

**I would really be grateful if you start to build the Developing Timer, that you go to the Photrio thread and say hi. Also please post photos of your completed tester.**

Please refer to Photrio for further build help & to let us know you are building the timer.  
[Build a B&W film developing timer & twiddler - Cheap, Easy & it Works | Photrio.com Photography Forums](#)

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

## **ESP32 Developing Timer Parts V1.4      28/04 2024**

Below are links to the parts required to make the ESP32 Developing Timer.

Links are valid now, but of course could become dead in the future.

Links are a guide only. Use a supplier that ships your country.

Ordering from China either from eBay sellers or AliExpress, the parts will be much cheaper.

Note, often if buying from AliExpress, there is a free express shipping option, if buying parts over a set value.

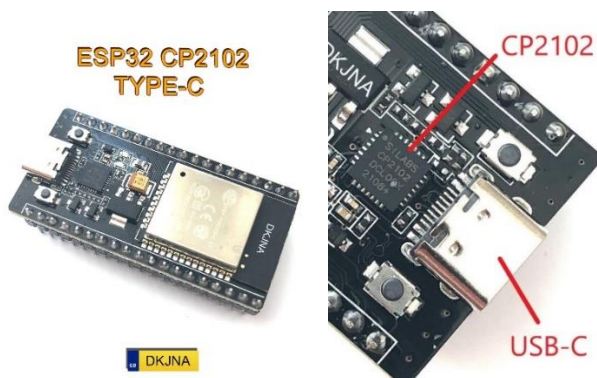
### **1. ESP32 Development Board. NodeMcu OR Lolin D32**

Pick ONE of the two development boards below. Either will work. The NodeMcu comes with header pins pre-soldered, but there is no socket for battery backup or charging,

The Lolin D32 requires the header pins soldering, but has the advantage of connection of a backup battery & charging.

### **ESP32 NodeMcu board. 38 pin version.    USB-C    CP2102**

[ESP-WROOM-32 ESP32-S Nodemcu ESP32 Development Board ESP32 Bluetooth Wifi 32Mbit SPI Flash Bluetooth Module ESP32 30 Pin/38Pin - AliExpress](#)

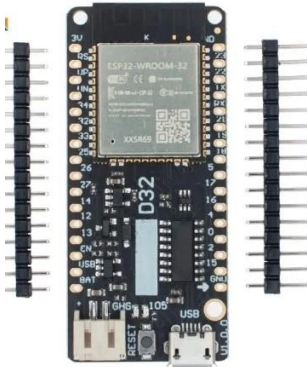


**IMPORTANT. There are multiple variants of this board. Get 38 pin USB-C and CP2102 chip.**

Note:- The guides have been written for this specific board type. Boards which differ with their USB chip and/or connector will still work, but the guides will not detail different driver installs or pin layout differences.

## ESP32 Lolin Wemos board

[LOLIN D32 V1.0.0 - wifi+bluetooth board based ESP-32 esp32 ESP-WROOM-32 4MB FLASH Arduino MicroPython Compatible - AliExpress 502](#)

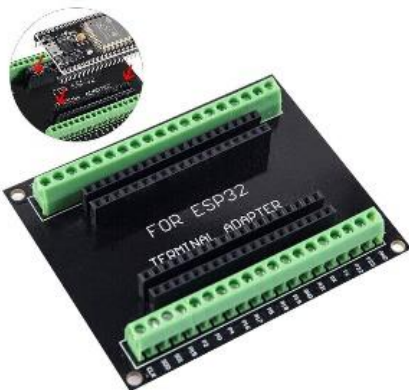


## 2. ESP32 prototype/breakout board (38 pin screw-terminal version).

**Note:-** You need this board regardless of the ESP32 board choice. If using the Lolin board, the breakout board legends will not match, so pay attention to the wiring guide.

[ESP32 Expansion Board Compatible with ESP32 WiFi Bluetooth Development Board NodeMCU-32S Lua 38Pin GPIO Expansion Board - AliExpress](#)

### 38 Pin Breakout Board For ESP32



## 3. Button Module.

There are all sorts of buttons available, feel free to choose different ones depending on your final design. This module has the advantage of header pins for use with Dupont jumper wires & is great for development, but the coloured buttons below will be better for the final build.

[DIY Kit 1x4 4 Independent Key Button Keypad Keyboard Module Mcu for Arduino Student Class Design Graduation Project Experiment - AliExpress](#)



#### 4. Buttons.

If mounting in a project box, these buttons are easier to fit and make a nice-looking project. The display will state which colour button to push, Green for the Start Button, Black for the reset & Yellow for the optional motor twiddler.

Note:- This set is pre-wired, so no soldering is required.

[DaierTek 5PCS 12mm Momentary Push Button Switch On Off Mini Round Switch Waterproof PBS-33B 3A 125V AC with Pre-soldered Wire - AliExpress](#)



Below is a link to buttons which maybe purchases as a 6-pack, including a white button, or individually. They have the advantage of including a white button, which whilst not used at present, would be the next colour to be used if an additional button is required in future development. (Red is used for E-stop & the encoder knob is Blue, so whilst the builder could use either of these colours from the pack, they would not match the on-screen prompt). Note these buttons require soldering & are slightly shorter than the pre-wired buttons.

[6piece Mini 12mm Waterproof Momentary On/off Push Button Round Switch Pbs-33b Kit White Black Red Yellow Blue Green - AliExpress](#)

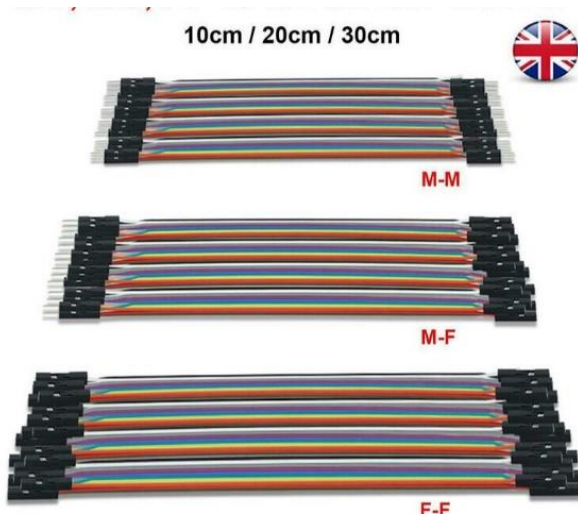
#### 5. Dupont wires.

Get male to female Dupont Wires if using the screw terminal prototype board.

Two packs of 10cm for connection to buttons, tft, encoder etc.

Two pack each, 20cm wires

[Dupont Line 10cm 20cm Dupont Cables Male To Male Female To Female Male To FeMale Jumper Wire, for Arduino DIY Electronics KIT - AliExpress](#)



## 6. Brown & Black Dupont wires – Not Required.

**Note.** There are enough of each colour if buying two packs each of the multi-coloured dupont wires detailed below, so additional single colours are not needed for the Development Timer, however a link to single colours is left here as having additional Brown (3V) Red (5V) & Black (0V) can be useful for other projects.

[10pcs Breadboard Dupont Cable For Arduino Line 2.54mm Male Female Dupont Jumper Wire 26AWG Cable DIY Electronic 1P Connector - AliExpress](#)



## 7. Connector block (optional)

There are many 3V & 0V wires to be connected. The best way to accomplish this is to use a choc-bloc to group all of the wires together & then just one wire from here which then connects to the breakout board. Alternates are to solder them together, or use a joining block similar to the below.

[10-75pcs Orange Universal Type Quick Plug-in Terminals, Electrical Equipment Connectors, Wire Connector Terminals, 250V/32A - AliExpress](#)

Single Strand Hard Wire (BV)  
0.5-4.0<sup>2</sup>



## 8. TFT display.

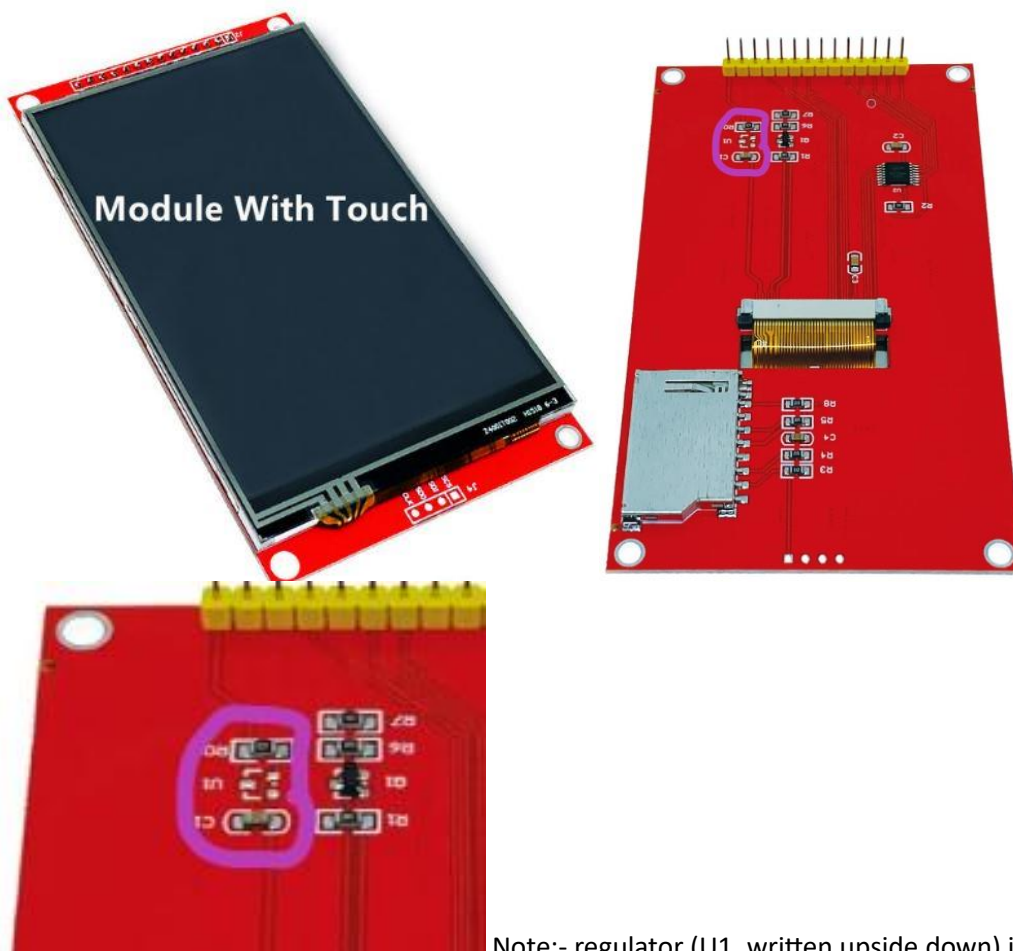
**4.0 inch SPI module 3.95 inch ILI9488 14 pin TFT LCD display scree Resistance touch panel PCB adapter base board 2.54 mm spacing (sic)**

Board size is 108.04 X 61.74

(The above, including mis-spelling, is taken from AliExpress listing, to help ensure the correct tft screen is purchased

**Note:-** There are many similar modules but they have different driver chips (ILI9488), the Develop Timer only works with this specific module. Please ensure you correctly order the module. The Aliexpress web sites often list similar but different modules & sometimes just the bare screen. The 4.0" specified for this project module does not have the 5V regulator populated on the board. (circled).

[4.0 inch SPI module 3.95 inch ILI9488 14 pin TFT LCD display scree Resistance touch panel PCB adapter base board 2.54 mm spacing - AliExpress](#)



Note:- regulator (U1, written upside down) is not populated on this board.

## 9. Rotary Encoder.

Ensure you purchase the one with blue pcb as shown below.

[With Switch Rotary Encoder Module for Arduino Brick Sensor Development Round Audio Rotating Potentiometer Knob Cap EC11 - AliExpress](#)



## 10. Piezo Sounder. (optional)

Audibly warns when next user operation is required (agitation, pour out dev, end of process)

[10PCS Passive Buzzer AC 12MMx8.5MM 12085 42R Resistance 3V 5V 9V 12V In Common Use Mini Piezo Buzzers For Arduino Diy Electronic - AliExpress](#)

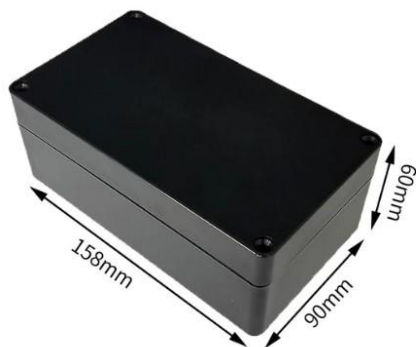


## 11. Project Box. (optional)

There are all sorts of shapes & sizes of project boxes. The 158 x 90 x 60 is a good size if not using the auto-twiddler. The screen must be positioned as high as possible, to leave enough space below, for two rows of buttons. Refer to cutting template.

If fitting the optional stepper board for auto-twiddling, whilst the stepper board can be squeezed it, it is a very tight fit, so using a larger project box maybe easier.

[Black Box Outdoor Waterproof Case Plastic Box Electronic Project Case Instrument Waterproof Junction Box Housing - AliExpress](#)

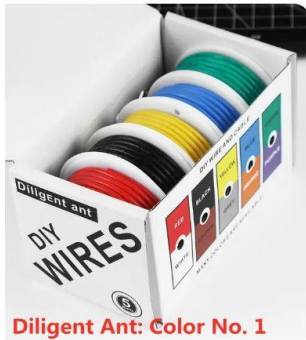




## 12. Hook-up wire. (optional)

To make all the soldered connections to buttons, sockets etc, jumper wire is required. You could just by a reel of one colour, or use wire from an ethernet cable. Or buy a box of multi-colour cable.

Here is a link to wire in a dispenser box. Buying both box 1 and box 2 will match the Dupont wire colours. Get 22AWG [High quality super soft silicone wire and cable household DIY 5 colors mixed box wire tinned pure copper \(aliexpress.com\)](https://www.aliexpress.com/item/High-quality-super-soft-silicone-wire-and-cable-household-DIY-5-colors-mixed-box-wire-tinned-pure-copper/32888888888.html)



## 13. Li-Po Battery (Optional, only for use with Lolin D32 board) With JST PH2.0 connector.

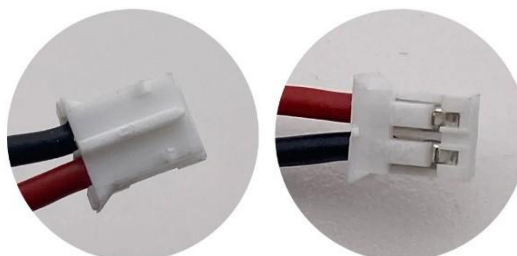
The prototype was built using the 1000mAh battery. A 2000mAh battery should also work well. If using a different battery to the ones specified below, ensure they have the little pcb at the top, which gives under-voltage & over-current protection.

[523450/503450 1000mAh 3.7V Polymer Lithium Rechargeable Battery Li-ion Battery JST PH2.0 2pin For GPS Smart Phone DVD MP5 - AliExpress](https://www.aliexpress.com/item/523450/503450-1000mAh-3.7V-Polymer-Lithium-Rechargeable-Battery-Li-ion-Battery-JST-PH2.0-2pin-For-GPS-Smart-Phone-DVD-MP5-/32888888888.html)

[100% real capacity 3.7V 103450 2000mAh Rechargeable Polymer Lithium Battery, for Cameras, GPS, Bluetooth Speakers, PS4 controller - AliExpress](https://www.aliexpress.com/item/100%-real-capacity-3.7V-103450-2000mAh-Rechargeable-Polymer-Lithium-Battery-for-Cameras-GPS-Bluetooth-Speakers-PS4-controller-/32888888888.html)



PH 2.0 plug



**Red & Black Pins require removal from plastic housing and swapping round.**

**Caution** – There is no standard for the polarity of the battery connector. Check and double check the red & black wires are the correct way round on the battery connector, to match the Lolin processor board. If they are not, carefully lift the plastic locking tab on the connector, securing the pin & slide out. Do this for both pins, taking care not to let them touch. Then re-insert the correct way round. **The batteries specified above have the connector pins the wrong way round and will need to be swapped.**

#### 14. On/Off switch. (Optional)

Use if fitting the Li-PO battery, else when disconnecting the Developing Tomer from the USB or 12V power, the Developing Timer will continue to run on battery.

[10Pcs SS22F32 6 Pins 2 Positions DPDT On/On Mini Slide Switch 0.5A Toggle Switch Y5GB - AliExpress](#)

#### **Optional Parts if Automatic Twiddling is required.**

Cavet Whilst the stepper motor works fine in testing, it has never been connected to a twiddling stick. The user will have to build their own mounting frame to hold the stepper and devise a method of connecting to a twiddling stick to the motor shaft. Using flexible plastic tube should work.

##### **a. Stepper Motor.**

Ensure the version with XH line is selected. This will then fit the driver breakout board.

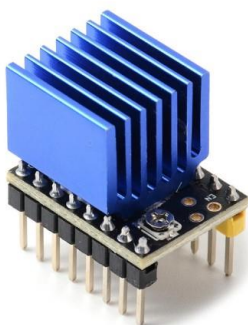
[3D Printer Parts Nema17 17HS4023 for Titan Extruder 4-lead Nema 17 22mm 42 Motor 0.7A 12V 14N.for 3D Printer Motor - AliExpress](#)



##### **b. Stepper Motor Driver Board.**

The version 2 board has the adjusting potentiometer mounted on the top (can be seen just in front of the blue heatsink) making it much easier to adjust than the earlier version.

[TMC2208 TMC2209 ATD5833 V2.0 With Heat Sink Stepper Motor Driver StepStick 3d Printer Parts 2.5A 256 Subdivision Silent Printing \(aliexpress.com\)](#)





### c. Stepper Motor Breakout Board.

[42 Stepper Motor Driver Expansion Board DRV8825 A4988 3D Printer Control Shield Module For Arduino 3 Ramps1.4 DIY Kit \(aliexpress.com\)](#)



### d. 12 Volt Power Supply.

A 12V 2A power supply is required to run the stepper motor. A socket could be mounted on the project box, for a neat connection, or use an adaptor (circled), or just cut the connector off & connect directly to the stepper board.

Note- Only the stepper uses 12V. The processor board still requires connection to a USB power supply. An alternate is to use a buck converter to convert 12V to 5V, negating the need for a separate USB power supply.

[AC DC 12v 1A 2A 3A 2000ma 3000MA adapter power supply EU UK AU US PLUG 5.5\\*2.5mm wall charger for DC male female led strip light \(aliexpress.com\)](#)



### e. DC Power Jack. (Optional)

This will allow a socket to be fitted to the project box, for a neat looking solution.

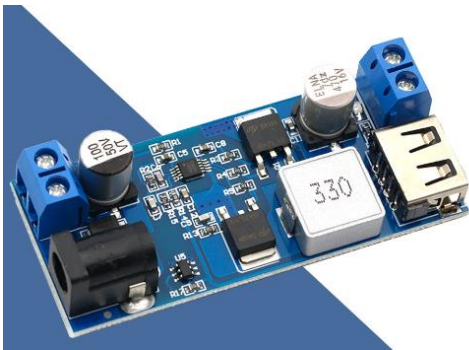
[5/10Pcs 5A 30V For DC Power Supply Jack Socket Female Panel Mount Connector 5.5mm 2.1mm Plug Adapter 2 Terminal Types 5.5x2.1 - AliExpress](#)



#### f. 12 Volt to 5 Volt buck converter. (Optional)

This will allow a single 12Volt connection to the project, to power both the stepper motor & processor board.

[DC-DC 24V/12V To 5V 5A Step Down Power Supply Buck Converter Replace LM2596S Adjustable USB Step-down Charging Module For Phone - AliExpress](#)



Alternate power converter, smaller & cheaper, but requires soldering. (ensure the 5V version is selected)  
[High Efficiency Output 3.3V 5V 9V 12V 5A mini560 Step Down DC-DC Converter Voltage Regulator Buck Stabilized Power Supply Module - AliExpress](#)

#### g. Diode. (Mandatory)

Fit If using a 12V to 5V regulator, a diode must be placed between the 5V output and the connection to the breakout board. This prevents 5V flowing back into the stepper board, which then tries to drive the stepper motor.

**Order the 1N5404 diodes**

[High quality Rectifier Diode 1N4007 10A10 1N5408 1N5819 1N4001 5822 1N4001 1N4004 1N4005 1N5404 1N5408 6A10 FR107 UF4007 SR5100 - AliExpress](#)

#### h. Self Locking switch. (Optional)

Fit in-line with the stepper motor enable pin, to make an emergency stop button for the stepper motor.  
**Select the Latching, Red option.**

[2PCS 12MM Mini 2pin Dome Push Button Switch OFF-ON Momentary Latching Waterproof Plastic Motorcycle \(aliexpress.com\)](#)



### **Additional useful parts**

The design of the auto-twiddler is up to the imagination of the builder. A universal joint (5mm) is required to connect the motor to a shaft, which in turn will connect to a rod and then the twiddling stick. The assembly must then be held in a frame above the developing tank, to engage with the spiral. The frame could be built the same width as the water bath, so it sits just outside, which will also ensure it is the spiral, not the frame, which turns.

Universal Joint

[2/3/3.17/4/5/6/6.35/8/10mm Boat Car Shaft Coupler Motor Connector Metal Universal Joint Coupling - AliExpress](#)

Drill bits for making encoder and button holes. 7mm for encoder, 13mm for the buttons.

[3-12mm Three-point Woodworking Drill Hole Opener Twist Drill Bit Practical Wood Milling Cutter Multifunctional Drilling Tools - AliExpress](#)

13mm drill bit

[10-35mm Woodworking Twist Drill Bit Set Long Four-Slot 6.35mm Shank Carbide Drill Bit Hole Saw For Door Lock Wood Slotting Tools \(aliexpress.com\)](#)

### **M3 Bolts, Nuts, Washers.**

Depending on the final design, M3 bolts can be used to hold the tft screen, breakout-board and stepper driver.

[https://www.aliexpress.com/item/1005005544927756.html?spm=a2g0o.order\\_list.order\\_list\\_main.96.18381802at3zUL](https://www.aliexpress.com/item/1005005544927756.html?spm=a2g0o.order_list.order_list_main.96.18381802at3zUL)

### **Glue Gun.**

Cheap glue gun, but surprisingly it works ok.

[20W Hot Melt Glue Gun DIY Mini Household Industrial Guns Heat Temperature Thermo EU Electric Repair Tool Use 7mm Glue Sticks - AliExpress](#)

### **Soldering Iron Kit.**

AliExpress have loads of cheap soldering irons. If buying one, wrap some kitchen foil between the ceramic heater, so the bit is a tighter fit. I found the one I bought lost heat too quickly, resulting in poor joints & melted plastic as heat had to be applied far longer. Mine went in the bin & I went back to an Antex soldering iron. You may have better luck.

### Change Log

V 1.1 changed piezo buzzer from active to passive buzzer

Extra coloured buttons added

V1.2 Button link changed & diode added, bolts added