting on the pad.
Solder wets the whole pad and climbs the lead.	Solder only on the lead, not the pad (or the reverse). A dark ring around the lead means a cold joint.
Nothing touches the next pad.	A bridge of solder joins two pads that should be separate.

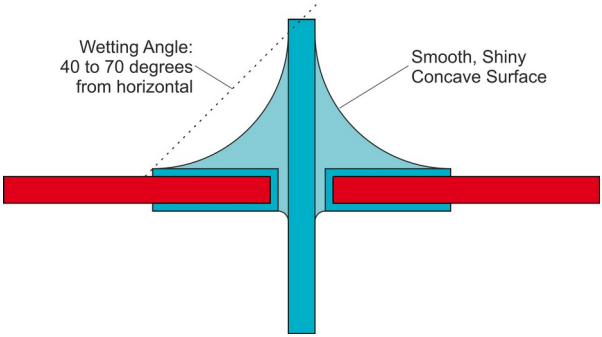


Figure 1. *An ideal solder joint in cross-section. Image: "Solder Joint en.svg" by SLUB Dresden / Carsten Pietzsch, based on an Adafruit diagram by Bill Earl. CC BY-SA 4.0 (creativecommons.org/licenses/by-sa/4.0), via Wikimedia Commons. Converted to PNG.*

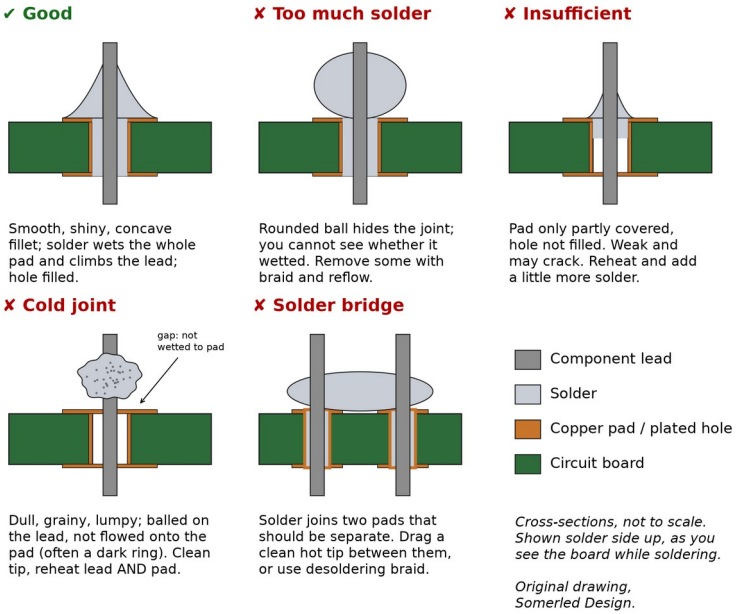


Figure 2. *A good joint and the four most common faults.*

To fix a poor joint, reheat it and add a small amount of fresh solder. To remove a bridge, drag a clean, hot tip between the pads, or use desoldering braid.

NOTE: Heat is the enemy of semiconductors. Do not hold the iron on a diode or regulator lead for more than a few seconds. If a joint is not right, let it cool, then try again.

Unpacking and Parts Inventory

Open the kit over a tray or a light-coloured towel so small parts cannot roll away. Check each part against the list below and mark its box. The **Ref** column gives the reference designator printed on the circuit board.

( )	Qty	Ref	Description
( )	1	—	LED Tester circuit board, v2.1 OLED Rev D, 1.630 × 0.915 in (41.4 × 23.2 mm)
( )	2	R1, R6	47 Ω resistor, ⅛ W, ±5% (yellow-violet-black-gold)
( )	1	R4	22 kΩ resistor, ⅛ W, ±5% (red-red-orange-gold)
( )	1	R5	12 kΩ resistor, ⅛ W, ±5% (brown-red-orange-gold)
( )	1	R7	0 Ω link, resistor-shaped, with a single black band
( )	1	D1	1N5817 Schottky diode, black body with a band at one end
( )	4	C1, C3, C4, C5	0.1 µF (100 nF) ceramic capacitor, marked “104”: disc, or axial mounted hairpin
( )	1	C2	1 µF tantalum capacitor, polarized (marked +)
( )	1	VR1	LM317L adjustable regulator, TO-92, marked “LM317L” (or “317L”)
( )	1	VR2	78L33 3.3 V regulator, TO-92, marked “78L33” (or “L78L33”)
( )	1	R2	500 Ω trimmer with knob, Bourns 3386F (marked “501”)
( )	1	R3	10 kΩ trimmer with knob, Bourns 3386F (marked “103”)
( )	1	XU1	8-pin DIP IC socket
( )	1	U1	ATtiny85 microcontroller, 8-pin DIP, **pre-programmed; silver dot ● on top (firmware mark)**
( )	1	SW1	Slide switch, 3 pins
( )	1	J1	4-pin female header (socket strip), 0.100 in (2.54 mm) pitch
( )	1	—	OLED display module, 0.91 in, 128×32, I²C, 4 pins
( )	1	B1	9 V battery snap with red and black leads

The two large gold squares marked **Anode (+)** and **Cathode (−)** are the LED test pads. They are part of the board and need no parts.

NOTE: A 9 V battery is **not** included. If a part is missing, check the packing material again, then email **support@somerled.design** with your kit version and the missing part.

Identifying the Parts

Resistors: the 4-band colour code

Resistor values are shown by coloured bands. Hold the resistor with the **tolerance band** on the right. It is gold or silver, and often set a little apart from the others. Then read from the left: the first two bands are digits, and the third band is the multiplier (the number of zeros).

The **fourth band is the tolerance**: how far the actual resistance may be from the marked value. **Gold** means within ±5%. **Silver** means within ±10%. A resistor with no fourth band is ±20%. Brown (±1%) and red (±2%) tolerance bands are found on 5-band precision resistors. Resistors are made in standard series of values. The ±10% series, called **E12**, has twelve values per decade: 10, 12, 15, 18, 22, 27, 33, 39, **47**, 56, 68, 82. The ±5% series, **E24**, adds twelve more in between. 47, 22 and 12 are in both series. All the resistors in this kit are ±5%. The tester's display recommends resistors from the E24 series.

Colour		Digit	Multiplier	Tolerance
Black		0	×1	
Brown		1	×10	±1%
Red		2	×100	±2%
Orange		3	×1 k	
Yellow		4	×10 k	
Green		5	×100 k	
Blue		6	×1 M	
Violet		7	×10 M	
Gray		8	—	
White		9	—	
Gold		—	×0.1	±5%
Silver		—	×0.01	±10%

Ref	Value	Bands	Reading
R1, R6	47 Ω ±5%	yellow-violet-black-gold	4, 7, ×1 = 47 Ω
R4	22 kΩ ±5%	red-red-orange-gold	2, 2, ×1 k = 22 000 Ω
R5	12 kΩ ±5%	brown-red-orange-gold	1, 2, ×1 k = 12 000 Ω
R7	0 Ω	one black band	a plain link, no resistance

R4 and R5 look alike. Their **first** bands differ: **red** for 22 kΩ and **brown** for 12 kΩ. Swapping them makes the voltage reading wrong.

Capacitors

C1, C3, C4 and C5 are small ceramic capacitors marked **104** (10 followed by 4 zeros = 100 000 pF = 0.1 µF). They can go in either way round. Your kit may have ceramic discs or small axial capacitors (a body with one lead out of each end). Both work. Mount an axial one hairpin style: stand it upright over one hole and bend its top lead down into the other hole. Keep the bend tight so it doesn't touch nearby parts.

C2 is a **tantalum** capacitor: a small teardrop-shaped bead. It is **polarized**. A + sign (and on many parts a stripe) marks the positive lead, which is usually also the longer one. The board marks the positive hole with a +. A tantalum capacitor installed backwards can fail, sometimes with a pop.

Diode D1

A diode lets current flow in one direction only. One end of the body has a painted **band**. That end is the **cathode**. On the board, the D1 outline shows the band, and the cathode hole is the square pad marked **K**. D1 protects the tester if the battery snap is ever touched the wrong way round.

Regulators VR1 and VR2

VR1 and VR2 look the same: a black plastic body with three leads and one **flat** face that carries the printing. **Read the markings.** VR1 is the **LM317L**. VR2 is the **78L33**. Swapping them will stop the tester working and may damage U1 or the display. On the board, each outline is a circle with one flat side. The flat face of the part goes against the flat side of the outline.

Trimmers R2 and R3

R2 and R3 are square Bourns 3386F trimmers with a finger knob. Their three pins form a triangle: two outer pins on one side and the centre pin on the other. They mount on the **edge** of the board, knob outward: R2 on the top edge and R3 on the left edge. **R2** is marked **501** (500 Ω) and sets the LED current. **R3** is marked **103** (10 kΩ) and sets the supply voltage used for the resistor calculation.

U1, its socket, and the display

U1 is an 8-pin chip. A **notch** (or a small dot) at one end marks **pin 1**. The socket XU1 has a matching notch. U1 comes **pre-programmed**, with its reset pin set up as an extra input. It cannot be replaced with a blank ATtiny85, and it cannot be reprogrammed with an ordinary ISP programmer.

U1 is marked on top with a silver dot ● (firmware mark).

The display module is a small board with a glass OLED panel and four pins labelled **GND**, **VCC**, **SCL** and **SDA**. It plugs into the 4-pin socket J1. It is usually supplied with its pins already fitted.

Switch, socket strip and snap

SW1 is a small slide switch with three pins. J1 is a strip of four sockets in black plastic. B1 is the 9 V battery snap with a red (+) and a black (−) lead.

Circuit Board Assembly

Look over the bare circuit board (Figure 3). All parts except the trimmers mount on the **top** (printed) side and are soldered on the bottom. The trimmers straddle the board edges: R2 the top edge and R3 the left edge. The two large gold squares along the bottom are the LED **test pads**, marked **Cathode (−)** on the left and **Anode (+)** on the right. Parts are installed from the lowest to the tallest, so the board rests flat on the bench while you solder.

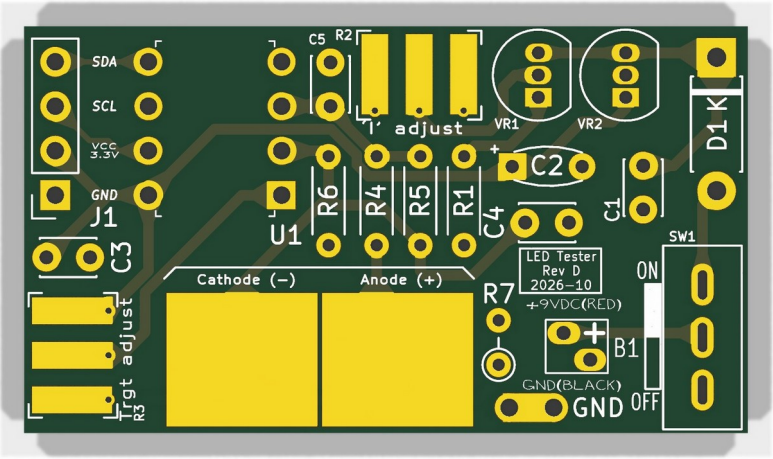


Figure 3. *The bare v2.1 OLED 128×32 Rev D board, top view.*

NOTE: Install each part flat against the board (or at the height given in the step), solder all of its leads, then trim the leads. Mark the ( ) box as you go.

Resistors

( ) **R6**: 47 Ω (yellow-violet-black-gold). Bend the leads at right angles close to the body to fit the hole spacing. Insert R6 at **R6**, the left-most of the row of four resistors just right of U1, lying flat. Either direction is fine, but for a neat look keep all the tolerance bands the same way (for example, all at the bottom).

( ) **R4**: 22 kΩ (**red**-red-orange-gold), at **R4**, next to R6.

( ) **R5**: 12 kΩ (**brown**-red-orange-gold), at **R5**, next to R4.

( ) **R1**: 47 Ω (yellow-violet-black-gold), at **R1**, the right-most of the row.

( ) **R7**: 0 Ω link (one black band). R7 stands **upright**: its two holes are only 0.1 in (2.54 mm) apart. Bend one lead back down alongside the body, like a hairpin. Insert it at **R7**, right of the **Anode (+)** pad, with the **body over the circled hole** (the lower hole, nearer B1) and the bent lead in the upper hole.

( ) Bend the leads slightly outward on the bottom so the parts cannot fall out. Solder all ten leads and trim them.

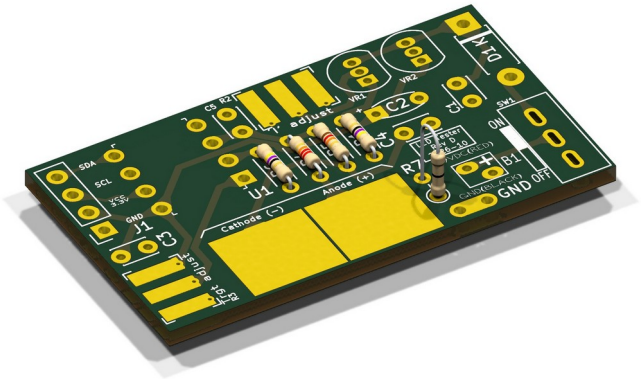


Figure 4. *R1, R4, R5, R6 and R7 installed. R7 stands upright.*

Diode

( ) **D1**: 1N5817 Schottky diode. Bend the leads close to the body to fit the hole spacing. Insert D1 at **D1**, along the right edge, with the **band toward the square pad marked K** (the upper pad, at the top-right corner).

( ) Solder both leads and trim them.

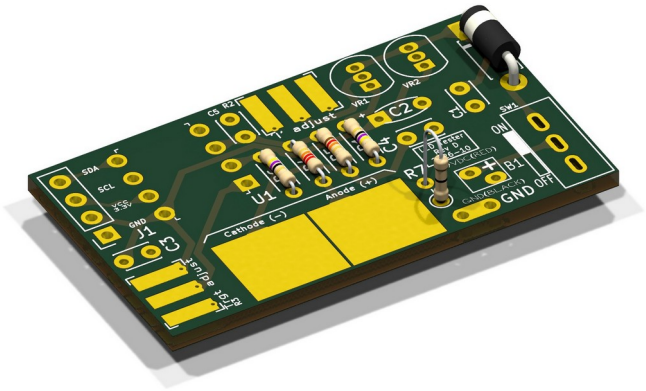


Figure 5. *D1 installed. The band faces the K pad.*

IC socket

( ) **XU1**: 8-pin socket, at **U1** (just right of the J1 labels). Turn it so its **notch points down**, toward the test pads. The square pad is pin 1, at the lower right. The socket's pins fit either way, so check the notch now.

( ) Hold the socket flat and solder **two opposite corner pins** only. Check that the socket sits flat. If it does not, reheat a corner and press it down. Then solder the other six pins. Do not plug U1 in yet.

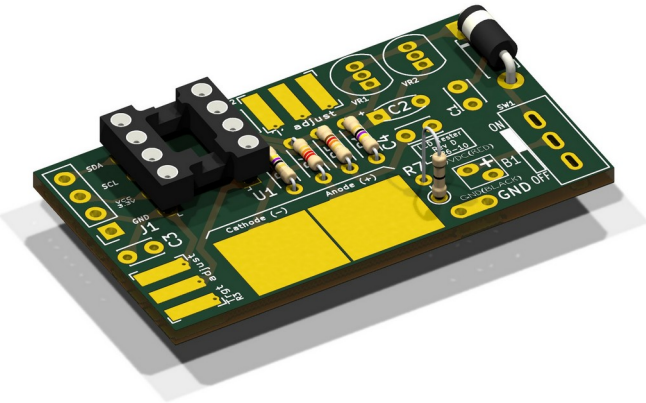


Figure 6. *XU1 installed, notch toward the test pads.*

Capacitors

( ) **C3**: 0.1 µF ceramic (104), at **C3**, on the left edge just below J1. Either way round. Disc or axial (hairpin).

( ) **C4**: 0.1 µF (104), at **C4**, right of R1, below the C2 outline.

( ) **C5**: 0.1 µF (104), at **C5**, at the top, between U1 and the R2 pads.

( ) **C1**: 0.1 µF (104), at **C1**, left of D1.

( ) Solder and trim the eight leads.

( ) **C2**: 1 µF tantalum. Find the + lead. Insert C2 at **C2**, just below VR1 and VR2, with the **+ lead in the square hole marked +** (the left hole). The holes are a little farther apart than the leads, so spread the leads gently to fit. Solder and trim.

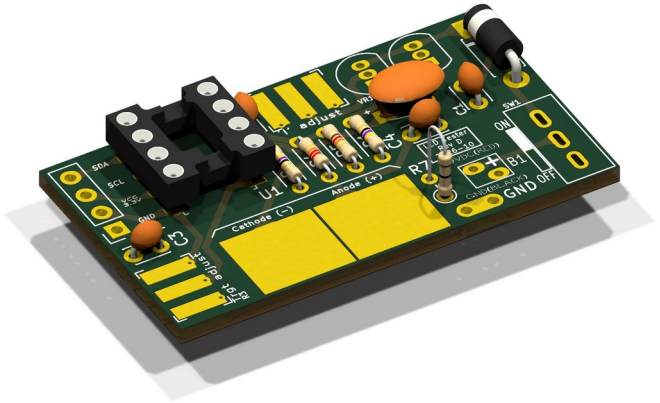


Figure 7. *Capacitors installed. C2 is the larger orange bead.*

Regulators

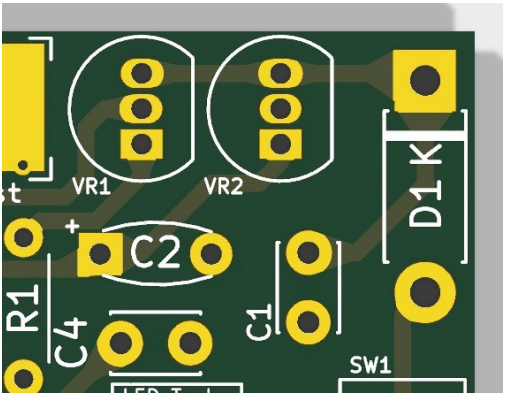


Figure 8. *VR1 and VR2 outlines (flat side to the right), C2 with its + hole, and D1 with its K pad.*

( ) **VR1**: the part marked **LM317L**. Hold it over the VR1 outline with its **flat face toward the right**, matching the flat side of the outline. Insert the three leads and push the part down until its body is about 1/8 in (3 mm) above the board. The display will sit above it later, so keep it low.

( ) Check the marking (LM317L) and the flat, then solder the three leads. Work quickly: about two seconds per lead. Check for solder bridges between the closely spaced pads, then trim.

( ) **VR2**: the part marked **78L33**. Install it at **VR2** in the same way, **flat face toward the right**, about 1/8 in (3 mm) above the board. Solder and trim.

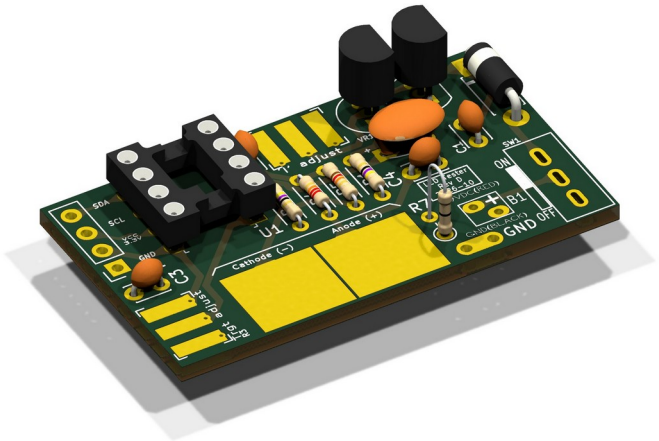


Figure 9. *VR1 and VR2 installed, flat faces to the right.*

Trimmers

The trimmers mount on the board edges (R2 on the top edge, R3 on the left edge) with the knob pointing outward, like a small thumbwheel. Each one has a set of three pads on the top of the board and a matching set underneath.

( ) **R2**: 500 Ω trimmer (**501**). Slide it onto the board edge at **R2** (top edge, above the label **'I' adjust**) so the board fits **between its pins**: the **two outer pins** lie on the outer pads on the **top**, and the **centre pin** lies on the centre pad **underneath**. Push it on until the body touches the board edge. The knob points away from the board.

( ) Check that each pin lies flat on its pad. Solder the two top pins, then turn the board over and solder the centre pin underneath. Use enough solder to form a fillet along each pin.

( ) **R3**: 10 kΩ trimmer (**103**). Install it at **R3** (left edge, beside the label **Trgt adjust**) in the same way: outer pins on top, centre pin underneath. Solder all three pins.

( ) Turn both knobs to the **middle** of their travel. R2 at mid-travel gives a moderate current (about 4 mA), which is safe for any LED.

The board labels say what each trimmer does: **'I' adjust** for R2 (the LED current) and **Trgt adjust** for R3 (the target supply voltage).

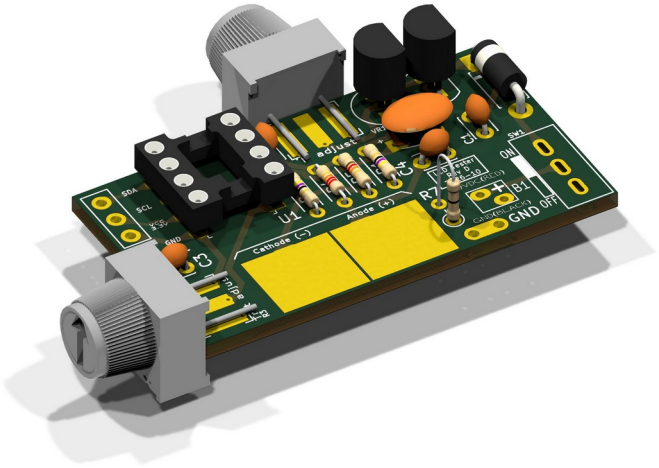


Figure 10. *R2 and R3 installed on the board edge.*

Power switch

( ) **SW1**: slide switch, at **SW1** (bottom right, beside the ON/OFF marking). It fits either way round. Hold it flat against the board, solder one pin, check that it is straight, then solder the other two.

( ) Slide the switch to **OFF** (toward the bottom edge).

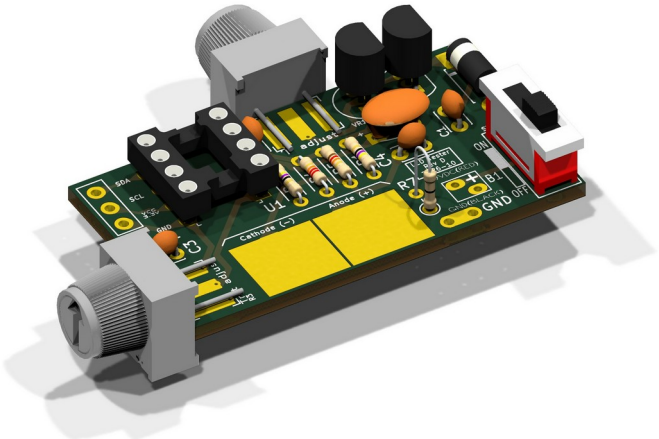


Figure 11. *SW1 installed.*

Display socket

( ) **J1**: 4-pin socket strip, at **J1** (on the left edge, beside the SDA, SCL, VCC and GND labels). Insert it from the top, open side up.

( ) Solder **one** end pin only. Check that the strip stands straight up and sits flat. If it does not, reheat the joint and adjust it. Then solder the other three pins.

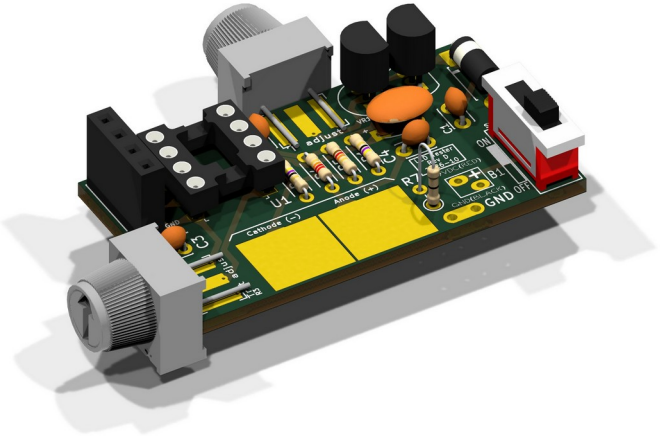


Figure 12. *J1 installed.*

Battery snap

( ) **B1**: 9 V battery snap. Push the **red** lead through the B1 hole marked **+9VDC (RED)** (the upper-left pad of the pair, beside the + sign) from the top of the board, and the **black** lead through the hole marked **GND (BLACK)** (the lower-right pad).

( ) Solder both leads on the bottom and trim the excess wire.

( ) For strain relief you may put a small dab of hot-melt glue over the two wires on the top of the board (optional).

NOTE: Boards from the first batch (previous version) have a 2-pin header footprint at B1 instead: a square pad and a round pad in a row, with +9VDC (RED) and GND (BLACK) printed beside them and no TP3. Kits with those boards: solder the 9 V battery-snap wires directly into the B1 2-pin header holes (red lead in the square hole marked +9VDC (RED), black lead in the hole marked GND (BLACK)) — no header is fitted. Newer boards replace it with dedicated 9 V off-board pads and add a GND test point at TP3.

Why your board may look different: the battery connection was moved from a pin-header footprint to pads made for soldering wires, and a ground test point was added. The circuit is the same, so both versions work the same way. TP3 (the two linked pads marked GND, below B1) is a handy place to clip a meter's black lead; no part goes there.

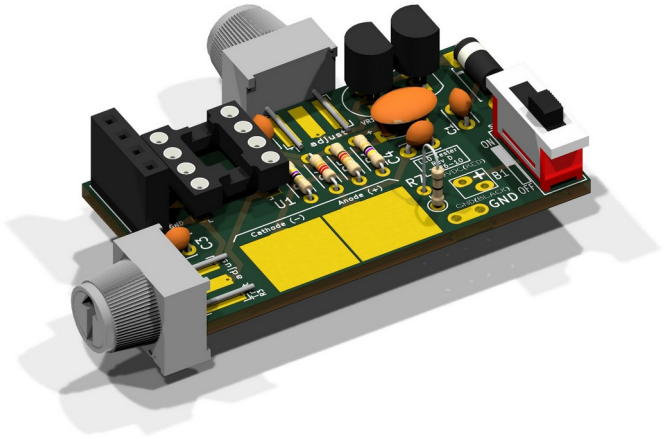


Figure 13. *Board assembly complete (battery snap leads not shown).*

Installing U1 and the Display

If you prefer, do the **Final Inspection** (it follows this section) before you fit U1 and the display. The solder joints are easier to see without the display in place.

Microcontroller U1

( ) Discharge yourself (see **Static electricity**). Take U1 out of its packing.

( ) **Check the firmware mark.** U1 is an 8-pin ATtiny85 marked on top with a silver dot ●. For reference, the 128×64 OLED board's ATtiny85 has a copper dot ●, and the LCD 0802 board uses a 14-pin ATtiny84A with a copper dot ●. If the dot on your chip is missing or the wrong colour, do not fit it: email support@somerled.design and we will send the right one. This ATtiny85 ships with its reset pin disabled (fuse already burned), so it cannot be reprogrammed without a 12 V high-voltage serial (HVSP) programmer. A chip fitted to the wrong board cannot simply be reloaded, so never swap chips between board types.

( ) New chips have their two rows of pins spread a little wider than the socket. If they do not line up with the socket, rest one row of pins flat on the bench and roll the chip gently to bend the whole row in slightly. Do the other row the same way.

( ) Line up U1's **notch with the notch of the socket**, pointing **down** toward the test pads. Make sure every pin is over its socket hole, then press U1 straight down with even pressure until it is fully seated.

( ) Check that no pin has folded under the chip or outside the socket.

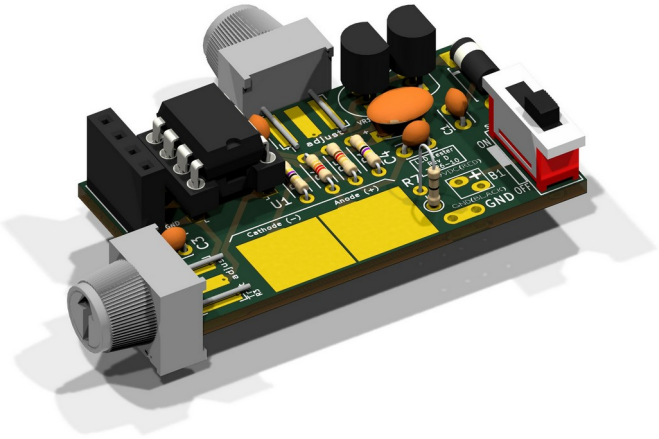


Figure 14. *U1 in its socket, notch toward the test pads.*

OLED display

( ) Compare the four pin labels on the display module with the labels on the board under J1: **GND, VCC, SCL, SDA**, from the bottom (GND, the square pad) to the top. They must match. Some modules have GND and VCC the other way round. Do not plug in a module that does not match. Email support instead.

( ) If your module came with its four header pins loose, solder them in from the back of the module, long ends pointing away from the module.

( ) Plug the module's pins into **J1** so the display panel lies over U1 and the regulators, facing up. Push it fully home.

( ) Look along the side of the board. The display should be level, and nothing on the main board should touch the back of the module. If a part does touch, unplug the display and bend that part over slightly.

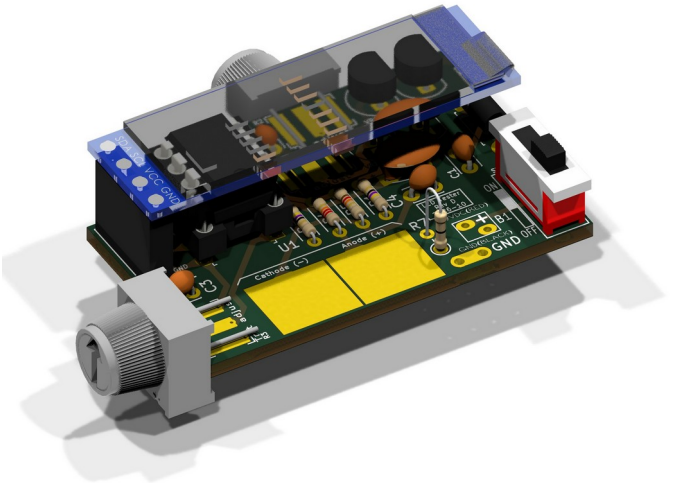


Figure 15. *The completed LED Tester with the display fitted.*

Final Inspection

Before you connect a battery, go over the board carefully with a magnifier and good light. Most problems are caught here.

- ( ) Every lead is soldered. Count them: R1, R4, R5, R6, R7 (10), D1 (2), XU1 (8), C1–C5 (10), VR1 and VR2 (6), R2 and R3 (6), SW1 (3), J1 (4), B1 (2): **51 joints**.
- ( ) No solder bridges, especially between the VR1 and VR2 pads, the socket pins, and the trimmer pins.
- ( ) D1 band toward the K pad. C2 + lead in the + hole.
- ( ) VR1 is the LM317L and VR2 is the 78L33, both with the flat to the right.
- ( ) R4 (red first band) and R5 (brown first band) are in their own places.
- ( ) U1 notch toward the test pads, all pins in the socket.
- ( ) Display labels match J1: GND, VCC, SCL, SDA.
- ( ) B1: red lead at **+9VDC**, black lead at **GND**.
- ( ) No clipped leads or solder splashes are stuck to the board. Brush the board off, especially between the test pads.

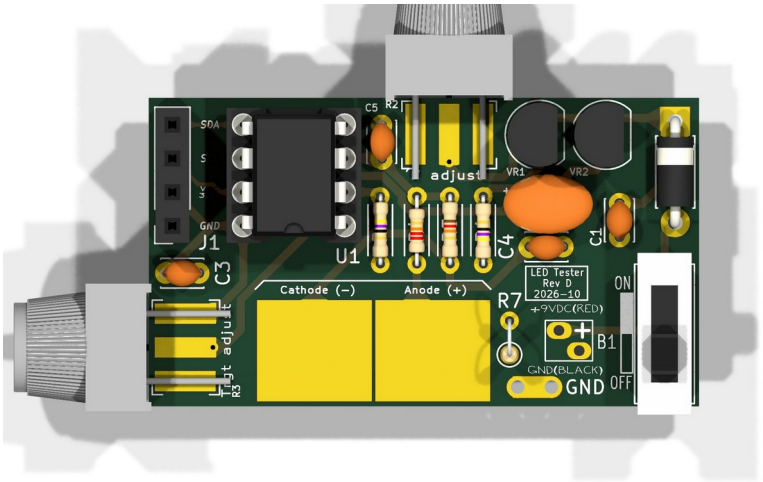


Figure 16. *Finished board, top view, display removed.*

Using the LED Tester

First power-up

( ) With SW1 at **OFF**, snap a 9 V battery onto B1.

( ) Slide SW1 to **ON**. The display shows three start-up screens, each for about a second: **LED TESTER** on one line with the firmware date code below, **Pro Version** with the version number, and **Vcc:** followed by the supply voltage, about **3.3 V**. Then it shows **TOUCH LED**.

NOTE: The Vcc reading uses the chip's own internal reference, so anything from about 3.1 V to 3.5 V is normal. If the screen stays blank, switch off and see Troubleshooting.

Testing an LED

( ) Hold the LED's leads against the two large test pads: the **anode** (the longer lead) on **Anode (+)**, and the **cathode** (the shorter lead, on the flat side of the LED rim) on **Cathode (−)**. The LED lights, and the display shows its readings.

( ) Watch the current on the display and turn **R2** to set the current you want. Do not exceed the current rating of the LED (many standard 5 mm LEDs are rated about 20 mA).

NOTE: An LED placed backwards will not light, and the display stays at TOUCH LED. Turn it around and try again.

Reading the display

Position	Shows	Example
Top left	LED forward voltage	2.1V
Top right	LED current, in mA	15mA
Bottom left	Your supply voltage, set with R3	5.0V
Bottom right	Nearest E24 series resistor	200R or 1.2K

Turn **R3** until the bottom-left figure shows the supply voltage of your project, from 0 to 9.5 V. The bottom-right figure is then the series resistor that would give the same current from that supply: (supply

voltage − LED voltage) ÷ current, rounded to the nearest E24 value. Values under 1000 Ω end in **R** (for ohms). Values from 1000 Ω up are shown in kilohms, with a **K**. If the supply voltage is no higher than the LED voltage, the display shows **0R**: that supply cannot drive the LED through a resistor.

Example. A red LED reads 2.0 V at 15 mA. With R3 set to 5.0 V, the resistor is (5.0 − 2.0) ÷ 0.015 = 200 Ω, and the display shows **200R**.

Check the resistor's power rating too. Power = current × current × resistance: 0.015 × 0.015 × 200 = 0.045 W, well within a ¼ W resistor.

The readings are good to a few percent, which is plenty for choosing a resistor. Use a multimeter if you need exact figures.

Battery life

The display and microcontroller draw current whenever the tester is switched on, whether or not an LED is on the pads. Switch it **OFF** after use. Replace the battery when the display dims or flickers, or when blue and white LEDs (which need a higher voltage) no longer reach the current you set.

Troubleshooting

Most problems are caused by solder joints or by parts installed the wrong way round. Recheck the Final Inspection list first.

Symptom	Check
Display stays blank	SW1 at ON? Battery good, snap firm, red lead at +9VDC? D1 band toward K? VR2 (78L33) in the VR2 place, flat to the right? Display labels match J1 and the module is fully seated? U1 notch toward the test pads and all pins in the socket? With a meter, J1 VCC to GND should read about 3.3 V.
Display shows start-up screens, then garbage or nothing	Reseat the display. Check the J1 joints and the U1 pin 5 and pin 7 socket joints (SDA and SCL).
LED does not light; display shows TOUCH LED	LED the right way round (long lead on +)? VR1 (LM317L) in the VR1 place, flat to the right? Check the R1, R2, R6 and VR1 joints.
LED lights but display still shows TOUCH LED	Look for a solder bridge across C4. Check that R6 is 47 Ω (yellow-violet-black), and check the U1 pin 2 socket joint.
Voltage reading clearly wrong	R4 and R5 swapped? (R4 is red-red-orange, R5 brown-red-orange.) Look for a bridge across C5. Check the R4 and R5 joints.
Supply-voltage figure will not change, or jumps	Check the three R3 joints and the R7 joints. R7 must be fitted.
Current cannot be turned down, or is very high	Look for bridges between the VR1 pads or the R2 pins. Check that R1 is 47 Ω, not 4.7 Ω or 470 Ω.
Blue or white LED dim or will not reach the set current	The battery may be low. These LEDs need more voltage. Try a fresh battery.
A regulator gets hot	Switch off at once. VR1 and VR2 swapped, or one is in backwards, or there is a bridge.

Still stuck? Email **support@somerled.design**. Include your kit version (v2.1 OLED 128×32, Rev D), what you see, and, if you can, clear photos of both sides of the board. The support page, **shop.somerled.design/support/**, has the interactive placement guide (iBOM) and updates.

How It Works

The current source

The LM317L (VR1) always tries to hold **1.25 V** between its OUT and ADJ pins. OUT feeds the wiper of trimmer R2. The part of R2 in use is in series with R1 (47 Ω) back to ADJ, and the LED is connected from ADJ to the test pads. To hold 1.25 V across R1 plus R2, the regulator must pass a current of

$$\mathbf{I \approx 1.25\ V \div (47\ \Omega + R2\ setting)}$$

and that same current flows through the LED. With R2 at 0 Ω the current is about 1.25 / 47 ≈ **27 mA**. With R2 at its full 500 Ω it is about 1.25 / 547 ≈ **2.3 mA**. The regulator adjusts its own voltage drop automatically, so the current stays the same whatever the LED's forward voltage, as long as the battery has enough voltage left.

The measurements

From the Cathode (−) pad the LED current flows through **R6**, a 47 Ω sense resistor, to ground. U1 measures the voltage across R6 on pin 2 and divides it by 47 Ω to get the current.

R4 (22 kΩ) and R5 (12 kΩ) form a divider across the LED. U1 measures the divider's midpoint on pin 3. The difference between the two readings is 12/34 of the LED voltage, so U1 multiplies it by 34/12 (about 2.83). C4 and C5 filter noise on the two measuring points.

R3 is wired between 3.3 V and ground (through R7, a 0 Ω link). U1 reads its wiper on pin 1 and scales it to 0–9.5 V for the supply-voltage figure. Pin 1 is normally the chip's reset pin. U1 is programmed so that pin 1 works as an ordinary input instead, which is why it cannot be reprogrammed with an ordinary programmer.

U1 sends the results to the OLED display over a two-wire I²C bus (SDA on pin 5, SCL on pin 7).

Power

SW1 switches the battery. D1, a Schottky diode with a low voltage drop, blocks current if the battery is ever connected backwards. VR2, a 78L33, makes a steady 3.3 V for U1 and the display. C1, C2 and C3 keep the supplies stable. The 3.3 V supply is also U1's measuring reference.

Schematic

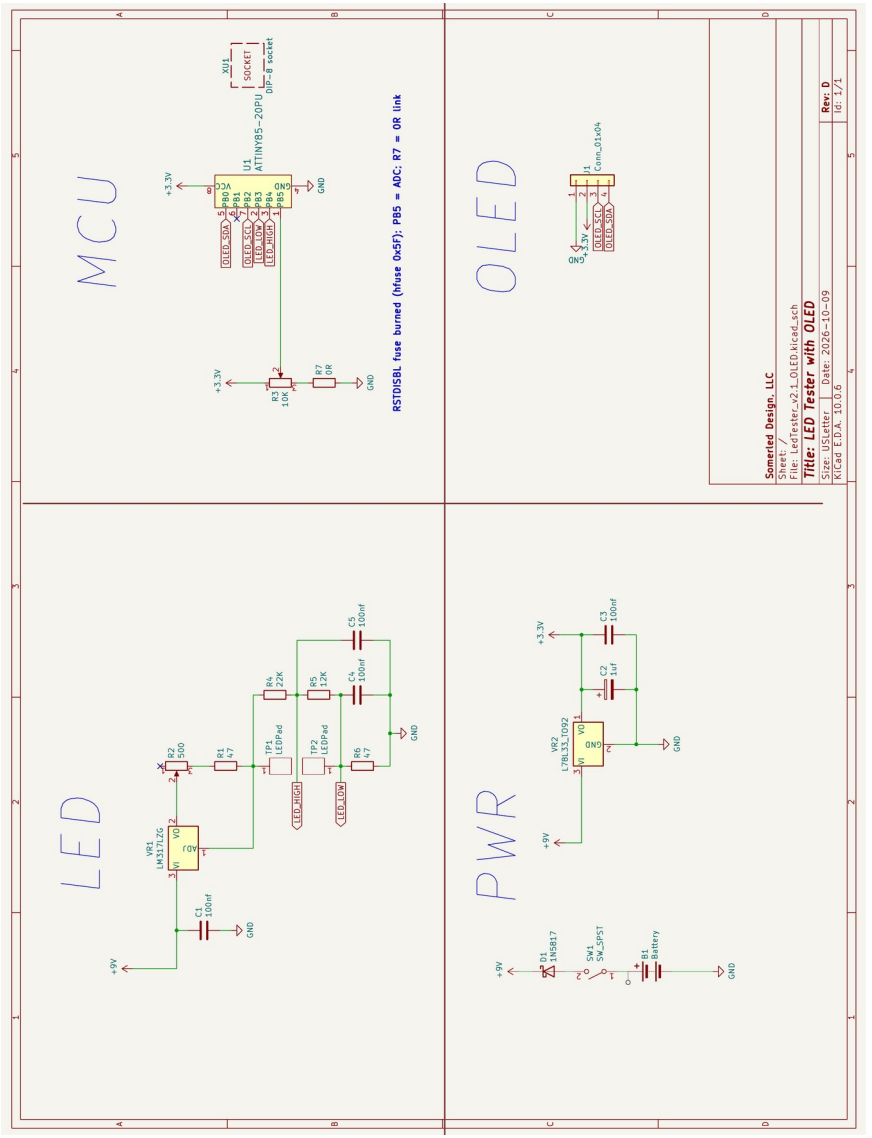


Figure 17. *LED Tester v2.1 OLED 128×32 Rev D schematic (from LedTester_v2.1_OLED.kicad_sch). Turn the page to read it.*

Specifications

Item	Value
Circuit	LM317L constant-current source; ATtiny85 measurement; 0.91 in 128×32 OLED display (SSD1306, I²C)
LED current	Adjustable with R2, about 2.3 mA to 27 mA (1.25 V ÷ (47 Ω + 0–500 Ω))
Displayed values	LED voltage (0.1 V steps), LED current (1 mA steps), supply voltage (0–9.5 V, set with R3), nearest E24 series resistor
Power	One 9 V battery (not included), via snap; slide switch SW1
Logic supply	3.3 V from a 78L33 (VR2)
Reverse-battery protection	D1, 1N5817 Schottky diode
Board size	1.630 × 0.915 in (41.4 × 23.2 mm)
Board version	v2.1 OLED 128×32, Rev D (2026-10)
Firmware	Somerled Design (proprietary), pre-programmed in U1; date code and version shown at start-up

Credits

Based on the LED tester design by **David Cook** of **Robot Room** (robotroom.com). The LED voltage divider and the choice of trimmers also follow his work. Many thanks to David for sharing his designs.

Kit design, board, firmware and manual: **Somerled Design, LLC** (Kevin Murphy).

Firmware © 2026 Somerled Design, LLC. All rights reserved. The firmware in U1 is proprietary, an original Somerled Design program, and is supplied pre-programmed. It may not be copied, read out or redistributed without permission.

Support

Email **support@somerled.design**. Support page, with the iBOM placement guide and updates: **shop.somerled.design/support/**

Illustrations: 3D images rendered from the KiCad design files. Good/faulty joint drawing: original, Somerled Design. Ideal joint diagram: “Solder Joint en.svg”, SLUB Dresden / Carsten Pietzsch after Bill Earl (Adafruit), CC BY-SA 4.0, commons.wikimedia.org/wiki/File:Solder_Joint_en.svg (converted to PNG).

Manual revision: October 2026, board v2.1 OLED 128×32 Rev D.