GitHub repository where all documentation & code can be found. [billbill100 (github.com)]

ESP32 Build a Box V1.0 28/02/2024

To make the box

The use of a milling machine with digital readout, makes it really easy to cut square holes in project boxes & align all the drill holes. I have done this many times, but at present having only access to basic tools, another method was used. Please note the photos below were made using just the most basic of hand tools I was able to source. A plastering trowel (to ensure fingers stay away from the blade), a Stanley knife, cordless drill & drill bits, a carpenters T square, slip-joint pliers and masking tape.

Whilst not the most professional looking, it does prove that much can be achieved with very little. Please be very careful when using the knife as detailed below.

The front of the box was covered in masking tape and the screen cut-out and button holes were drawn onto the tape. Note that the screen is smaller than the orange pcb it is mounted to, so only cut the hole to fit the screen. Do not make it too tight at the bottom. There are ribbon cables that must not be crushed.

There is only just enough room for the screen and two rows of buttons. The cut-out for the screen should be made such that the top of the tft pcb is touching the top inside edge of the of the box, mounting it as high as possible.

To mark out the box, cover the front with masking tape.

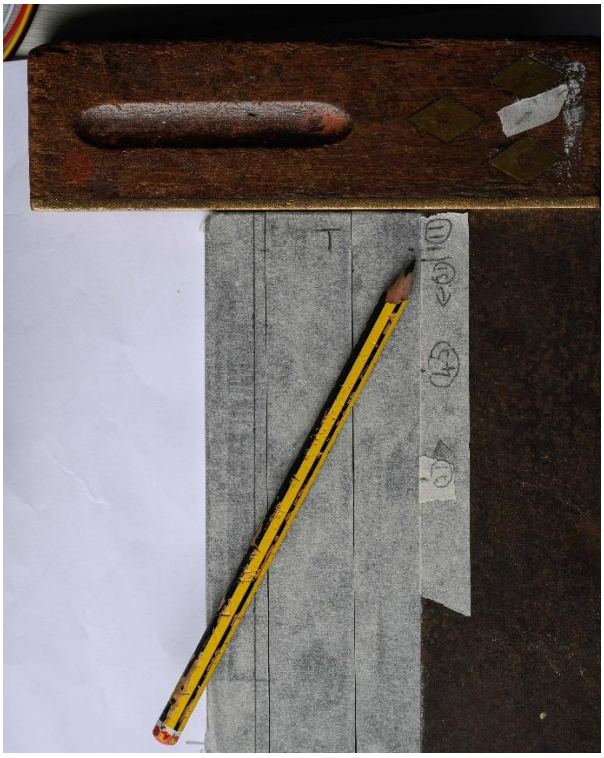
As the edge of the box is radiused, it is difficult to take a measurement, so put some masking tape on a T square. One can now measure 45MM on the square and 31MM either side of this mark.

This gives the centre line and the width of the TFT screen, being 62MM.

Thease measurements can now be transferred to the box, making marks from the top of the box to the bottom, then use a straight rule and a pencil to draw three solid lines, indicating the centre of the box and width of the screen.

Transfering the screen measurements to the box.

The top edge of the cut line for the screen can be marked.
Again, measure 11MM on the T square and transfer this to the top of the box



Transfering the 11mm top mearement to the box. Note the previous horzontal markigs, 45MM an 31MM

Using the same teknique, mark the bottom line for the screen and the button positions

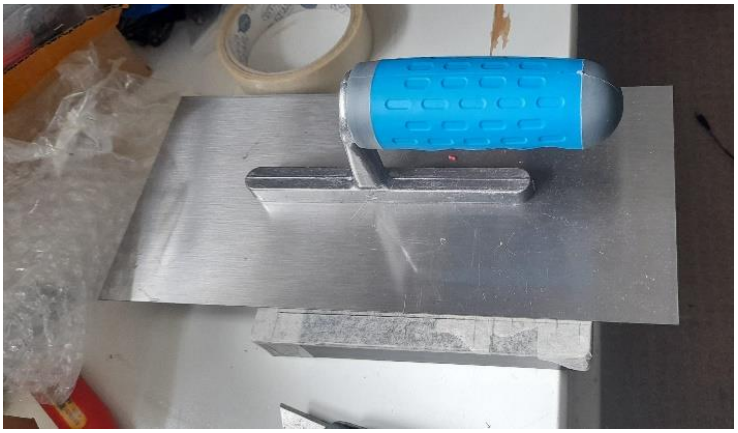
The edges of the rectangle are repeatedly scored using a Stanley knife. Being very careful not to slip & cut one's fingers or to cut past the pencil lines.

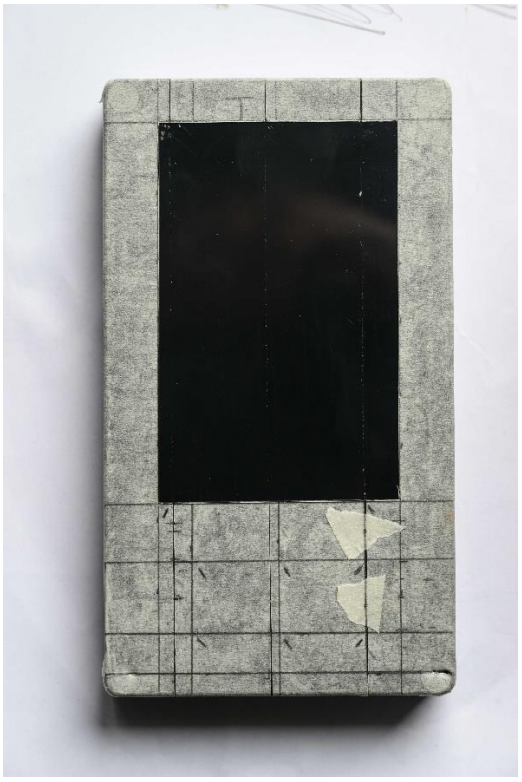
Ensure the box lid is clamped in a vice or similar and use ***extreme care*** to always ***keep fingers BEHIND*** the blade, to avoid injury.

A new plasters trowel was used as the straight edge so one's fingers can be kept well away from the blade.

Keep scoring, being careful not to have any accidents and also to keep the knife within the cutting area. Starting at a corner and scoring down the line and then doing the same from the other end, will stop any over-cutting.

Continue scoring until about 1/3 to ½ the depth of the plastic,





The box scored and masking tape removed from the screen area.

Drill a series of holes around the inside of the score lines. Do not go too close to the cut lines, as some material has to remain for the next stages.

Cut diagonally into the four corners using a junior hacksaw, keeping the blade at 90 degrees

to the front of the box.

On the inside of the box, using the saw marks as a reference, again score the inside of the box.

Using slip-joint pliers (as they fit into the opening) grip the lid at the score line and gently bend inwards. Do this all along the score line and repeat, each time bending a little more. Alternate this with more scoring if the plastic does not easily bend. Eventually the plastic will snap away.

The stanley knife as shown below, can be used as a scraper by dragging the blade. It will smooth the rough edges and can be used to widen the hole if it is a bit tight for the screen to fit.
Make sure you are fully in control of the knife at all times to ensure it cannot slip & cause injury.

Place the screen into the box and drill the four 3MM mounting holes. Be careful not to damage the screen.

Drill the holes for the encoder (7mm) and the buttons (13mm) using a brad point drill bit.

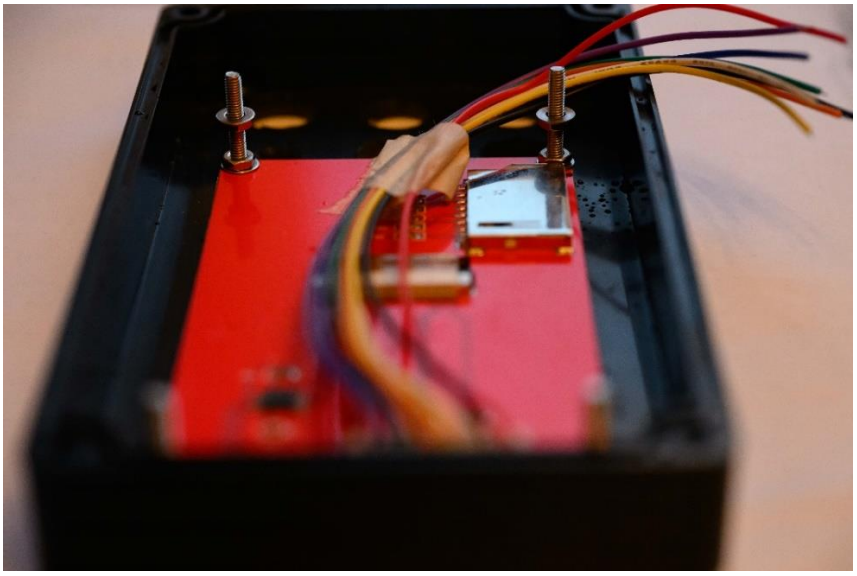
The button holes need to be slightly contersunk or radiused, to allow the buttons to sit flush as the underside of the button has a small ring, just slightly bigger than 13mm at the top of the thread.

3MM bolts (25MM long) with washers and nuts are put through the holes. The nuts act as spacers to keep the screen below the front of the box. You can substitute a number of washers, if you prefer the screen flush.

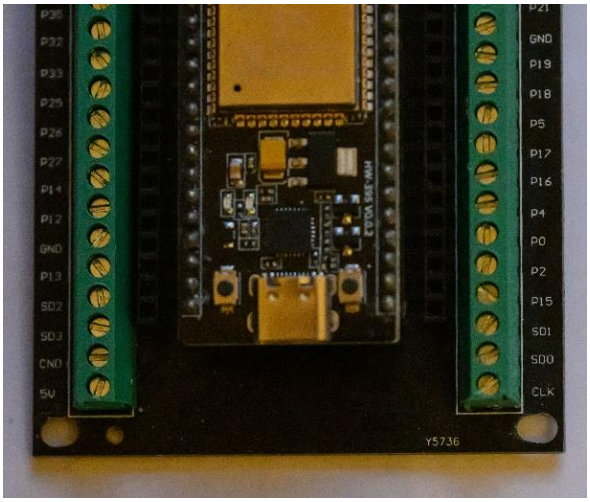
Note the extra half-deep hole near the 7MM encoder hole. This is to allow the anti-rotation pin on the encoder to locate.

Fit the screen and secure with washers and nuts.

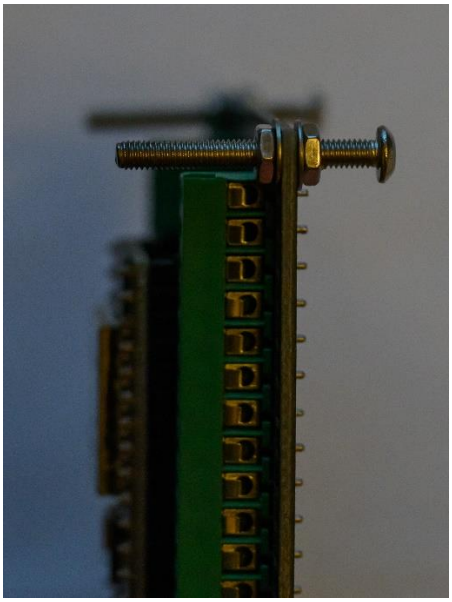
Add two more nuts and washers on the lower two bolts.



Elongate the two lower holes on the breakout board, so they fit over the bolts.



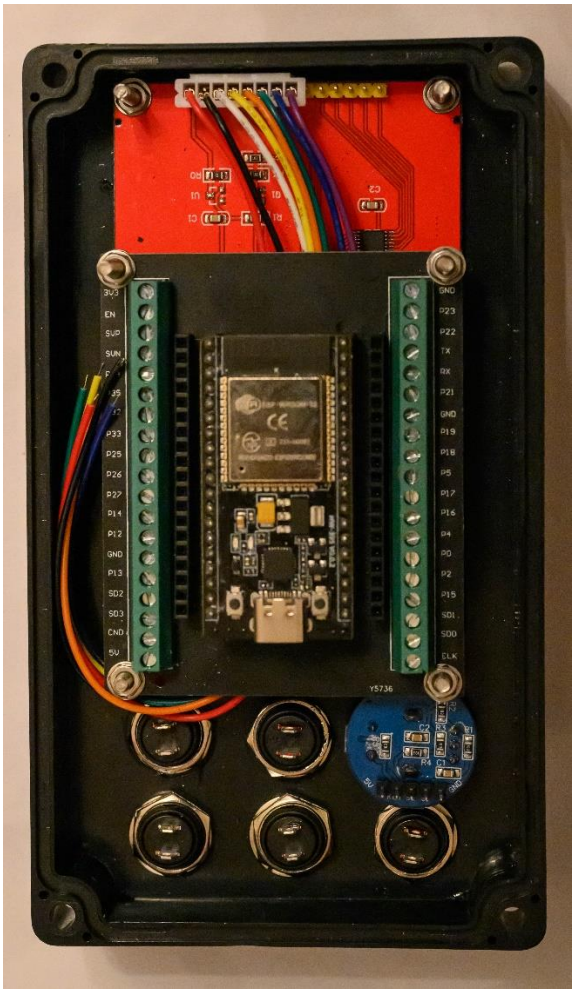
Fit nuts, bolts & washers to the top two holes of the breakout board, adjust the exact length during the next step, by trial & error.



The breakout board can now be secured to the lower two bolts with nuts & washers.

This method allows a convenient way of mounting the breakout board, using the extra length of the bolts as stand-offs. The bolt heads touching the tft pcb can be held in place by a little hot-glue.

Add the buttons, being careful not to overtighten the nuts and add the encoder.



The finished top of the box

Layout & mark the bottom of the box for connectors.

Cover the sides of the box with masking tape. Mark a line 14MM from the bottom, scribed along their length. Ensuring enough space from the end of the box is left due to the bolt holes behind, mark the position for the flash socket.

Above this, mark the position of the Din connector(s) if using them, else a suitable size hole for the multicore cable to run directly to the breakout board.

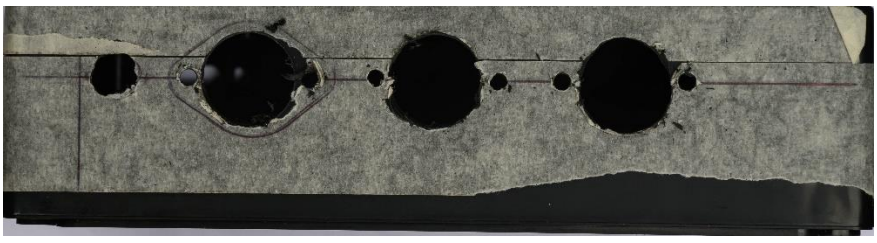
From the centre of this connector, mark a line a further 33MM higher (for Light-meter) and again another 33MM for the LED matrix, if required.

The other side of the box was marked for the USB-C socket.

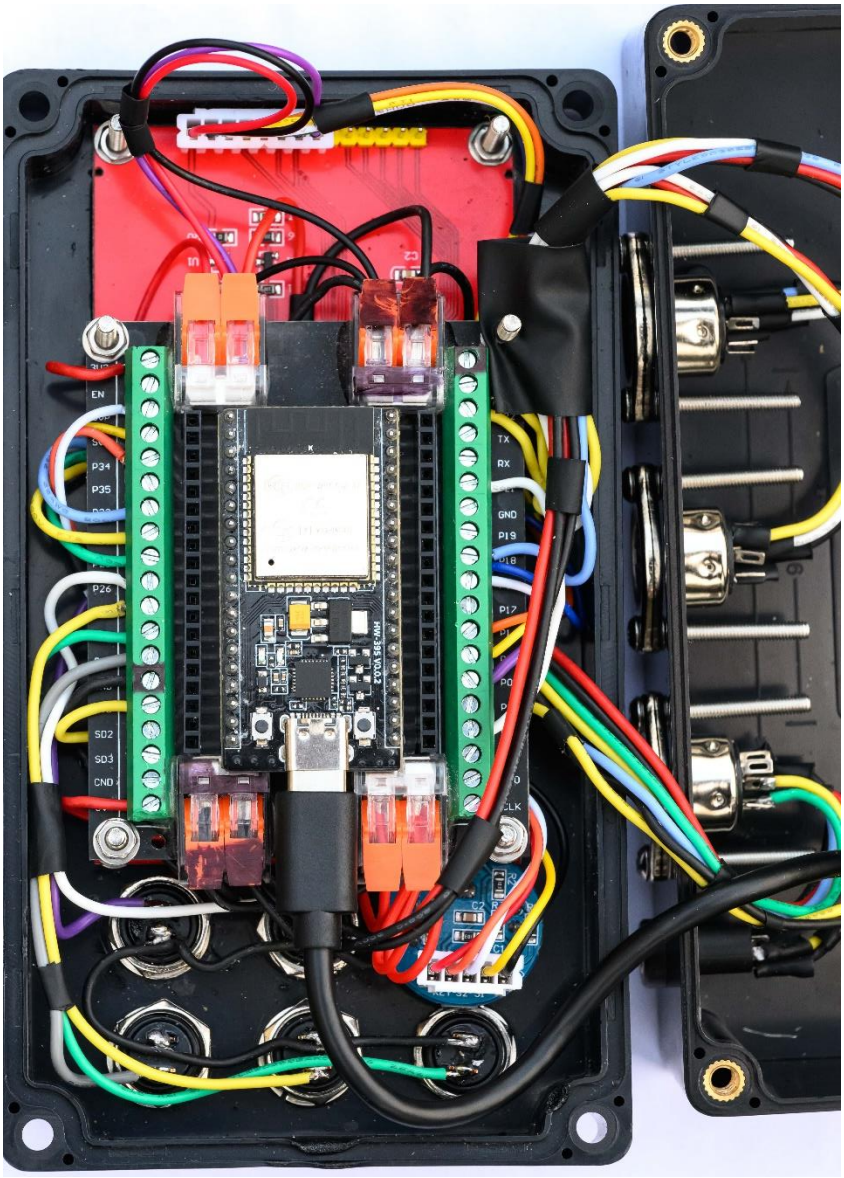
The centre marks are drilled with a fine drill, to accurately locate the mark.
The USB connector centre line was scribed with a Stanley knife, to stop the drill bit wandering.

Drill the holes with with suitable bits, 16MM for the Din sockets, 7mm for the flash socket, which may need to be opened slightly bigger using a file, or bigger drill bit.

A series of holes were drilled for the USB socket and then file to make a slot. Holes for the securing screws were marked by offering up the sockets and marking through the bolt holes.



Side of box with sockets fitted.



Inside of the completed Shutter Tester.

Note this is running the Developing Timer firmware, but the box layout for the Shutter Tester is the same.

Template for box cutting