

TOUCH AND GO

OVERVIEW

Touch and Go is an open source software program to create your own basic timer for an electric powered control line model aircraft. Utilizing a low cost Adafruit Industries Trinket M0 microcontroller development board the timer is compact, light-weight and simple to use. With a few taps of your finger the timer can be quickly programmed at the flying field to change the time delay before start-up, the length of the flight and the RPM setting of the motor. Because it's open source, you can customize the functionality to your liking or even add new features.

LIST OF FEATURES

Although Touch and Go is meant to be an economical “do-it-yourself” project, it packs a lot of useful functions:

- Compact. 27mm x 15mm
- Lightweight. 1.5g
- Capacitive touch sensor for user input. No additional switches or buttons required.
- Onboard multicolor DotStar LED. Visible from the center of the circle, even in bright sunlight
- Well supported. The Adafruit web pages are chock-full of information and comprehensive learning guides to answer any question.
- Written in CircuitPython. No programming skills or experience is required, unless you want to change some things. In that case, CircuitPython is an easy to read and easy to learn language.
- Built-in micro USB port. Plug it into your computer and it shows up as a small disk drive. The stored programs can be opened and edited in a simple text editing program. No extra software or apps to download. Although, if you intend to make extensive changes to the code then a free software editing program is highly recommended.
- Field programmable. The delay, flight time and RPM settings can be changed without any extra tools, cards, computers or programming boxes.
- Soft start. The programmed RPM increases and decreases over a period of several seconds for smoother take-off and landings
- On-board memory to store your settings.
- Usable with lower cost ESC's.
- Easy to assemble. Solder a few pins, update to the latest version of CircuitPython, save the programs and libraries onto the drive, connect to your ESC, adjust your settings and fly.
- Reprogrammable. Have another project in mind? The Trinket M0 can be programmed for a multitude of other maker and hacker projects. It can even be programmed as an Arduino board if preferred.

BILL OF MATERIALS

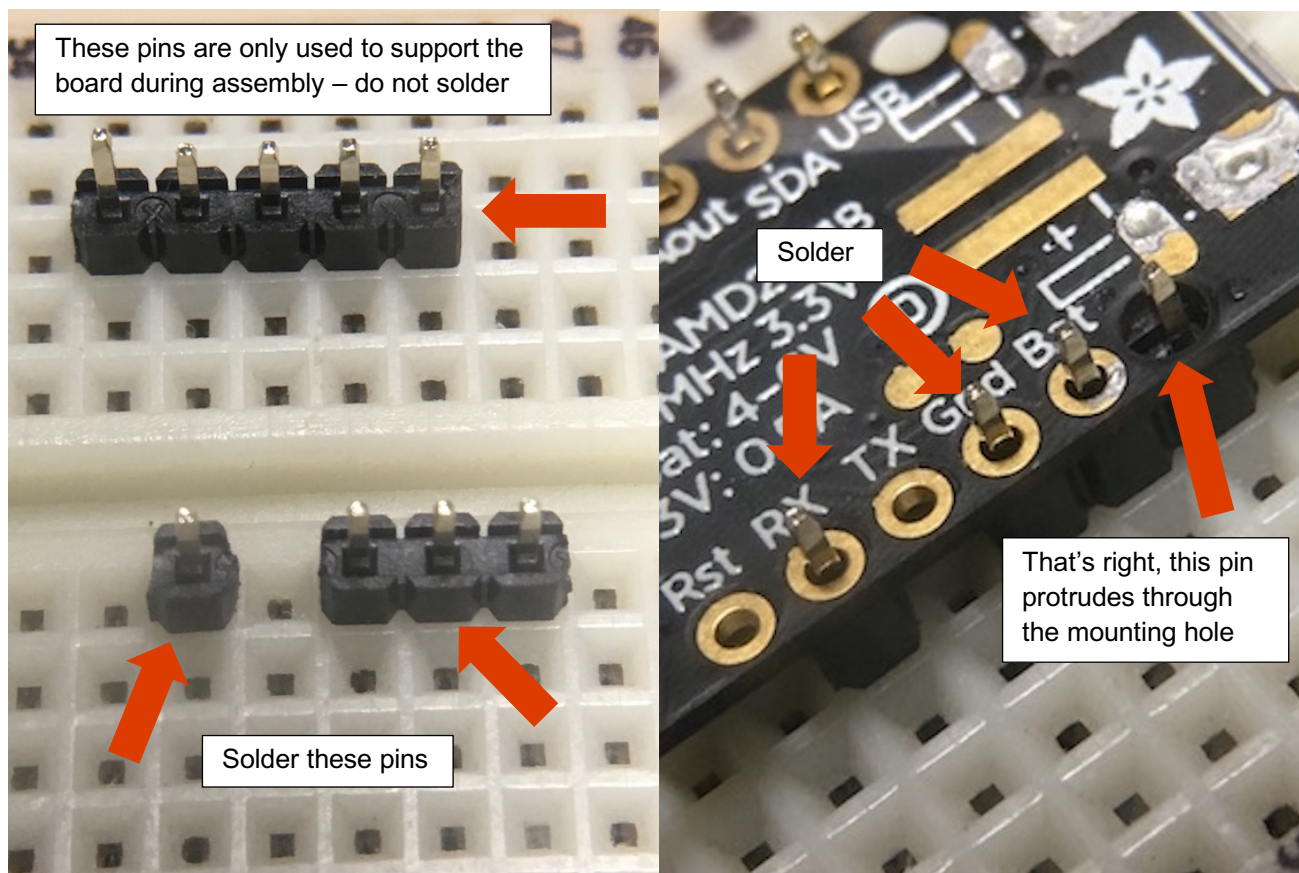
Qty -1 Adafruit Trinket M0, Product ID 3500 \$8.95US

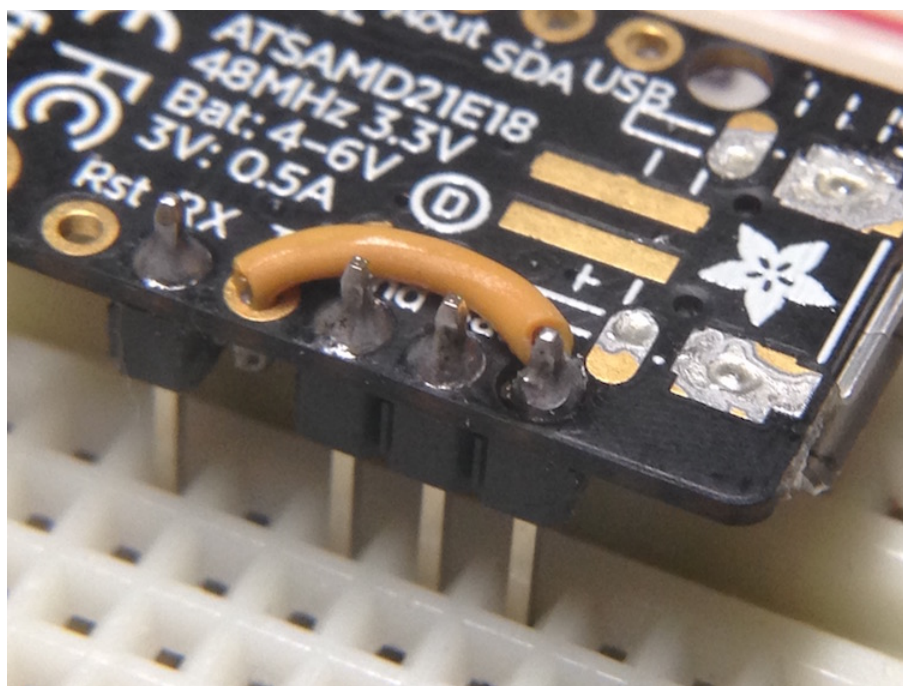
available from [adafruit](#), [digikey](#), [mouser](#)
plus numerous other distributors worldwide

A short piece of 24 to 28AWG stranded insulated wire is also required. Tools required: Soldering equipment, breadboard, magnifying glass, wire strippers, pliers and a micro-USB *data* cable.

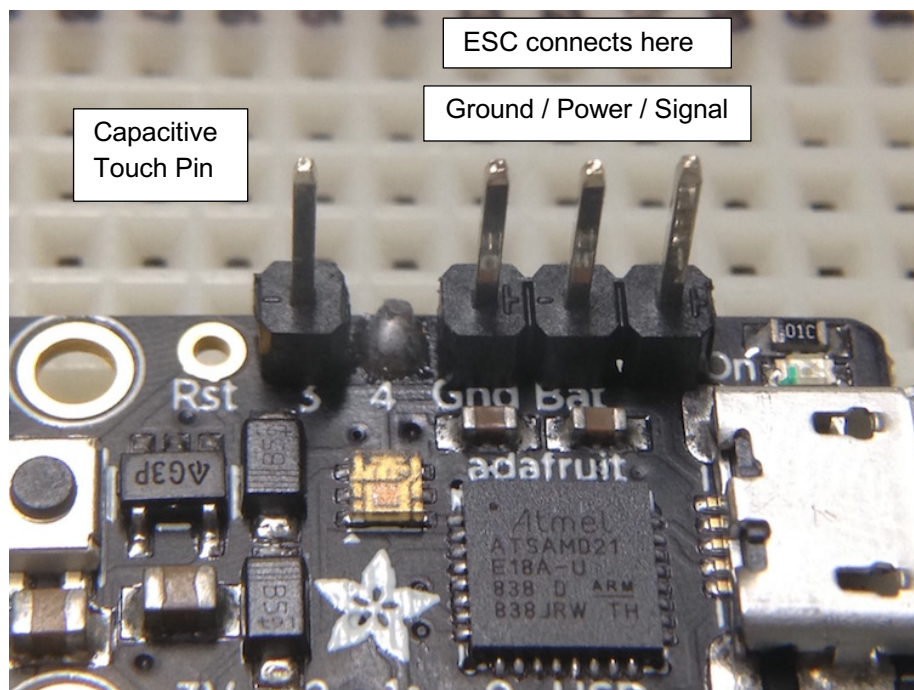
HARDWARE ASSEMBLY INSTRUCTIONS

The board as supplied includes a strip of breakaway header pins. Trim the strip and solder as shown in the photos below. If you are new to soldering circuit boards both [Adafruit.com](#) and [Sparkfun.com](#) are just a few of many great sources for information and tutorials on soldering. They are also a great source for the appropriate soldering equipment.





Solder a short length of jumper wire between the pin that protrudes through the mounting hole to pin 4/TX. This is the PWM servo signal to the ESC. The pins need to be arranged in this manner in order to mate correctly with a standard servo connector. When connecting the ESC be sure the connector ground wire (brown or black) is attached to the ground pin on the board and the signal wire (yellow or white) is connected to the pin that passes through the mounting hole.



Because the signal pin passes through the mounting hole and is not soldered directly to the board, it is possible that the ESC connector may try and push the pin out the back of the board. If that is the case, a well-placed dab of epoxy on the back of the board will secure the pin.

SOFTWARE INSTALLATION

Plug in your board to your computer with a micro USB data cable. A new drive called CIRCUITPY should appear. If it doesn't you likely are not using a data cable. Most micro USB cables these days are used for charging only and are not data cables. Be sure you have the right one.

Read through the Adafruit Learning Guide for the Trinket M0 and CircuitPython here:

<https://learn.adafruit.com/adafruit-trinket-m0-circuitpython-arduino/circuitpython>

Use this guide to update your boards firmware to the latest version of CircuitPython (4.1.0) by following the instructions under "Set up CircuitPython Quick Start!". This will update the UF2 file on your board to the latest version. Stop when you get to the section "Trinket Default Zip Install", you don't need that.

If you haven't downloaded the program files for the Touch_and_Go yet, they can be found at CircuitFlyer.com. Click on the download button. There will be 4 files inside the .zip; a copy of this manual, main.py, boot.py and a lib (library) folder.

To program your board simply copy and paste main.py, boot.py and the lib folder to your CIRCUITPY drive, one at a time (my Mac OSX complained if I copied and pasted all three at once). Replace the existing lib folder when asked. Congratulations, that's it, you're done! Eject the drive before disconnecting.

If you have any difficulties with installing the software read through the Adafruit learning guides. Troubleshooting steps can be found here:

<https://learn.adafruit.com/adafruit-trinket-m0-circuitpython-arduino/troubleshooting>

INSTALLATION & OPERATING INSTRUCTIONS

A piece of Velcro can be used to attach the board to the side of the fuselage facing the pilot. The super bright DotStar LED is visible from the inside of the circle, even on a sunny day. The DotStar LED is used to communicate the different modes of operation.

Connect the ESC as discussed in the assembly instructions above. The capacitive touch pin is used for operator input. This is similar to the touch sensitive screen on a smart-phone. (Hint: Because the touch sensor lacks the tactile feel of a push-button make sure your touch gestures are decisive. In other words, don't be gentle or slow with your finger movements.)

A long touch is a sustained touch for a minimum of 3 seconds. A tap or series of taps is a single or multiple quick tap on the pin. You will notice a 1 second delay after the last tap before the desired action takes place. This short waiting period is needed to make sure all of the taps are complete.

When you connect the battery to the ESC the board will boot-up (it takes about 3 seconds) and the DotStar LED will turn green (Standby Mode). At this point the board will output an "idle" signal to the ESC. The ESC should complete its initialization and arming sequence.

SAFETY FIRST! Any time the battery is connected stay clear of the prop. The aircraft should always be held or secured until the pilot is ready. When the flight is complete the pilot should wait until his/her helper disconnects the battery before putting the handle down.

The very first time the board is powered up it will load the default settings of 30 second start delay, 240 second flight time and about 75% throttle on the RPM.

PROGRAMING PROCEDURE:

To change any settings, use the following guide:

5 taps on the pin to enter the programming mode – the LED will change to yellow (Program Start Delay)

To move between the three available programming modes:

1 tap for Program Start Delay (yellow)

2 taps for program Flight Time (cyan)

3 taps for program RPM (magenta)

Whenever you are finished making any changes:

4 taps to exit the programming mode and return to Standby (green)

To change a setting while in the programming mode:

Program Start Delay (yellow): Touch and hold the pin. After a short delay the LED will flash. Count the number of flashes. Each flash = 1 second of delay. Release the pin when you reach the desired count.

Program Flight Time (cyan): Touch and hold the pin. After a short delay the LED will flash. Count the number of flashes. Each flash = 10 seconds of flight time. Release the pin when you reach the desired count.

Program RPM (magenta): CAUTION: You are about to run the motor at its flight RPM, secure the aircraft and stay clear of the prop. The next thing to always remember: 3 TAPS TO STOP THE MOTOR.

To start the motor, touch and hold the pin. The LED will flash quickly to warn of the impending start-up. After a short delay the motor will start and accelerate to the last programmed flight RPM. Release the pin and the motor will stay running. While the motor is running, 1 tap on the pin will increase the RPM a slight amount. 2 taps will decrease the RPM a slight amount. Be sure to wait about a second between each set of taps for the RPM to change. Use a tachometer for a more precise setting of the RPM. When the desired RPM is reached: 3 TAPS TO STOP THE MOTOR. Avoid prolong running on the ground as some electrical components may get hot.

Any new settings you enter will automatically be saved to memory and used for subsequent flights.

NORMAL OPERATION:

For a typical flight first connect the battery, after booting up the LED will turn green (Standby Mode) and the ESC will arm. When ready, touch and hold the pin (a long touch of a minimum 3 seconds) to enter the Start Delay mode (flashing blue). This indicates the start of the countdown timer before the motor starts. During the last 5 seconds of the countdown the LED will change to white and flash quickly to warn of the impending startup of the motor. Any touch of the pin during the Start Delay mode will stop the countdown and return to the Standby mode.

After the Start Delay the Flight mode will start (flashing red) and the motor RPM will increase to the programmed flight RPM over a 2 second period. This will assist with a smooth take-off. After the motor starts any touch of the pin will stop the motor and jump to the Flight Complete mode (LED off). During the flight there will be periodic

increases in the RPM to compensate for the decreasing battery voltage. 10 seconds before the Flight mode is complete the LED will quickly flash white to indicate the end of the flight. The RPM will then slowly drop over a 4 second period before stopping to aid in a smooth approach and landing. Once the motor stops the program enters the Flight Complete mode (LED off). The power must be reset in order to exit the Flight Complete mode.

Disconnect the battery, replace it with a fully charge one and repeat the process for the next flight.

FAQ

Does the Touch and Go work with any ESC? No, not all of them. Because ESC's are designed for RC, some manufacturers add 'safety' features that are not compatible with the current program. So far, I have found two that won't work. Any ESC that requires the transmitter stick at full throttle to initialize the ESC and then return to idle to complete the arming sequence will not work. Some ESC's will shut down if there is a loss of signal after 3 seconds. The boot process of the Adafruit Trinket is also about 3 seconds. This may cause the ESC to think there was a loss of signal and prevent it from arming. If possible, read through the instruction manual of the ESC before purchasing.

Can I make changes to the program code? Yes, Adafruit CircuitPython makes it easy. There is one important requirement – touch and hold the touch sensor pin when connecting the USB cable. Hold it for at least 5 seconds then release. This will remount the drive to allow write access from the USB port. Otherwise, you will not be able to save any of your changes.

If you are making minor changes, open main.py in any text editor program, like Notebook or TextEdit. Make your changes and then save it as main.py back onto the CIRCUITPY drive.

If you would like to make more substantial changes then I would suggest a proper code editing program. The Adafruit Learning Guides cover everything you need to know.

Can I extend the touch sensor pin? Yes, in theory. You will have to experiment to make sure it works reliably, but you can add a wire to the touch sensor pin to extend the 'sensor' to another location.