Filament Scale

# Introduction

This system is designed to give a continuous display of how much filament is left on the spool. It does this by knowing the weight of the empty spool and subtracting this from the total weight that is measured. The empty spool weight can be determined by using any of the following methods:

1. Weighing on a scale and entering the value manually.
2. Weighing an empty spool on this system and entering the value manually.
3. Weighing a full spool on a scale and subtracting the filament weight to give the spool weight which is then entered manually.
4. Weighing a full spool on this system with a known amount of filament, typically 1kg. Subtracting the filament weight from the total weight gives the spool weight which is then entered manually.

The system maintains a list of 100 spool settings that are easily selected.

# Hardware

## Parts Needed

The main part used is a TTGO ESP32 T-Display component. It is wired with a rotary push button and the HX711 loadcell amplifier. I have created a PCB that can be purchased that holds all the parts, but it is also easy to hand wire all the components. The wiring diagram can be found on the github site.

* TTGO ESP32 T-Display. https://www.amazon.com/TTGO-T-Display-Bluetooth-Development-Arduino/dp/B07XQ5G279/ref=sr\_1\_1\_sspa?crid=DFS8HSCA4CFS&dchild=1&keywords=ttgo+t-display+esp32&qid=1612330662&s=electronics&sprefix=ttgo+t%2Celectronics%2C222&sr=1-1-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzMFZSSEZUQUc0SUszJmVuY3J5cHRlZElkPUEwMzM4NzM0MVo0SzIzSlIxM1BFVSZlbmNyeXB0ZWRBZElkPUEwMjI2ODQ2Skc1RVlJSE44SkJXJndpZGdldE5hbWU9c3BfYXRmJmFjdGlvbj1jbGlja1JlZGlyZWN0JmRvTm90TG9nQ2xpY2s9dHJ1ZQ==
* 5kg loadcell with HX711 amplifier. https://www.amazon.com/gp/product/B08KRWY43Y/ref=ppx\_yo\_dt\_b\_asin\_title\_o05\_s00?ie=UTF8&psc=1
* Rotary push button switch. https://www.amazon.com/gp/product/B07DM2YMT4/ref=ppx\_yo\_dt\_b\_search\_asin\_title?ie=UTF8&psc=1
* 5V power supply, USB works fine.
* 2- 42x20x12 mm ball bearings. <https://www.amazon.com/gp/product/B075QHL18L/ref=ppx_yo_dt_b_asin_title_o00_s01?ie=UTF8&psc=1>

I supplied Amazon links, but most parts are readily available from other sources.

# Software

The program source files are available at <https://github.com/MartinNohr/FilamentScale> .

## Development Environment

I used Microsoft Visual Studio with the Visual Micro add-in. However, it is not required, the code should compile just fine using the Arduino IDE. Microsoft Visual Code should also work.

## Libraries

The following software libraries are used.

* Bodmer TFT-eSPI for the display, configured for the TTGO T-Display
* HX711\_ADC Arduino library for HX711 Scale by Olav Kallhovd
* EEPROM

# The Main Screen

After booting the main screen of the system displays a bar showing the % of the remaining filament. It also shows the two important numbers: remaining weight and length.

# Menus

The menu system for setting values is entered by a long press of the push button. The dial is then rotated to move to different selections. Clicking the button selects the current choice. The current selection is indicated with a ‘\*’ at the front of the line. A ‘+’ indicates that the choice switches to a new submenu. A ‘-‘returns to the previous menu. A long press can also be used to immediately return to the main screen.

## Main Menu

### Main Screen

Closes the menu system and returns to the main screen.

### Spool Settings

#### Previous Menu

Returns to the main menu.

#### Active Spool

This is used to select the currently active spool number. Different spool numbers allow for different spool weights. There is a limit of 100, which should be adequate. The active spool number is used by the main screen and by most of the following commands.

#### Spool Wt From Full

#### Weigh Empty Spool

#### Empty Spool Wt

#### Full Spool Weight

#### Save Settings

### Scale Settings

#### Previous Menu

#### Tare (reset zero)

#### Calibrate Weight

#### Weight to Length

#### Save Settings

### Reboot System