# Knox Makers COVID-19 V1 Kit Instructions

We usually assemble circuit boards starting with the lowest profile components and work our way up to the taller, higher profile components. This board has components on both the front and the back; for ease of assembly we will solder the front components first, the back ones last.

Start with the resistors

With this circuit board, like most, we'll start with the resistors. Resistors are usually labeled on schematics and circuit boards as R1, R2, R3, etc. To keep the visual appearance of this board clean, these labels were not included. Resistors are not polarized components so they can be inserted with either end in either hole. They are typically labeled with colored rings. This kit can be built with a wide range of resistor values so use whatever was included in the kit. The resistors are all of the same value so any resistor can go into any position on the circuit board.

For each of the 8 resistors, bend its leads 90 degrees, insert the resistor through the PCB from the front and bend the leads outward on the back around 45 degrees to hold it in place. Resistors should sit fairly flush with the circuit board and hold in place when the circuit board is upside down.

You might find it helpful to go ahead and solder the resistors in place and trim the leads on the back flush so they aren't in the way of the next components.
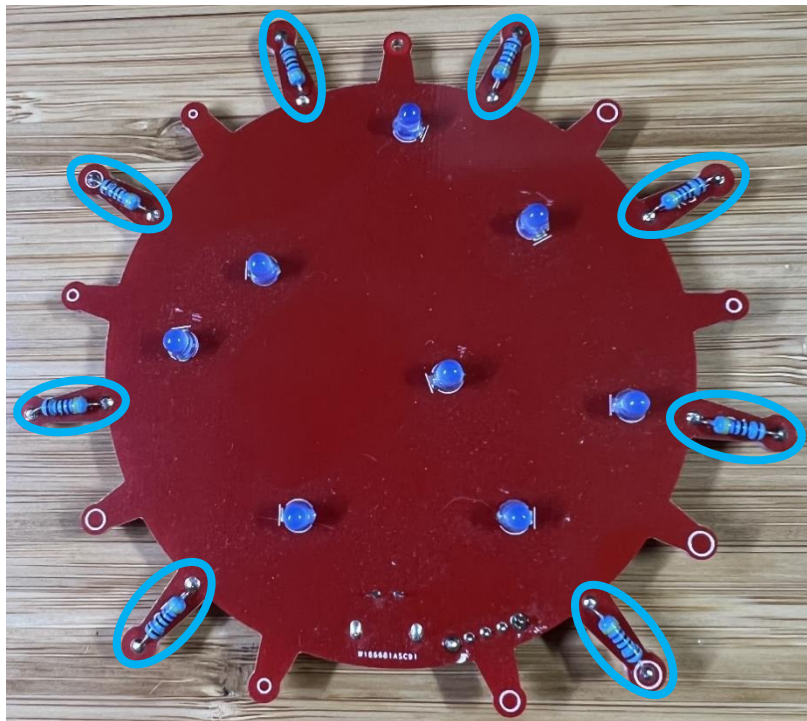
Now the LEDs

LEDs are a type of diode and all diodes are polarized with one lead being the anode and the other being the cathode. There are two ways to identify which lead is which on an LED. The shorter leg is the cathode, the longer leg the anode. There is also a flat side on the LED housing which indicates that side is the cathode.
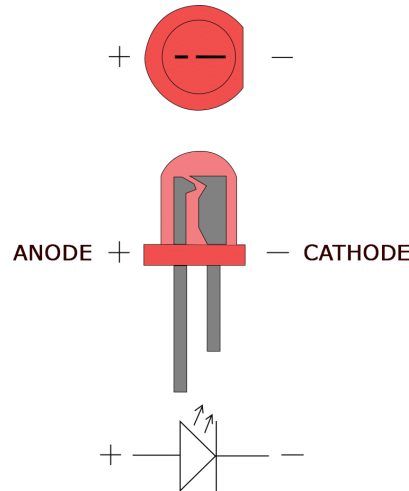
The circuit board has a visual indicator, a short white line, next to where the diode goes, indicating the flat on the diode. This is the cathode, or the short lead on the diode.
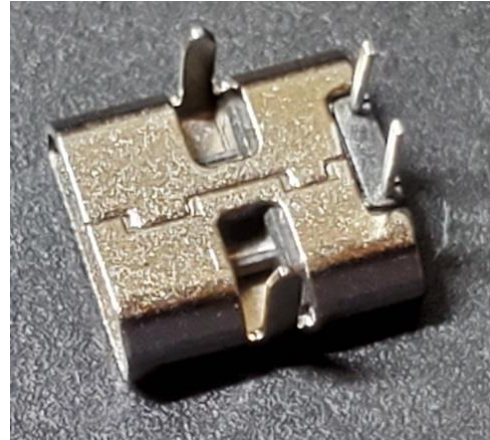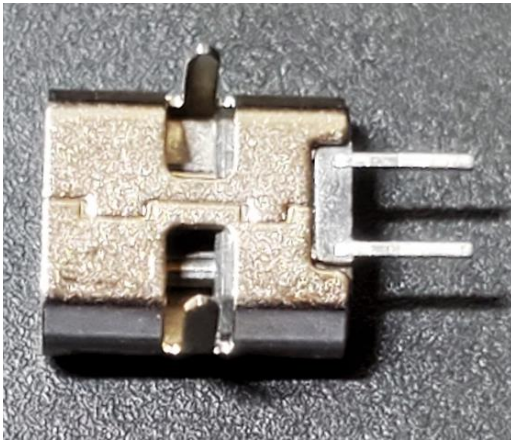

Insert the 8 diodes, carefully noting lead polarity, bend the leads outward on the back, solder them and trim the leads flush.

The USB Power Jack

The USB jack is quite delicate and has been pre-installed on the kits. In the event you need to replace the jack, here are instructions.

Bend the two leads on the USB power jack at a right angle as shown:

Now insert it into the back of the board, flip the board over and solder it in place being careful to keep the power jack flush on the back. The power jack has plastic molding inside so try to work quickly as you solder to avoid melting the plastic.
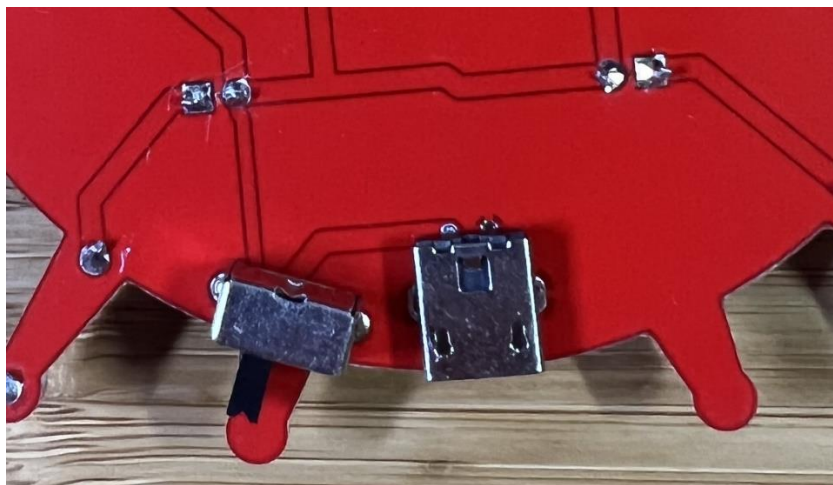
Finally, the power switch

Insert the power switch into the back as shown in the last picture and solder it from the front. Again work quickly to avoid melting the internal plastic, and possibly damaging the switch.

Test and debug

Plug a USB micro cable into the power jack, flip the switch and you should see the LEDs light up and begin to blink.

No lights illuminate:

- The switch has a bad connection: reflow the 4 solder joints on the switch.
- The USB power jack or power source is faulty. If you have access to a multimeter, measure the voltage across the center lead of the switch and the metal housing of the USB jack. This should read 4.5 to 5VDC.
- The switch is faulty: Measure the voltage across the left-center or right-center switch contact and the USB jack housing. The switch should cause 5V to show up on each of the left-center and right-center contacts, corresponding with each of the two switch positions.
- All of the LEDs are installed backwards: Verify that the flat on the LED is on the side with the silkscreen line.

Some LEDs work, but not all of them

- Bad solder joints on the resistor or LED that isn't lighting up. Reflow these joints.
- The LED is backwards: Check orientation of the LED
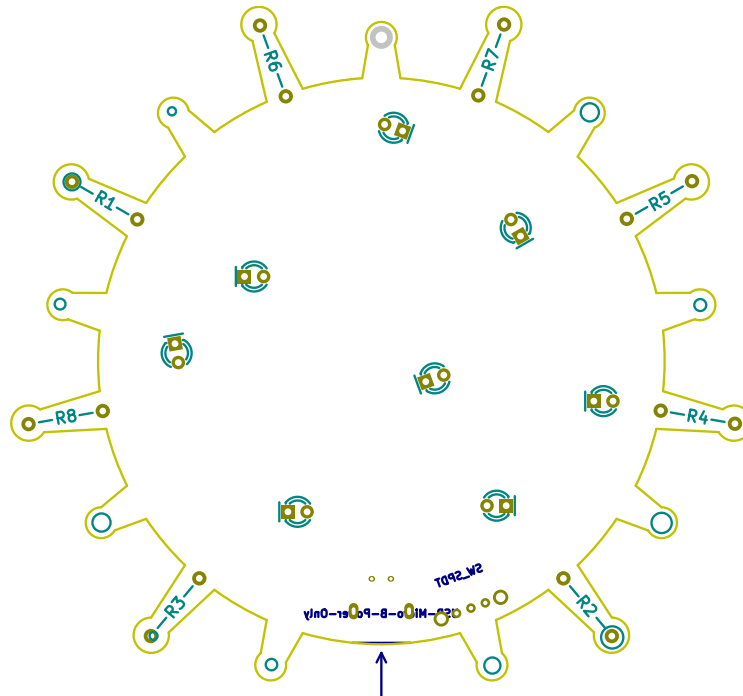
Congratulations, you did it!

Theory of Operation

The circuit is simply a power source, a switch and 10 diodes with resistors. The USB jack provides a 5V power source to the switch. The switch disconnects power from the circuit when it's in the off position, and connects power when in the on position. The LEDs contain internal circuitry that causes them to flash. The circuitry internal to each LED ensures that proper current is drawn; a current limiting resistor is not required. Each LED does have a resistor however, to limit current during fault conditions such as a shorted LED.

Bill of Materials

Qty	Designator	Item
1	-	PCB
1	J1	USB Micro Power Jack
1	S1	Slide Switch
8	R1-R8	Resistors
8	D1-D8	3mm flashing LEDs

PCB Layout

Schematic